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The Cost of Switching Schools

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Abstract

Almost every elementary and secondary student changes schools at some time, but some students change very frequently and some schools face unusually large annual turnover rates for students. A number of prior researchers have speculated that high mobility rates particularly harm disadvantaged students in inner cities. Analytical difficulties of separating moving effects from other circumstances have, nonetheless, yielded mixed and unreliable evidence about the impact of mobility. This paper, exploiting the rich longitudinal data of the UTD Texas Schools Project, employs an individual fixed effect strategy in achievement growth to disentangle moves per se from individual, school, and peer effects. The results suggest: (1) Moving, whether initiated by the school or the family, has a significant negative impact in the year of move and these is little or no recovery of lost achievement in the subsequent year; (2) Minorities and economically disadvantaged students are much more sensitive to moving than whites and more advantaged students; and, (3) Students in schools with high turnover suffer a disadvantage, even if they do not move. A decomposition of differential achievement growth shows that school mobility effects can explain *all* of the average difference between low income and upper income students and between white and either Blacks or Hispanics.

The Cost of Switching Schools

by Eric A. Hanushek, John F. Kain, and Steven G. Rivkin[*]

Switching schools is a common occurrence for school children in the United States, if for no other reason than the natural moves dictated by a school organization commonly divided into elementary, middle, and high schools. In Texas public schools, for example, less than two percent of children do *not* switch schools at least once between grades four and seven. The common perception of school moves differs dramatically by the underlying perspective. Typically, district dictated moves with largely intact peer groups would seem far less disruptive than, for example, moves dictated by divorce and family dislocation. Balanced against these moves, "Tiebout" mobility with parents changing districts in pursuit of higher quality schools would generally be thought of as achievement-enhancing moves. Frequent school changers, such as children of migrant workers and those who live in economically disadvantaged families, evoke particular concern. The combination of school instability with the pressures of economic disadvantage and limited community roots might be expected to seriously diminish prospects for academic success. This paper, taking off from the suggestive findings on mobility in Kain and O'Brien (1998, 1999), investigates the short and long run implications of different kinds of moves. Particular attention is given to differences by race, ethnicity, and income, because the heterogeneity in mobility propensity and circumstances holds the possibility for explaining substantial portions of the racial, ethnic, and income achievement growth differentials.

Prior evidence suggests that all types of switches may be harmful to students, though in many studies the relationship is not statistically significant and some papers even report a positive relationship between achievement and mobility (see Alexander, Entwisle and Dauber 1996). But, the paucity of strong

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evidence on the impact of mobility appears to result in large part from the methodological difficulties inherent in trying to identify the impact of moving. First and most important, children who switch schools, particularly children who transfer at the instigation of the family, differ from non-switchers. A number of recent studies show that the inclusion of controls for socio-economic status or pre-move achievement level tend to reduce the magnitude and statistical significance of moving effects on a number of outcomes, often to the point that hypotheses of zero mobility effects cannot be rejected at conventional significance levels. Alexander, Entwisle and Dauber (1996) and Ingersoll, Scamman and Eckerling (1989) both find that the inclusion of controls for family socio-economic status diminish estimated moving effects, and Alexander *et al*. find that the inclusion of initial academic achievement generally produces estimated moving effects that are not significantly different from zero.

Kain and O'Brien (1998), however, find significant negative impacts of all kinds of mobility, even after conditioning on initial achievement. Their analysis, with extraordinarily large samples of Texas school children, suggests that part of the mobility puzzle might simply come down to power of the statistical tests. Nonetheless, there is reason to believe that the limited information on family background and even the use of value added specifications may not capture fully the differences between movers and non-movers.[1]

A second important problem is the difficulty of separating any effects of the change in schools per se from the effects of concurrent changes in school quality. The aforementioned studies with the exception of Kain and O'Brien (1999) do not address the possibility that estimates of mobility effects might confound the true cost of moving with changes in school quality. School quality differences might amplify or dampen the estimated effect of moving depending upon the difference in quality between pre- and post-move

[1]Similar concerns about endogeneity bias in the estimation of school resource effects have lead researchers to search for sources of variation in school characteristics that are orthogonal to family differences. Angrist and Lavy (1998) and Hoxby (1998), for example, each attempt to isolate variations in class size that are uncorrelated with other student characteristics.

schools. Importantly, to the extent that school quality changes are long lasting, their impact might tend to dominate the one time cost of moving over the long run.

A final issue vital to policy considerations is the duration of moving effects. If a move were to precipitate a temporary decline in achievement after which the student fully recovers to the prior learning path, there would be little reason to intervene. On the other hand, if a move were to permanently lower the achievement trajectory, a much more aggressive intervention would be in order. Kerbow ‘s (1996) findings suggest that most students recover fully two years following a move but that frequent movers lose ground relative to other students. The possibilities that both the initial mobility cost and the subsequent recovery might differ by both type of move and student characteristics merits further inspection.

overestimate the impact of moving per se. Conversely, if the cause of the move has the largest negative impact in the school year prior to the move, or if a positive change in family circumstances accompanies the move, fixed effects models would tend to underestimate the effect of moving. The possibility that estimates of mobility effects are contaminated by accompanying changes in family conditions is considered during the analysis, though it should be noted that recent evidence using the Panel Survey of Income Dynamics suggests that the inclusion of detailed controls for family structure have little effect on the magnitude or significance of estimated mobility effects on the probability of graduating high school.[2]

The primary results are straightforward. Moving reduces mathematical achievement, and the effects are noticeably larger for lower income and minority students. Some of the effect of school dictated moves appears to be reversed in the subsequent year, while recovery is much less pronounced for students who move for other reasons. Changes in school resources and student ethnic and economic composition account for little of the impact of moving. Finally, the percentage of students who are new to the school is negatively related to achievement for all students; again the effects tend to be larger for economically disadvantaged and minority students. These external effects are large enough to generate serious disadvantages for students who attend schools with highly mobile student populations[3]. Overall, the much larger estimated effects of mobility on minority and low income students in combination with their higher mobility rates imply that the mobility of students and their schoolmates accounts for much if not virtually all of the racial, ethnic and income differentials in sixth grade achievement gains.

The Texas Schools Microdata Panel

[2]In private communication, Dan Aaronson indicates that preliminary estimates using PSID data show robust influences of mobility on high school graduation rates.

[3]Kerbow (1996) finds that mobility is concentrated among a select group of schools in Chicago, indicating that many students will spend their academic careers in very unstable environments.

