

Research Brief

**USING LONGITUDINAL STUDENT MOBILITY
ACROSS SCHOOLS AND DISTRICTS TO
IDENTIFY AT-RISK STUDENTS**

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Using Longitudinal Student Mobility Across Schools and Districts to Identify At-Risk Students

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We use comprehensive administrative data from three states to document the relationships between geographic mobility and student outcomes during K-12 schooling. We focus specifically on *nonstructural* mobility events—which we define as school or district changes that do not occur naturally as the result of planned transitions between schools—and on longitudinal measures that capture these events cumulatively for students. We show that the number of nonstructural moves experienced by a student is a powerful indicator of low academic performance and graduation rates. Longitudinal information on student mobility is unlikely to be readily available to local practitioners—i.e., individual districts, schools, or teachers. However, due to recent investments in longitudinal data systems in most states, this information can be made available at low cost by state education agencies.

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Introduction

We use administrative data panels in three states—Massachusetts, Missouri, and Washington—to document the link between educational outcomes and longitudinal measures of student mobility across schools and districts. We define two types of student mobility. The first, “structural mobility,” is when a student’s natural progression through the schooling system is such that a cross-school or cross-district move occurs due to school district structure (e.g., at the transition point from elementary to middle school). The second, “nonstructural mobility,” is when a student moves for another reason (e.g., a residential move due to economic instability—e.g., see Been et al., 2011; Desmond & Gershenson, 2016). Our goal is to examine the extent to which repeated *nonstructural* mobility during primary and secondary education is useful for identifying at-risk students.

We show that nonstructural mobility is strongly associated with at-risk status, as measured by low academic performance and graduation rates. For example, students in all three states who switch schools (non-structurally) three times during grades 3-12 score about 20 percentile points lower in the distribution of test performance in high school and are 9-27 percentage points less likely to graduate from high school, on average, compared to students without any nonstructural moves. Our findings are in line with existing evidence showing that mobile students are more likely to be at-risk than other students (Anderson and Leventhal, 2016; Barrat & Berliner, 2013; Courtney et al., 2004; Cowen, 2017; Cutuli et al., 2013; Ingersoll et al., 1989; Mehana and Reynolds, 2004; Rumberger and Larson, 1998).

Our unique contribution is to establish that the relationships between student mobility and outcomes are much stronger when the cumulative history of mobility is considered. In this way, our work mirrors findings by Micheltore and Dynarski (2017), who perform a conceptually similar analysis of the information conveyed by a student’s history of free and reduced-price lunch (FRL) eligibility to identify *persistent poverty*. Like their work, our findings point to the value of using longitudinal data to provide a more complete picture of student risk status than is available from cross-sectional data. Moreover, we show that longitudinal mobility captures unique information that is not captured by persistent poverty. In addition, longitudinal mobility is an appealing alternative to FRL-based measures in light of the USDA’s recent adoption of the Community Eligibility Provision (CEP) in the administration of the school lunch program. The CEP allows eligible districts and schools to designate all students as eligible for free meals, degrading the value of FRL data for identifying persistent poverty at the individual student level.

The evidence we present in this note is purely descriptive. The methods we employ are not suited to isolate the causal impacts of nonstructural mobility on students’ academic outcomes, but causal inference is not necessary for longitudinal information on student mobility to be put to good policy use. In particular, we show that longitudinal measures of mobility can be used by policymakers, administrators, and teachers to better identify at-risk students. A concrete policy recommendation based on our findings is that state education agencies construct panel measures of student mobility to help educators identify students who are likely in need of additional supports. Repeated mobility information over the span of K-12 schooling is unlikely to be

readily available to individual districts, schools, or teachers, which highlights a valuable role that states can play as information providers by leveraging their broader data systems.¹

Data and Measures

Our analysis is based on state administrative microdata covering nearly all students enrolled in public schools in Massachusetts, Missouri, and Washington. In each state we track two cohorts of students, who were enrolled in the third grade in either the 2006-07 or 2007-08 school years, from grades 3-12. Students who exit the public school system at any point prior to the 12th grade, either because they enroll in private schools or leave the state, are excluded from the data.² Our samples include 113,938 unique students from Massachusetts, 101,629 unique students from Missouri, and 120,294 unique students from Washington.