The cornerstone of this research is the analysis of a unique microdata set of school operations constructed by the UTD Texas Schools Project, a project conceived of and directed by John Kain. The Texas Schools Microdata Panel, or TSMP, currently contains extensive data for five entire cohorts of Texas students. The TSMP tracks elementary students as they progress through school; it measures student performance each spring; and it contains detailed information about their school services. For each cohort there are over 200,000 students in over 3,000 public schools. The large numbers of students who change schools and school districts are especially important for the methodology pursued here, as are the multiple cohorts which permit tracking of students who fall as far back as two grade levels behind their 4th grade classmates or who move ahead as many as two grade levels.

The student data contain a limited number of student, family and program characteristics including race, ethnicity, gender and eligibility for a free or reduced price lunch, but the panel feature can be exploited to account implicitly for time invariant individual effects on achievement. Importantly, students who switch schools can be followed as long as they remain in a Texas public school. In fact the attendance data provide information on school attended for each of six, six week periods during the school year, permitting us to identify the approximate timing of all school switches.

Beginning in 1993, the Texas Assessment of Academic Skills (TAAS) was administered each spring to eligible students enrolled in grades three through eight. The criteria referenced tests evaluate student mastery of grade-specific subject matter. Unique IDs link the student records with the test data.[4] We employ the data for the cohort in grade 4 in 1993. This paper presents results for mathematics,

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[4]One important data consideration is the possibility that schools miscode student IDs, which would tend to depress the number of movers within the public schools and overstate the percentage who exit Texas public schools. While there is no sure check for coding errors, the evidence suggests that other types of coding problems are quite minimal. Less than one percent of observations in 4th grade and less than one half of one percent of observations in 5th thru 7th grades did not have unique IDs; a small number of duplicate records were deleted.

although the results are qualitatively quite similar for reading achievement. Consistent with the findings of our previous work on Texas,[5] schools appear to exert a much larger impact on math than reading in graders 4 thru 7. Each math test contains approximately 50 questions. Because the number of questions and average percent right varies across time and grades, we transform all test results into standardized scores with a mean of zero and variance equal to one. The regression results are robust to a number of transformations including the raw percentage correct.

Importantly, the student data base can be linked to information on teachers and schools through the school IDs. While individual student-teacher matches are not possible, students and teachers can be uniquely related to a grade on each campus. To describe changes experienced by movers and investigate whether such changes in school and teacher characteristics contribute to the estimated mobility effect, each student is assigned the school average class size and the distribution of teacher experience for the appropriate grade and school year.

Empirical Model

Most studies of moving simply compare the academic achievement of movers and non-movers (see Alexander *et al*.1996). Even though recent work has given more attention to potential differences between movers and non-movers, the methods employed are unlikely to adequately control for all relevant factors. Even estimates generated by a value added framework (Kain and O'Brien 1998, 1999), which examines differences in achievement growth between movers and non-movers, are likely to confound moving effects with other influences on the rate of learning.

We report the estimated effects of moving on the level of achievement for comparison purposes, but the value added framework, which is today the "baseline model" for the examination of student performance, provides the starting point for the empirical analysis of the effects of mobility on

[5]Hanushek, Kain, and Rivkin (1998) and Rivkin, Hanushek, and Kain (1998) both demonstrate that school effects are larger for math than for reading achievement.

achievement. The value added model conditions current achievement on a prior measure of achievement and on intervening inputs. This formulation, which we apply in a simple difference form for standardized achievement scores (i.e., outcomes are measured as the difference in scores between grade g and g-1), eliminates any fixed individual differences in the level of achievement.[6] This specification has been used extensively because it effectively accounts for the entire history of school and family inputs that affect the level of achievement in grade g-1. It also handles variations in ability to the extent that they affect levels of performance. It does not, however, deal with any conditions that might affect the rate of learning gain.

Equation (1) describes the standard value added formulation: Test score gain (ΔA_{sgs}) for student i in school s in grade g is modeled as a function of a vector of school transition indicators (M) and three error components: a time invariant individual component (γ_i), a school quality component that varies across grades (δ_{sg}),[7] and a random error (ε_{isg}). A vector of school resource and school demographic characteristics (S) is also included in some specifications. There are three school transition dummy variables in most specifications. They indicate: 1) a school dictated move[8]; 2) a family dictated move within district; and a family dictated move between districts.

(1) $$\Delta A_{isg} = M_{isg}\lambda + S_{sg}\theta + \delta_{sg} + \gamma_i + \varepsilon_{isg}$$

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[6]Note that Kain and O'Brien (1998) apply a different variant of value-added estimation by using the prior achievement on the right hand side of the equation. This approach has the advantage of freeing up the relationship between test scores in adjoining years but the disadvantage of complicating the estimation when multiple years of individual student performance are employed in estimating fixed effects in growth and introducing contamination due to measurement error.

[7]Rivkin, Hanushek and Kain (1998) document substantial differences in school quality between grades.

[8]A within district move in which the student attends a new school attended by less than 30% of previous schoolmates is considered to be a family dictated move. Otherwise, within district moves are considered to be school initiated changes.

Equation (1) can be estimated from cross-sectional data on student achievement growth. The coefficient vector λ captures the average difference in test score gains among movers of different types and non-movers, controlling for observed school characteristics (S). Interpreting λ as the causal impacts of different types of moves, however, requires that none of the error components are correlated with the probability of a specific type of move. The value added framework almost certainly reduces endogeneity bias by accounting for fixed differences in the level of achievement, but the orthogonality condition for OLS estimation is likely to be violated due to the correlation between unobserved influences on the rate of learning and the propensity to move. In addition, district school structures may vary systematically with student characteristics.

Rather than using non-movers as a control group, a two-period panel can be used to estimate mobility effects by comparing achievement gains prior to moving to gains following a move. Specifically, the dummy variables indicating that a certain type move occurred prior to grade g are interacted with a dummy variable equal to one for grade g and zero for grade g-1. By restricting the sample to students who did not move prior to grade g-1[9], the coefficients on the move dummy variables capture the effects of different types of mobility on achievement in grade g. The effects are identified as the difference in achievement growth between those who make a specific type of move and non-movers.

The student fixed effect estimator can be written as deviations (symbolized by the dot) from each student's mean of all variables, as in Equation (2). In this formulation, all time invariant individual, family and community factors that might contaminate the estimates of mobility effects are eliminated. Letting T be a dummy variable equal to 1 for grade g and 0 for grade g-1,

$$\textbf{(2)} \qquad \Delta A_{isg.} = M_{isg.} \cdot T_g \lambda + S_{sg.} \theta + T_{g.} \quad + \quad _{sg.} + \quad _{isg.}$$

[9]Movers in the previous period are excluded because of the possibility that mobility effects would confound any recovery from a previous move with the effect of the current move. As we show below, mobility effects are not sensitive to previous period mobility.

The removal of individual fixed effects from the achievement growth model almost certainly reduces contamination due to the non-randomness of mobility. In addition, the included school characteristics should capture much of the confounding effects of school quality differences, because families likely use student demographics, average class size and teacher experience (contained in S) as important indicators of school quality (cf. Kain and O'Brien 1999). The effects of other determinants of student achievement should average out if they are not systematically related to mobility decisions.

The fixed effects model is also used to investigate the duration of mobility effects by comparing the achievement gain in the second year following a move to the achievement gain in the year prior to the move. Full recovery to the initial achievement path would require that any decline in the rate of achievement gain following a move would be fully offset in the subsequent year. An important case would be "Tiebout" moves, where the family is moving specifically to better the school situation. If there is a loss in the moving year regardless of the reasons for moving, successful Tiebout moves would require that this loss is more than made up for in subsequent years by improvements in school quality.

Student Mobility

Little doubt remains after looking at mobility in Texas public schools that switching schools is a regular part of academic life for elementary school students. Table 1 presents the distribution of students by the number of school changes between 4^{th} and 7^{th} grade. It is important to note that school attended is identified in the spring of each year at the time the TAAS tests are administered. Therefore what we refer to as a move between, say, grades 5 and 6 could occur prior to the start of 6^{th} grade, or it could occur during 6^{th} grade prior to the date of the test. Student attendance data show that over 90 percent of family dictated moves and all school dictated moves occur prior to the start of the school year, and the timing of the move is not considered in this analysis. Students must remain in Texas public schools throughout the sample period to be included in the calculations. The summary statistics are an understatement of the amount of moving, because multiple within year moves are not counted.

The top panel of Table 1 reports the distribution of all types of school changes combined, while the bottom panel presents the distribution of family initiated school changes. Less than two percent of students remain in the same school between 4th and 7th grade, primarily because of school initiated changes. The majority of students experience one change, and this is true for all economic and ethnic groups. While Blacks and low income students are more likely to experience multiple moves, the distribution of the total number of changes is quite similar across demographic groups.

The bottom panel of Table 1 reveals more pronounced differences in the distribution of family initiated moves. Whites and non-low income students are much more likely to experience no family initiated moves and much less likely to experience multiple moves. Low income students are about twice as likely as non-low income students to move twice or three times. Over 14.5 percent of Black students move at least twice during this period, while less than 9 percent of Hispanics and less than 7 percent of Whites move two or three times.

Tables 2 thru 5 focus on the transition between 5th and 6th grade. Little is lost by focusing on this transition, because family dictated moving patterns by ethnicity and race are quite similar for each of the other grade transitions observed in the sample. Of course the number of districts that require students to switch schools following a particular grade does vary substantially by grade, and the 5th to 6th grade transition is the point at which many districts separate middle school from junior high school.

Table 2 divides family initiated moves into within and between district changes and reports the percentage of students who exit Texas public schools between 5th and 6th grade.[10] Approximately 8 percent of students exit the public schools each year, and slightly fewer than 7 percent switch districts. There is

[10]Exits combines two heterogeneous groups: those who leave the state entirely and those who leave the public schools for private schools within the state.

little variation by income or ethnicity in the probability of exiting or switching districts. The most pronounced differences by income and ethnicity occur in the probability of a family initiated transfer within district. Blacks are almost three times as likely as Whites (16.3% to 5.5%) to change schools within district and Hispanics are almost twice as likely as Whites. The income gap is smaller, though low income students are more than 2 percentage points more likely to switch schools within district.

The income and ethnic differences in within district changes reflects the fact that minorities and low income students are much more likely to attend public school in urban districts where within district moves are much more common. Almost fifty percent of Black and Hispanic students attend urban schools while only 20 percent of Whites attend public school in urban districts. There is also a 15 percentage point gap by income. Table 3 confirms that within district transfers are much more prevalent in urban districts, particularly large districts in major urban centers. Over 17 percent of students in urban schools in 5^{th} grade opt to transfer to another school within the same district for 6^{th} grade, and only 25 percent remain in the same school. This contrasts sharply with rural districts in which only 2 percent choose to transfer to another school within the district (many have no within district alternative) and over one third remain in the same school. Not surprisingly, rural and suburban students are somewhat more likely than urban students to change districts but less likely than urban 5^{th} graders to exit the Texas public schools entirely.

Table 4, which describes the pattern of district switchers by both origin and destination district type, shows the general trend away from cities and toward less dense population areas. Among students who leave urban districts, almost 85 percent move to a suburban or rural district. Sixty-five percent of rural district switchers move to another rural district, and 70 percent of suburban district switchers move to another suburban or a rural district. Only one fourth of suburban students who switch districts move to an urban school, while 65 percent of urban district switchers move to a suburban district.

One important aspect of school switching is the change in school characteristics. Table 5 reveals that minority and low income students who switch schools within district experience an average four to six percentage point drop in free lunch eligible schoolmates, while those who switch districts experience slightly larger changes. Whites and non-low income students who switch schools within district experience slight increases in the percentage of schoolmates eligible for a free lunch. Consequently, school switching by minority and disadvantaged students and within district switching by whites and non-low income students are leading to less segregation by income. However, Whites and non-low income students who switch districts tend to experience slight decreases in the percentages of free lunch eligible and minority students. In terms of school characteristics, movers tend to experience a larger average reduction in class size between 5th and 6th grade than non-movers, though movers also experience a slightly larger increase in the probability of having a new teacher.[11] Overall, there is little support for the belief that most movers, particularly minority and economically disadvantaged students, are forced to relocate to higher poverty neighborhoods. We do, nonetheless, lack detailed information on family circumstances, so we cannot adequately distinguish between cases of "distress" (such as job loss or divorce) and cases of Tiebout moves.

Mobility Effects on Mathematics Achievement

The baseline results, reported in Table 6, provide estimates of the effects of different types of moves on achievement levels and gains in 5th, 6th and in one case 7th grade. The estimates for mobility effects on the level of achievement provide a comparison with other studies that investigate simple

[11]The difference between movers and non-movers is small, but our previous work (Rivkin, Hanushek, and Kain 1998) suggests this is likely to be an unfavorable trade-off in achievement terms.

The comparisons of the estimated effects of family initiated moves in the level and the growth models of achievement yield the expected pattern: the level estimates are substantially larger in virtually all specifications. These results are consistent with the hypothesis that the higher propensity to move for lower socio-economic background students inflates the mobility coefficients in models of achievement levels.