We follow these students as they progress through public schools and track their school and district transitions from the 3rd through 12th grades. We distinguish between structural school and district transitions, which are associated with normal promotion from one grade to the next, and nonstructural transitions that are unexpected given school and district grade configurations. Specifically, we define nonstructural transitions as follows. First, we identify the highest grade in each school in each year (e.g., grade-5 in a K-5 school). We define all school transitions in years other than those following a school's terminal grade as nonstructural moves. If the move also entails a district switch, then this also counts as a nonstructural district move. If a school transition occurs immediately after a school's terminal grade, the grade is not the highest grade served by the district, and the student moves to a new district, we also treat this transition as a nonstructural school and district move.³

We believe our definition of nonstructural moves is conservative; i.e., it likely understates the total number of moves associated with disruptions. In particular, school transitions that take place after a school's terminal grade to another school in the same district are not counted as nonstructural moves, despite the fact that some of these moves may be to schools other than the "next-in-line" zoned school. Unfortunately, we are unable to cleanly identify such moves because we do not observe student addresses (and hence cannot identify zoned schools).⁴

To assess the extent to which longitudinal mobility is an indicator of students being at risk, we document the relationships between student mobility and three primary performance measures – achievement in third grade, achievement in high school, and high school graduation. We measure

¹ In states with existing or emerging "early warning systems," repeated student mobility is a strong candidate for inclusion. The National Forum on Education Statistics (2018) reports that mobility is used by most existing systems, although information on whether longitudinal mobility is considered in most systems is not provided.

² We set the initial cohorts based on all students who have either 3rd grade math or reading/ELA test scores. Although most students in our initial third-grade cohorts remain in-state in the public school system through high school (about 80 percent), our samples of state stayers are more advantaged and higher achieving, on average, than the full population (Austin et al., 2020).

³ There are, for instance, K-5, K-6, and K-8 school districts in each of the three states.

⁴ There is also some measurement error in the mobility data stemming from district restructurings and mergers. These can create excess structural and nonstructural moves and will cause very modest attenuation bias in our estimates (because most students do not experience restructurings or mergers). If states package information on longitudinal student mobility to districts and schools per our policy recommendation, data on restructurings and mergers could be used to remove the small amount of measurement error in the data created by these events.

achievement in the third grade and high school by percentiles of the statewide test distribution.⁵ The third-grade tests are common statewide exams in math and English language arts (ELA). The high school exams we use in each state are the MCAS ELA exam in Massachusetts, the English II end-of-course exam in Missouri, and the HSPE ELA exam in Washington. For the graduation outcome, a student is considered a graduate if she is observed graduating high school within one year of her expected graduation year based on normal grade progression from the third grade forward. To be included in the non-graduate sample, a student must be observed with an enrollment record indicating a dropout. Students who simply disappear from the cohort without a graduation or dropout record are treated as state leavers and omitted from the graduation portion of the analysis.

Table 1 provides descriptive information about structural and nonstructural student mobility in each state overall and broken out by student race-ethnicity and FRL status. Across the three states, students experience an average of 1.7-2.0 structural school moves during grades 3-12 and 0.66-0.95 nonstructural school moves. For district moves, structural moves are uncommon (students average just 0.01-0.12 structural district moves across states, reflecting the fact that most students attend districts that contain the full 3-12 grade span), but the average number of nonstructural moves is non-negligible, ranging from 0.37-0.58 across states. Consistent with the idea that nonstructural mobility serves as a general indicator of disadvantage, underrepresented-minority (Black and Hispanic) and FRL-eligible students are much more likely to experience non-structural moves than their socioeconomically more-advantaged peers.⁶

Figure 1 provides complementary distributional information about nonstructural mobility in the form of student shares in each state with 0, 1, 2, 3, and 4+ nonstructural moves between grades 3-12. About 50-60 percent of students across the sample states have zero nonstructural school moves, which leaves 40-50 percent with at least one move. And we find that 15-25 percent of students across the three states experience two or more nonstructural school moves.

The rates of nonstructural district mobility are lower; still, 8-15 percent of students experience two or more nonstructural district moves. Appendix Table A1 provides the tabular data underlying Figure 1, along with similar distributional information broken out by student race-ethnicity and poverty status.