A second interesting pattern in Table 6 is the variation across grades in the magnitudes of the effects of different types of moves on the gain in achievement. In particular, moves between the end of fifth grade and the end of sixth grade appear to be more disruptive than those in 5th grade or 7th grade (not reported), and this pattern is most pronounced for family initiated moves.[12] Within district sixth grade moves initiated by the family reduce achievement growth by 0.22 standard deviations and those initiated by the district reduce achievement by 0.18 standard deviations. The finding that school generated changes are important, both relative to family moves and in absolute terms, is consistent with the prior finding by Kain and O'Brien (1998). Nonetheless, because of the possibility of bias from omitted individual characteristics, we exploit the panel aspects which permit estimation of models with fixed individual effects in achievement growth, i.e., equation (2).

Table 7 provides the fixed effect estimates that come from contrasting an individual's achievement growth in 6th grade with that in 5th grade. In order to avoid contamination from prior moves affecting the "base" growth, we begin by restricting the sample to just those students who did not move between grade 4 and grade 5.[13] The first column reveals sizeable mobility effects that are slightly larger in magnitude than estimates from the 6th grade gains specification and much larger than the estimates from the 5th grade gain

[12]The substantial differences in effect sizes across grades suggests that mobility timing is quite important, but these results are preliminary and merit much more detailed investigation. In subsequent work we intend to combine 5th, 6th, and 7th grade gains in a single fixed effects model and to use a different student cohort to examine the effects of moving prior to 4th grade.

[13]This restriction could itself cause some selection factors to enter. We test this below by looking at the complement, i.e., those who moved in fourth grade. Subsequent work will add to the length of the panel and permit direct estimation of the effects from the various move patterns.

specification in Table 6. The estimated mobility effects are -.21 for school dictated moves, -.12 for between district transfers, and -.28 for within-district family initiated changes. The similarity of the fixed effects and the previously presented growth estimates provides evidence that the omission of (time-invariant) background factors is not a major source of bias for value-added education production function specifications. This aspect of the analysis confirms our previous estimates for class size and teacher experience.[14]

Though the estimated effects of the different types of moves are large, particularly for school changes within districts, their importance for academic achievement over the long term depends crucially on the answers to two questions: 1) Are the effects temporary, or do they persist beyond the year immediately after the move? And 2) Are the effects of additional moves additive, or do additional school changes have little or no added effect?

The second column of Table 7 addresses the question of whether mobility effects are additive, and the answer is a resounding yes. In this estimation, the sample is restricted to just those who moved between grades 4 and 5, and the effects of a move between grades 5 and 6 are estimated. The penalties for each type of move for students who did not move in the prior year (first column of Table 7) are virtually identical to the estimated effects of an additional move for students who had moved in the previous year. Moreover, all the estimates probably understate the full effects of frequent moving by ignoring multiple within year moves. In other words, a student who moves three times between being tested in fourth grade and tested in fifth grade is viewed the same as a student who moves only once over that period.

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[14]The finding that gains specifications with and without controls for individual fixed effects generate quite similar results is consistent with the analysis of class size effects using the same Texas data (see Rivkin, Hanushek, and Kain, 1998).

[15]Subsequent analysis will consider the effects of multiple within year moves.

The third column in Table 7 addresses the duration of mobility effects by estimating the effects of a move prior to 6th grade on the achievement gain in 7th grade. In other words, the comparison is the achievement growth in the second year following a move to the growth in the year prior to the move.[16] The estimates reveal that there is some recovery but that it does not restore the losses from the move. For both school dictated and between district moves, the coefficients in Table 7 are exactly one third as large as those for the sixth grade loss. In contrast, the recovery of 0.02 for students who moved within district is minuscule compared to the sixth grade loss of 0.28 standard deviations. After two years, within district movers lost slightly more than one fourth of a standard deviation of achievement compared to non-movers.

Overall, the empirical evidence is not consistent with the view that mobility effects largely reflect differences between movers and non-movers rather than a causal relationship. Rather the findings support the hypothesis that school changes hinder academic development over the long term, particularly for multiple movers and students who move within districts. An important question is why the effects of certain types of moves differ from those of other types of moves. Is the impact of between district moves smaller because a more definitive relocation is actually less harmful to academic achievement, or is the gap related to differences in school quality changes or student composition for the various types of moves? The next two sections seek an answer to this question.

School Resources, Peer Groups, and School Organization

The previous evidence that the rate of learning decreasing following a move leads naturally to the important question of whether a concomitant change in school quality and peers contributed to that decline. Systematic changes in school characteristics, the object of a number of planned moves, could complicate the interpretation of the underlying causal structure. We measure school quality with information on class

[16]The sample is again restricted to students who did not move in the year prior to grade 5. Unless stated otherwise, this restriction is imposed on all specifications.

size and teacher experience[17], and we measure peers by the percentage of students eligible for a free or reduced price lunch and the percentage of students who are new to the school (excluding school dictated moves).[18] Finally, to capture the organization of the school and the importance of school dictated moves, we incorporate whether subject specialist teachers or general teachers are used in regular instruction.[19] A significant change in estimated mobility effects following the inclusion of school and peer group characteristics or information on school organization would indicate that the previous estimates captured differences in the school environment in addition to the direct effect of moving.

Table 8 reports mobility effects – both immediate and during the second year – when school, peer group, and organizational characteristics are included. All estimates are done within the framework of individual fixed effects in achievement growth (equation 2), implying that the school and peer effects are identified by changes in these characteristics between grades. The estimates in the first and fifth columns reproduce the basic fixed effects estimates from Table 7, columns one and three, that did not include controls for school or peer group characteristics. The sample restrictions identified in Table 7 (no moves in grade 4 or grade 7 for the last three columns) also apply to each of these new estimates.

Despite the fact that the effects of teacher experience are significant in all specifications and the effects of class size significant in some (not reported), there is no evidence that differences in class size or teacher experience accounts for any of the estimated effects of mobility, as seen by the unchanged mobility

[17]Based on our previous work, the most important systematic effects are captured by the percentage of teachers with zero years of experience and the percentage of teachers with one year of experience (Rivkin, Hanushek, and Kain 1998).

[18]Subsequent analysis in this section concentrates on the racial and ethnic make-up of the school's students as they interact with racial and ethnic differences among the movers.

[19]Specifically three dummy variables are included: subject specific teachers in both grades; general teacher in grade 5 and subject specific teachers in grade 6; and general teacher in grade 6 and subject specific teachers in grade 5. In the achievement models subsequently estimated, the strongest effect is a positive boost in achievement growth from having subject specialists in both grades.

estimates in columns two and six. The results from inclusion of peer group characteristics are also largely unaffected except for students who move within districts, where the magnitude of the coefficient falls from -.28 to -.21. As will be discussed below, it appears that the key peer group characteristic is the percent of students who are new to the school, a more important factor in within district moves. Since the evidence in Texas and elsewhere suggests that mobility is not evenly distributed across all schools (Kerbow 1996), those who move appear to be disproportionately affected by the mobility of others.

Finally, however, consideration of the organization of instruction does have a significant effect on the estimated effect of mobility. The immediate negative impact of mobility is reduced by 25-30 percent, regardless of the type of move, when changes in the use of specialist teachers in instruction are accounted for, and the estimated recovery during the second year is both reduced and statistically insignificant. This suggests that the academic disruption from changing the mode of instruction, which is common with middle school moves, is confused in part with the move itself. Allowing for these factors, nonetheless, shows that mobility has a sharp depressing effect on achievement growth that is not made up for during the second year after the move. Changing districts, which is more likely to be associated with Tiebout choice behavior, has less of an effect, but it remains negative over the first two years of a school change.

Differences by Income and Ethnicity

Both because of family resource differences and because of the possibility that the acclimation process is more difficult for minority students, there may well be substantial differences in the costs and benefits of moving by income and ethnicity. This section parallels the previous analysis except that estimates are computed separately for specific demographic groups.

Table 9 reports mobility effects for low income (eligible for a reduced price lunch) and non-low income students. The pattern of estimates is quite similar for the two income groups, though mobility effects are approximately twice as large for low income students.[20] Neither income group sees any significant recovery during the second year following a move. Moves within the same district — whether initiated by the school or the family — are significantly more damaging to achievement growth than moves across districts, suggesting that the choice of new districts can ameliorate any moving losses. Low income students have one-quarter standard deviation less growth in the year of a move to another school in the same district, and this appears to be a permanent loss. The differences in coefficient magnitudes across specifications again suggests that measured school and peer factors do not confound the estimates but that differences in the organization of instruction account for a small portion of the mobility effects.

Table 10 reveals that the differences among ethnic groups are much more pronounced than those by family income.[21] Black and Hispanic students incur significant losses in achievement following a move, and there is no significant recovery of this lost achievement during the subsequent year. Concentrating on the moves that control for measured school, peer, and organizational factors, within district family initiated moves cost Blacks and Hispanics -.29 and -.25 standard deviations, respectively, in the period following the move, and there is no recovery in the second year. School initiated moves cost Blacks and Hispanics -.17 and -.28 standard deviations, respectively, also without significant recovery. Finally, Blacks and Hispanics who switch districts also incur a significant cost, though it is slightly smaller for Hispanics.

These separate estimates by income and race/ethnicity show noticeably more sensitivity to moving for disadvantaged populations. This heightened sensitivity is coupled with higher mobility rates, implying

[20]The effect of moving across districts for the upper income group is insignificantly different from zero, although the point estimates fit into the pattern of the other coefficients. Further investigation is required to ascertain whether greater flexibility in moving offered by more income permits better (offsetting) choices of schools.

[21]In the separate race and ethnicity estimates, measures of the aggregate racial and ethnic composition of the school were also included in the peer variables. In no case did any of these compositional measures have a statistically significant impact on achievement. Subsequent work will investigate the role of peers in more detail.

the potential for truly significant differences in achievement growth. Before considering the combined influence of these, a third factor is relevant: What is the effect of attending a school where greater proportions of the students are moving each year?

External Effects of Mobility

The possibility that turnover effects non-movers as well as movers is raised by many including Alexander, Entwisle, and Dauber (1996) and Kerbow (1996), though neither attempts to estimate the impact of turnover on non-movers. By including the percent of within and between district movers as an explanatory variable, the effects of turnover rates on achievement gains can be estimated. Importantly, the specifications also include an interaction term to permit the effect on non-movers to differ from the effect on movers. If higher turnover improves the ability of schools and teachers to integrate new students into the classroom, the adverse effect of turnover might be smaller for movers.

Table 11 reports individual fixed effect estimates of the effects of the percentage of new students and the interaction term of this with individual moving behavior have on achievement growth. Estimates are again obtained for the entire sample and for the separate demographic groups. The pattern (but not magnitude) of effects is quite similar for all demographic groups. Higher turnover in the school exerts a negative effect on achievement which is significant at less than the 1 percent level for all groups expect for Hispanics, for whom it is significant at the 7 percent level. The estimate of the effect equals -.0040 for all students, meaning that a 10 percentage point increase in the percent of students who are new would tend to reduce achievement gains by -.04 standard deviations. There is some variation of turnover effects by income and a great deal of variation by ethnicity. Black students appear to be much more sensitive to turnover, as a 10 percent increase in aggregate school mobility leads to a .08 standard deviation decline in achievement, more than two and one half times as large as the effects for Hispanics and Whites. Blacks are also the only demographic group for which the turnover effect on movers is significantly smaller than the effect on non-movers, at least at the 9 percent level. Thus there is clear evidence of a negative externality associated with moving, and Blacks appear to be most sensitive to changes in aggregate student turnover.

The sensitivity to school turnover takes on added significance because of systematic differences in average turnover rates. While the average percentage of new students[22] in the school of a typical white sixth grade student is 12.8 percent, it is 14.6 percent for the typical Hispanic and 18.2 percent for the typical Black student. School mobility rates for the typical free and reduced lunch student are closer but still above those of more economically advantaged students (15.0 versus 13.5 percent). Thus, heightened sensitivity to the externality of school churning is exacerbated by the fact that disadvantaged and minority students attend high turnover schools.

The Differential Effect of Moving

Understanding the implications of student mobility has been difficult, because moves are associated with both a variety of complex family decisions and institutional decisions by schools themselves, and many of these other factors likely exert a direct effect on student performance. However, the fixed effects analysis provides the building blocks for calculating the differential effect of moving on observed student performance. We concentrate on the effects of mobility between fifth and sixth grade, a time of significant school changing.