Note that the move counts and shares in Table 1 and Figure 1 understate total nonstructural mobility because as noted above, we restrict our sample to students who remain in our sample states from grades 3-12. By definition, this excludes students who cross state boundaries, who are also nonstructural movers (the total number of moves for students who leave state databases are unobserved in our data). This constraint on the sample may also impact the gradients we show below connecting the number of nonstructural moves to student outcomes. If nonstructural movers who cross state boundaries are more (less) likely to be at-risk than nonstructural movers

⁵ Percentile ranks are cohort-specific and based on the full entry cohort with values imputed for students with missing exam scores (to account for sample attrition over time). Details of the imputation procedure are available from the authors upon request.

⁶ We also observe discrepancies in the number of structural moves across racial groups and groups based on FRL eligibility. This could be driven by the fact that students from disadvantaged backgrounds (e.g., racial minorities, FRL eligible students) are more likely to attend schools with wider grade bands in the three states we examine.

who remain within their states, then the gradients we show below will be understated (overstated).

Using Longitudinal Nonstructural Mobility to Identify At-Risk Students

Figure 2 shows percentile ranks on the high school test for students who had 0, 1, 2, 3, or 4+ nonstructural moves during grades 3-12. Panel A shows the results for school moves, and Panel B for district moves. The charts show that the relationship between achievement rank and mobility events is roughly linear in all three states, and as measured by mobility at the school or district level. This points to the value of tracking mobility longitudinally—e.g., knowing a student moved twice during grades 3-12 indicates roughly double the disadvantage of a student who moved just once (relative to a student with zero moves).⁷

Next, Figure 3 replicates the same trends for graduation rates. The trends are somewhat flatter here, especially for lower numbers of mobility events, likely reflecting the fact that graduation is a less differentiated outcome than test scores. There are also clear differences in the gradients across states, unlike in Figure 2. The gradient is flattest in MA, followed by MO, and is steepest in WA. This pattern aligns with evidence from Austin et al. (2020), who show that graduation rates are lowest among initially low-performing students in WA, followed by MO, and then MA using similar data. That is, graduation appears to be a more discriminate outcome in the states with the steeper gradients in Figure 3. This is consistent with interpreting the number of nonstructural mobility events as an indicator of at-risk status—the relationship becomes more apparent as the outcome metric becomes more discriminate.

We again note that these relationships are descriptive and should not be interpreted causally. As a way of illustrating this, Figure 4 replicates the mobility-event trends using students' test percentile ranks in the third grade. The third-grade tests are taken prior to our mobility metrics between grades 3 and 12. The time inconsistency does not entirely preclude causal impacts of mobility on achievement because unmeasured mobility prior to the third grade is likely correlated with later-grade mobility. However, the similar trends for the third-grade and high-school tests in Figures 2 and 4 suggest that what we are largely capturing is not causal; rather, nonstructural mobility is serving as a general indicator of at-risk status. This interpretation is consistent with available research that aims to estimate plausibly causal effects of mobility, which finds negative but small mobility effects (e.g., Brummet, 2014; Grigg, 2012; Hanushek et al., 2004; Xu et al., 2009) or mixed effects depending on type of move (e.g., structural versus nonstructural moves, short- versus long-distance residential moves) as in Cordes et al. (2019) and Schwartz et al. (2017).

Appendix Tables A2-A4 provide tabular data corresponding to Figures 2-4, with additional subgroup splits by race-ethnicity and FRL status measured in the 3rd grade, like in Table 1. Qualitatively, the relationships between mobility and performance outcomes are similar within all race-ethnicity and poverty groups. There are modest fluctuations in the magnitude of the mobility relationship depending on the outcome measured and student group, and the relationships are generally less steep for students from more disadvantaged backgrounds. The flatter relationships are likely the product of weaker positive selection into the low-mobility

⁷ Michelmore and Dynarski (2017) find a similar near-linear relationship between exam scores and the number of grades spent in economic disadvantage.

categories among Black, Hispanic, and FRL students relative to Asian, White, and non-FRL students.⁸