On average, white students have achievement growth during the sixth grade that is 0.11 standard deviations higher than Blacks and 0.12 standard deviations higher than for Hispanics. The difference across free and reduced lunch eligibility groups is approximately the same: .09 standard deviations. Table 12 provides estimates of the extent to which differences in mobility rates of students and their schoolmates and differences in the effects of mobility on achievement account for race/ethnicity and income differences

[22]Again, in these calculations, school initiated moves are not considered, so “new students” refers to those entering because of family initiated school changes.

in achievement gains.[23] In other words, the effects of mobility are decomposed into the portion due to differences in mobility rates and the portion due to differences in mobility coefficients, considering both individual and school aggregate effects. The components of the decomposition of differences in achievement growth between, say, whites and Blacks, are:

$$\begin{aligned}\overline{\Delta A}_{white} - \overline{\Delta A}_{black} = {} & \beta^{i}_{white}(\overline{R}^{i}_{white} - \overline{R}^{i}_{black}) + \overline{R}^{i}_{black}(\beta^{i}_{white} - \beta^{i}_{black}) \\ & + \beta^{s}_{white}(\overline{R}^{s}_{white} - \overline{R}^{s}_{black}) + \overline{R}^{s}_{black}(\beta^{s}_{white} - \beta^{s}_{black})\end{aligned}$$

The first line considers individual differences (superscript i), while the second line considers aggregate school effects (superscript s). The race/ethnicity and income differences in mobility rates (R) are weighted by the low income or minority coefficients (β), while coefficient differences are weighted by the high income or white mean mobility rates. (The opposite weighting scheme yields very similar results). These components are then expressed as percentages of the overall gaps in achievement growth during the sixth grade.

Three conclusions about overall mobility effects stand out from the calculations in Table 12. First, while there is some variation across groups, it is clear that differential costs of moving are very important and dominate the contribution of differences in moving propensities. Eighty-four percent of the income gap, 96 percent of the Hispanic-White gap, and 47 percent of the Black-White gap in achievement growth can be explained by differences in the effects of individual student moves. Second, differences in both school average mobility rates and the impact of student turnover account for a substantial portion of the Black-White achievement differential. Specifically, the higher average turnover rates in schools attended by

[23]For these decompositions, separate achievement equations were estimated and the interaction between individual moves and aggregate school effects was constrained to zero (as suggested by the estimates in Table 11).

Black students accounts for roughly one third of the Black-White gap, and the larger effect of turnover on Blacks explains another 43 percent. Third, the total effect of moving, calculated from adding the individual and aggregate school effects, *more than explains* the differences in achievement growth that are observed. The final column shows that the combined elements of mobility costs explain 110-124 percent of the lower growth of minority and economically disadvantaged students. The decompositions suggest that other, unmeasured factors actually favor these students, though the hypothesis that mobility accounts for exactly 100 percent of the gain differential likely would not be rejected at standard levels of significance.

Conclusion

Prior evidence on mobility effects did not reach a consensus, in part because of differences in methodological approach and in part because of the small number of students used in most studies. More importantly, the true effects of mobility may also vary by grade, type of move, student characteristics, and school organization and stability. The results of this study provide strong support for each of these explanations. We find that mobility effects are much larger in 6^{th} than in 5^{th} grade, much larger for minority students than for Whites, larger for lower income than non-lower income students, and much larger for those who move within rather than between districts. In general students do not recover from these effects in the two years following the move, particularly for family initiated moves within the same school district. Even moves dictated by the structure of district schools appear to impose a long term cost on some students. Estimated effects differ based on the method used to control for student heterogeneity, but remain quantitatively and statistically significant in our models with individual fixed effects for student growth, with measures of how school and peers change with moves, and with detailed measures about the organization of instruction.

While we lack sufficient information to characterize the various motivations for moving, the results suggest that district changes – which might on average be dominated by Tiebout selection – have negative average effects on achievement growth that are not made up for at least during the second year after a move. Moves within districts, which are likely to be motivated more by other factors, do have a larger negative impact. Perhaps more importantly, the large and persistent effects of school dictated moves suggests that the mobility estimates are not driven by changes in student circumstances that either precipitate or accompany a change in schools. Nevertheless, such changes may contaminate the estimates, particularly the family initiated, within district changes, and further investigation of this issue will be undertaken.

When we aggregate all of the separate aspects of mobility, we find that school changing by itself can explain *all* of the difference in achievement growth between low and upper income students and between white and Black or white and Hispanic students. While somewhat surprising and possibly driven in part by the influences of unobserved factors, this finding is not inconsistent with previous work on Texas schools that showed very little correlation in school and teacher quality across grades (Rivkin, Hanushek, and Kain, 1998). It may be that the systematic differences in achievement gains by race, ethnicity and income are driven by the greater instability of minority and low income students

A number of issues merit further investigation. Perhaps the most important is the difference in mobility effects at different ages. Is the early adolescent period of 6th grade a time in which moving is particularly harmful and difficult to recover from in the subsequent years? We will explore the effect of school switching prior to 5th grade with additional data from the UTD Texas Schools Project. A second question is whether a move from an urban school to a suburban or rural district pays off in terms of raising academic achievement. This is a particularly important question for low income and minority students, and preliminary estimates of the effects of Black suburbanization are available in Kain and O'Brien (1999). Nonetheless, critical policy issues, such as those surrounding school desegregation, are related to these overall concerns. Finally, how do specific types of moves during specific grades affect longer run outcomes such as high school completion and college attendance.

If the true effects of student moving are well approximated by this study, mobility issues certainly merit much more consideration in the education policy discussion. The effect sizes for mobility exceed the estimated effects of a 10 student reduction in class size that were estimated with this same student population (Rivkin, Hanushek, and Kain, 1998). While it may be difficult to limit family initiated moves, the negative externality associated with such moves should be addressed. In addition, if the existing divisions of middle and junior high schools force students to switch schools at precisely the time such switches appear most harmful for certain demographic groups, this structure should be modified.

References

Alexander, Karl L., Doris R. Entwisle, and Susan L. Dauber. "Children in motion: School transfers and elementary school performance." *Journal of Educational Research* 90, no. 1 (September/October 1996): 3-12.

Angrist, Joshua D., and Victor Lavy. "Using Maimondides' rule to estimate the effect of class size on scholastic achievement." *Quarterly Journal of Economics* (forthcoming).

Hanushek, Eric A., John F. Kain, and Steven G. Rivkin. "Does special education raise academic achievement for students with disabilities?". National Bureau of Economic Research, Working Paper No. 6690, 1998.

Hoxby, Caroline Minter. "The effects of class size and composition on student achievement: New evidence from natural population variation". National Bureau of Economics Research, Working Paper No. 6869, December 1998.

Ingersoll, Gary M., James P. Scamman, and Wayne D. Eckerling. "Geographic mobility and student achievement in an urban setting." *Educational Evaluation and Policy Analysis* 11, no. 2 (Summer 1989): 143-49.

Kain, John F., and Daniel M. O'Brien. "A longitudinal assessment of reading achievement: Evidence for the Harvard/UTD Texas Schools Project". UTD Texas Schools Project, University of Texas at Dallas, April 1998.

---. "Minority suburbanization in Texas metropolitan areas and its impact on student achievement". UTD Texas Schools Project, University of Texas at Dallas, February 1999.

Kerbow, David. "Patterns of urban student mobility and local school reform." *Journal of Education for Students Placed at Risk* 1, no. 2 (1996): 147-69.

Rivkin, Steven G., Eric A. Hanushek, and John F. Kain. Teachers, schools, and academic achievement.

Table 1. Distribution of Students by the Number of School Changes between 4th and 7th Grade, by Income and Ethnicity

	Number of Changes				
	0	1	2	3	Number of Students
I. All Changes					
All Students	1.7%	62.7%	29.5%	6.1%	226,849
Low Income	1.7%	60.7%	30.4%	7.3%	105,867
Not Low Income	1.7%	64.1%	29.0%	5.3%	120,982
Black	0.7%	57.0%	34.3%	7.9%	30,795
Hispanic	1.4%	65.6%	27.0%	6.0%	79,690
White	2.1%	62.4%	29.7%	5.7%	110,974
II. Excluding School Dictated Moves					
All Students	67.9%	23.5%	7.2%	1.5%	226,849
Low Income	63.3%	25.4%	9.2%	2.1%	105,867
Not Low Income	71.9%	21.9%	5.3%	0.9%	120,982
Black	54.8%	30.6%	11.9%	2.7%	30,795
Hispanic	67.0%	24.1%	7.4%	1.5%	79,690
White	72.2%	21.1%	5.7%	1.1%	110,974

Table 2. 5th to 6th Grade Transition by Type of Move, Income and Ethnicity

	Income		Ethnicity			All movers
	Low Income	Not Low Inc	Black	Hispanic	White	
Same Campus	27.7%	31.2%	30.0%	28.8%	30.6%	29.7%
School Dictated Move	46.4%	46.6%	37.6%	47.4%	48.5%	46.6%
New Campus Same District	10.3%	7.8%	16.3%	10.5%	5.5%	8.9%
New District	7.4%	6.4%	7.1%	5.8%	7.5%	6.8%
Exit Texas Public Schools	8.3%	8.0%	9.0%	7.5%	7.9%	8.0%
ALL	100%	100%	100%	100%	100%	100%
No. students	132,626	159,232	41,137	103,480	139,018	290,468

Table 3. 5th to 6th Grade Transition by Type of Move and Origin Community Type

Move type	Origin community type: Large Urban	Small Urban	Suburban	Rural
Same Campus	25.3%	24.0%	27.5%	38.0%
School dictated move	39.8%	47.5%	49.6%	47.2%
New campus, same district	17.3%	13.6%	8.0%	2.1%
New district	6.7%	5.1%	7.2%	7.2%
Exit Texas public schools	10.9%	9.9%	7.7%	5.5%
ALL	100%	100%	100%	100%
Number of students	60,766	36,902	108,266	85,275

Table 4. Destination Community Type for Students Changing Districts, by Origin Community Type

	Destination community type				
Origin district type	Large Urban	Small Urban	Suburban	Rural	ALL
Large Urban	12.3%	3.7%	65.3%	18.8%	100%
Small Urban	7.2	9.9	53.2	29.7	100
Suburban	18.7	9.7	48.0	23.6	100
Rural	6.9	8.2	20.0	64.9	100

Table 5. Average Change in Student and School Characteristics, by Type of Family Dictated Move, Ethnicity and Income

Type of Move	Income		Race/ethnicity			All movers	All
	Low Income	Not Low Inc	Black	Hispanic	White		nonmovers
I. Within District							
% Free Lunch	-6.1	0.8	-5.6	-3.8	1.3	-2.8	-1.7
% Black	-0.3	0.2	-4.1	1.4	1.2	-0.1	-0.1
% Hispanic	-1.9	1.5	2.1	-3.0	1.4	-0.3	0.0
Ave Class Size	0.0	-0.2	-0.6	-0.1	-0.3	-0.3	-0.1
% Teas 0 yrs Exp	2.7	2.3	2.6	2.7	2.2	2.5	1.8
% Teas 1 yr Exp	-0.2	1.0	0.6	-0.6	1.2	0.3	-0.1
II. New District							
% Free Lunch	-6.9	-4.7	-8.5	-6.9	-4.2	-5.8	
% Black	-1.8	-2.4	-6.1	-0.3	-1.9	-2.1	
% Hispanic	-3.1	-2.3	-0.2	-4.7	-2.1	-2.7	
Ave Class Size	-0.3	-0.7	-0.3	-0.3	-0.4	-0.3	
% Teas 0 yrs Exp	2.9	2.1	2.9	2.4	2.5	2.5	
% Teas 1 yr Exp	0.8	0.4	1.0	0.8	0.4	0.6	

Table 6. Estimated Effects of Moving on Mathematics Test Scores, by Type of Move
(huber adjusted t statistics in parentheses)

	Grade and model type				
	5	5	6	6	5 to 7
Move type	Level	Growth	Level	Growth	Growth
School Dictated Move	-0.06	-0.08	-0.07	-0.18	-0.01
	[-2.22]	[-4.08]	[-3.29]	[-15.6]	[-1.12]
New Campus Same District	-0.25	-0.01	-0.27	-0.22	-0.06
	[-15.1]	[-1.19]	[-10.1]	[-15.2]	[-8.48]
New District	-0.20	-0.02	-0.22	-0.12	-0.02
	[-17.9]	[-2.83]	[-14.8]	[-10.6]	[-3.42]
Sample Size	214,944	186,203	225,077	190,545	154,932

Note: Grade 5-7 calculations employ the growth in achievement between grade 4 and grade 7 as the dependent variable and include the number of years during which each type of mover was observed.