Finally, in Appendix Tables A5 and A6, we examine the relationship between persistent poverty and longitudinal mobility to determine whether longitudinal mobility predicts variation in student at-risk status *above and beyond persistent poverty*. Appendix Table A5 presents (1) the distribution of nonstructural school and district mobility and (2) average high school test scores and high school graduation rates by student mobility conditional on persistent poverty. Appendix Table A6 repeats the same exercise using different definitions of partially persistent poverty based on the number of years the student was FRL-eligible between grades 3 and 12.⁹ Both tables show a strong link between nonstructural mobility and student outcomes holding the level of (measured) persistent poverty constant. For example, among persistent FRL students, those who do not change schools non-structurally score 9 to 11 percentiles higher on high school tests and are 8 to 21 percentage points more likely to graduate from high school compared to those who change schools non-structurally three times.

Conclusion

The key contribution we make is showing that longitudinal data on nonstructural student moves between schools and districts can help identify at-risk students. These findings have implications for both research and policy similar to those articulated by Michelmore and Dynarski (2017) in their related study on longitudinal poverty status based on FRL data. Importantly, the longitudinal mobility metrics are complementary to persistent FRL designations as they identify dimensions of at-risk status not captured by FRL information alone. They are appealing to use not only because they supplement FRL-based information, but also because they are not affected by district and school adoptions of the Community Eligibility Provision.

The findings also indicate that research relying on cross-sectional mobility information to proxy for student at-risk status, which is the current norm, will not fully capture differences across student circumstances captured by longitudinal mobility. To the extent that these differences are correlated with specific interventions and/or teacher and school assignments, they could cause bias in causal studies if left uncontrolled.

From a policy perspective, the main takeaway from our study is that state longitudinal data systems contain information that policymakers and practitioners can use to better target resources toward high-need students. It is unlikely that individual districts, schools, and teachers will have the ability to effectively collect data on longitudinal mobility. However, state education agencies can produce this information at low marginal cost given recent investments in state longitudinal data systems. Our findings point to a clear role of state education agencies in providing this type of information to local education actors in an effort to better serve at-risk students.

⁸ Put another way, within mobility categories there is less variation across student groups in the high-mobility categories than the low-mobility categories.

⁹ We define persistent poverty in Table A5 as being FRL eligible in all years during grades 3-12; Table A6 shows results using a variety of “partial persistence” poverty metrics.

Table 1. Mean Mobility and Outcome Values Overall and for Student Subgroups, by State

			(1)	(2)	(3)	(4)	(5)	(6)	(7)
			All	White	Asian	Black	Hispanic	Low Poverty (non-FRL)	High Poverty (FRL)
Massachusetts	School Moves	# of structural moves	1.692	1.757	1.650*	1.406*	1.528*	1.755	1.541*
		# of nonstructural moves	0.664	0.557	0.548	1.090*	1.031*	0.500	1.054*
	District Moves	# of structural moves	0.116	0.130	0.086*	0.086*	0.061*	0.133	0.075*
		# of nonstructural moves	0.374	0.321	0.281*	0.603*	0.554*	0.271	0.617*
		3 rd grade test	48.827	53.029	54.742*	32.730*	32.385*	54.832	34.571*
		10 th grade test	49.474	52.882	64.685*	34.615*	33.355*	55.739	34.600*
		High school graduation	97.721	98.450	99.119*	94.841*	94.933*	98.989	94.711*
Missouri	School Moves	# of structural moves	1.997	2.053	2.080	1.735*	2.006*	2.115	1.838*
		# of nonstructural moves	.770	.563	.452*	1.730*	.863*	.419	1.246*
	District Moves	# of structural moves	.027	.023	.015*	.045*	.018*	.019	.037*
		# of nonstructural moves	.584	.448	.272*	1.244*	.537*	.302	.966*
		3 rd grade test	52.034	55.757	61.194*	35.935*	42.607*	59.184	42.340*
		10 th grade test	51.846	54.772	65.969*	36.555*	45.203*	58.925	41.477*
		High school graduation	94.121	95.501	97.485*	88.069*	91.268*	97.564	89.453*
Washington	School Moves	# of structural moves	1.798	1.804	1.826*	1.675*	1.858*	1.840	1.739*
		# of nonstructural moves	0.954	0.893	0.742*	1.550*	1.013*	0.699	1.325*
	District Moves	# of structural moves	0.012	0.014	0.003*	0.005*	0.010*	0.012	0.012
		# of nonstructural moves	0.579	0.548	0.408*	0.920*	0.593*	0.398	0.843*
		3 rd grade test	49.476	53.847	54.846*	37.536*	34.840*	56.961	38.584*
		10 th grade test	50.693	54.520	60.057*	37.943*	36.725*	58.876	38.787*
		High school graduation	87.148	88.421	93.236*	80.003*	83.583*	92.485	79.381*

Notes: The poverty split divides students who are and are not eligible for free- or reduced-priced lunch in 3rd grade. Students coded as “other” race-ethnicity are omitted for brevity.

* indicates a value that is statistically significantly different from the comparison category at the 5 percent level or better. The values for the racial-ethnic subgroups are compared to white students for these tests; the values for high-poverty students are compared to low-poverty students.

Figure 1. Student shares by the number of nonstructural moves.

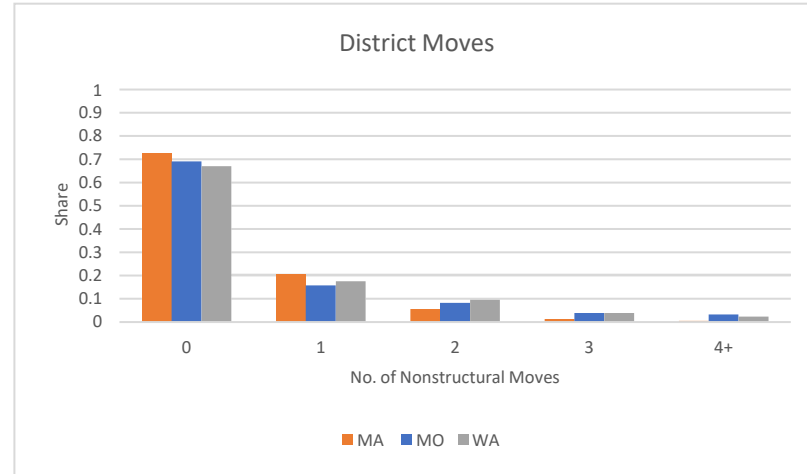
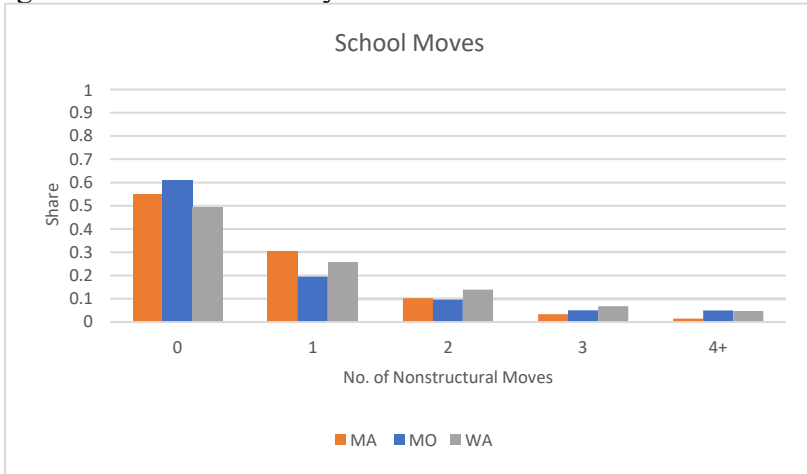


Figure 2. Relationships between high school achievement (percentile ranks) and school and district nonstructural mobility events.