Table 7. Fixed Effect Estimated Effects of Moving on Mathematics Test Scores, by Pattern of Moves and Grades (huber adjusted t statistics in parentheses)

Comparison	Gain in 6 to	Gain in 6 to	Gain in 7 to

Table 8. Fixed Effect Estimated Effects of the Persistence of Moving on Mathematics Test Scores, by Type of Move and controls for school and peer group characteristics
(huber adjusted t statistics in parentheses)

	Gain in 6 to gain in 5				Gain in 7 to gain in 5			
School Dictated Move	-0.21 [-10.1]	-0.21 [-9.91]	-0.20 [-9.36]	-0.16 [-5.36]	0.07 [3.47]	0.07 [3.42]	0.07 [3.55]	0.04 [1.44]
New Campus Same District	-0.28 [-10.7]	-0.28 [-10.7]	-0.21 [-5.60]	-0.17 [-3.84]	0.02 [0.94]	0.02 [0.91]	0.01 [0.36]	-0.01 [-0.30]
New District	-0.12 [-6.13]	-0.12 [-6.07]	-0.10 [-3.67]	-0.07 [-2.18]	0.04 [1.97]	0.04 [1.93]	0.03 [1.27]	0.01 [0.27]
school variables	no	yes	yes	yes	no	yes	yes	yes
peer variables	no	no	yes	yes	no	no	yes	yes
subject specialists	no	no	no	yes	no	no	no	yes

Table 9. Fixed Effect Estimated Effects of Moving on Mathematics Test Scores, by income and controls for school and peer group characteristics (huber adjusted t statistics in parentheses)

	Gain in 6 to gain in 5			Gain in 7 to gain in 5		
Low Income						
School Dictated Move	-0.30	-0.28	-0.23	0.07	0.07	0.03
	[-10.4]	[-9.70]	[-5.70]	[2.61]	[2.66]	[0.90]
New Campus Same District	-0.37	-0.30	-0.24	0.02	0.02	0.00
	[-10.2]	[-5.43]	[-3.88]	[0.77]	[0.32]	[0.00]
New District	-0.17	-0.14	-0.10	0.06	0.05	0.03
	[-5.54]	[-3.40]	[-2.13]	[1.85]	[1.30]	[0.68]
Sample Size	47,517	47,517	47,517	38,191	38,191	38,191
Not Low Income						
School Dictated Move	-0.16	-0.15	-0.12	0.07	0.07	0.04
	[-7.77]	[-7.24]	[-4.04]	[3.37]	[3.38]	[1.61]
New Campus Same District	-0.20	-0.16	-0.12	0.02	0.01	-0.01
	[-7.45]	[-3.66]	[-2.55]	[0.87]	[0.30]	[-0.27]
New District	-0.09	-0.08	-0.05	0.03	0.02	0.00
	[-3.98]	[-2.64]	[-1.57]	[1.37]	[0.69]	[-0.13]
Sample Size	81,300	81,300	81,300	70,734	70,734	70,734
school and peer group	no	yes	yes	no	yes	yes
subject specialists	no	no	yes	no	no	yes

Table 10. Fixed Effect Estimated Effects of Moving on Mathematics Test Scores, by Ethnicity and controls for school and peer group characteristics (huber adjusted t statistics in parentheses)

	Gain in 6 to gain in 5			Gain in 7 to gain in 5		
Black						
School Dictated Move	-0.32	-0.24	-0.17	0.05	0.08	0.04
	[-6.94]	[-5.27]	[-3.07]	[1.41]	[2.22]	[1.02]
New Campus Same District	-0.40	-0.37	-0.29	-0.02	-0.01	-0.01
	[-6.71]	[-4.34]	[-3.08]	[-0.40]	[-0.10]	[-0.16]
New District	-0.25	-0.25	-0.19	0.04	0.04	0.03
	[-4.51]	[-3.51]	[-2.50]	[0.73]	[0.60]	[0.45]
Sample Size	15,121	15,121	15,121	11,811	11,811	11,811
Hispanic						
School Dictated Move	-0.32	-0.31	-0.28	0.08	0.07	0.00
	[-8.94]	[-8.75]	[-5.48]	[2.36]	[2.32]	[0.14]
New Campus Same District	-0.33	-0.29	-0.25	0.07	0.04	-0.01
	[-8.19]	[-4.61]	[-3.33]	[1.92]	[0.78]	[-0.11]
New District	-0.20	-0.19	-0.16	0.09	0.08	0.04
	[-5.06]	[-3.73]	[-2.69]	[2.20]	[1.60]	[0.70]
Sample Size	35,547	35,547	35,547	29,868	29,868	29,868
White						
School Dictated Move	-0.14	-0.13	-0.10	0.07	0.07	0.05
	[-6.49]	[-6.05]	[-3.37]	[3.21]	[3.29]	[1.85]
New Campus Same District	-0.16	-0.10	-0.07	0.01	0.00	-0.01
	[-5.78]	[-2.30]	[-1.41]	[0.27]	[0.14]	[-0.28]
New District	-0.07	-0.05	-0.03	0.02	0.01	0.00
	[-3.27]	[-1.80]	[-0.82]	[0.91]	[0.45]	[-0.11]
Sample Size	74,663	74,663	74,663	64,302	65,196	65,196
school and peer group	no	yes	yes	no	yes	yes
subject specialists	no	no	yes	no	no	yes

Table 11. Estimated Effects of Percentage of Students Who Are New to the Class, by Income and Ethnicity

	Gain in 6 to gain in 5
All	
% New	-0.0040
	[-3.66]
% New * Move	-0.0001
	[-0.08]
Low Income	
% New	-0.0046
	[-3.06]
% New * Move	-0.0001
	[-0.03]
Not Low Income	
% New	-0.0035
	[-3.40]
% New * Move	0.0001
	[0.04]
Black	
% New	-0.0081
	[-3.96]
% New * Move	0.0048
	[1.71]
Hispanic	
% New	-0.0030
	[-1.81]
% New * Move	0.0004
	[0.14]
White	
% New	-0.0026
	[-2.25]
% New * Move	-0.0012
	[-0.73]

Table 12. Percentage of Racial, Ethnic and Income Gaps in Achievement Gains Accounted for by Differences in Mobility patterns and Estimated Effects of Mobility

	average gap (s.d. in annual growth)	% due to difference in individual mobility rates		% due to difference in school mobility rate		Total gap explained by mobility
		means (ΔR^i)	coefficients ($\Delta\beta^i$)	means (ΔR^s)	coefficients ($\Delta\beta^s$)	
I. Income Gap						
5th to 6th Grade	.09	1.6%	84.3%	7.5%	17.1%	110.5%
II. White/Black Gap						
5th to 6th Grade	.11	1.3%	46.9%	32.3%	43.1%	123.6%
III. White/Hispanic Gap						
5th to 6th Grade	.12	10.3%	96.0%	4.0%	0.2%	110.5%

Note: Decompositions use data for high income students or Whites to weight coefficient differences and coefficients for low income students or nonwhites to weight differences in mobility rates. The reverse decompositions generate quite similar results.