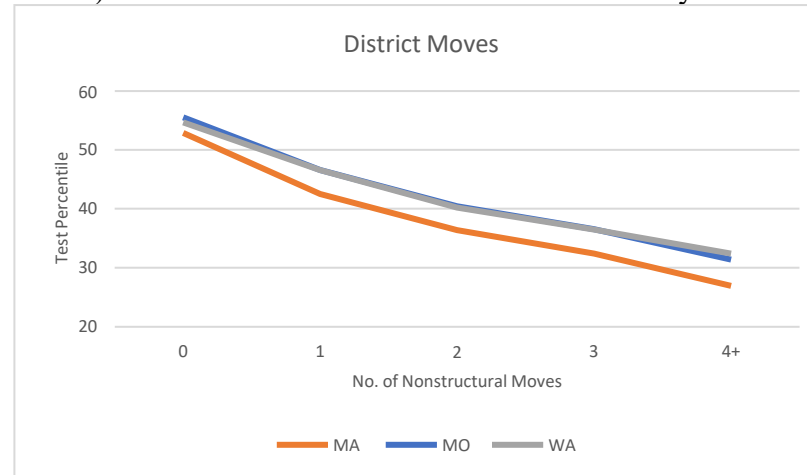
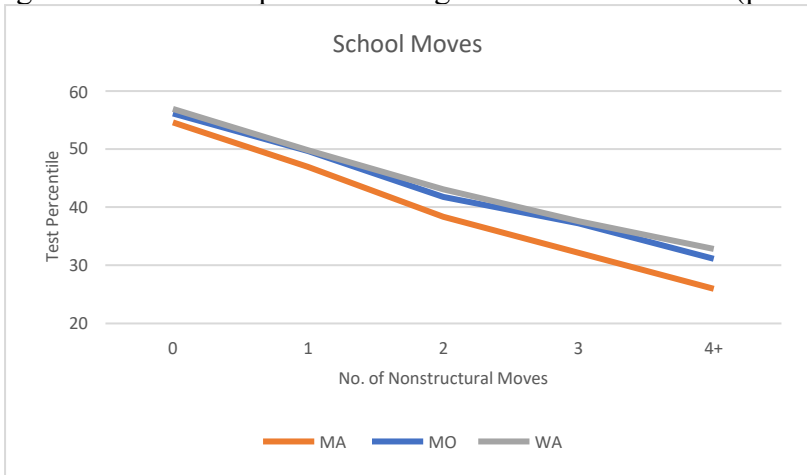


Figure 3. Relationships between high school graduation (rates) and school and district nonstructural mobility events.

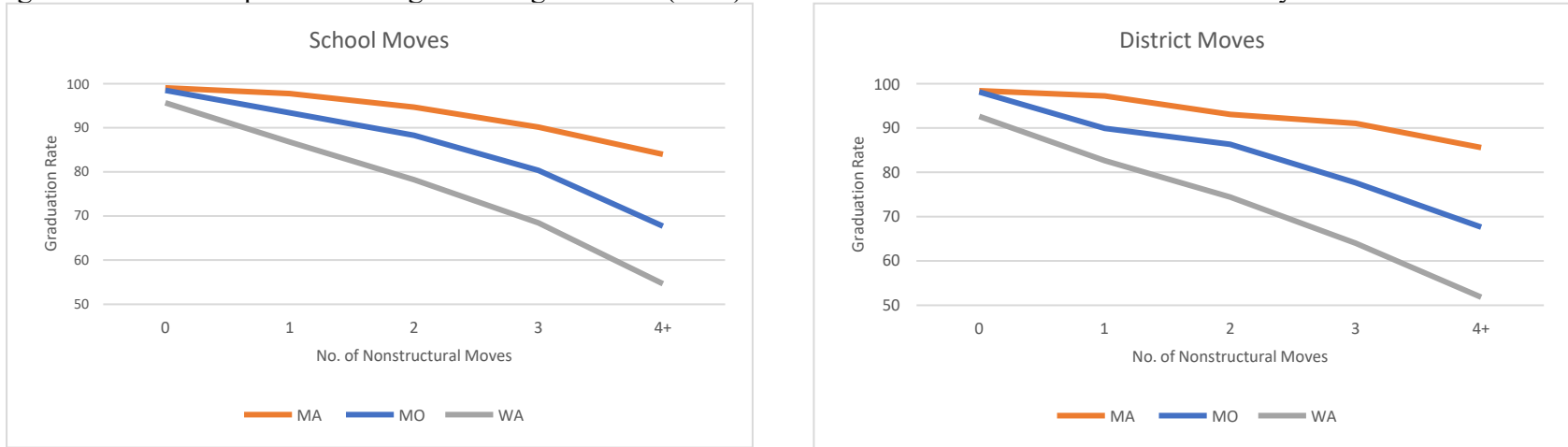
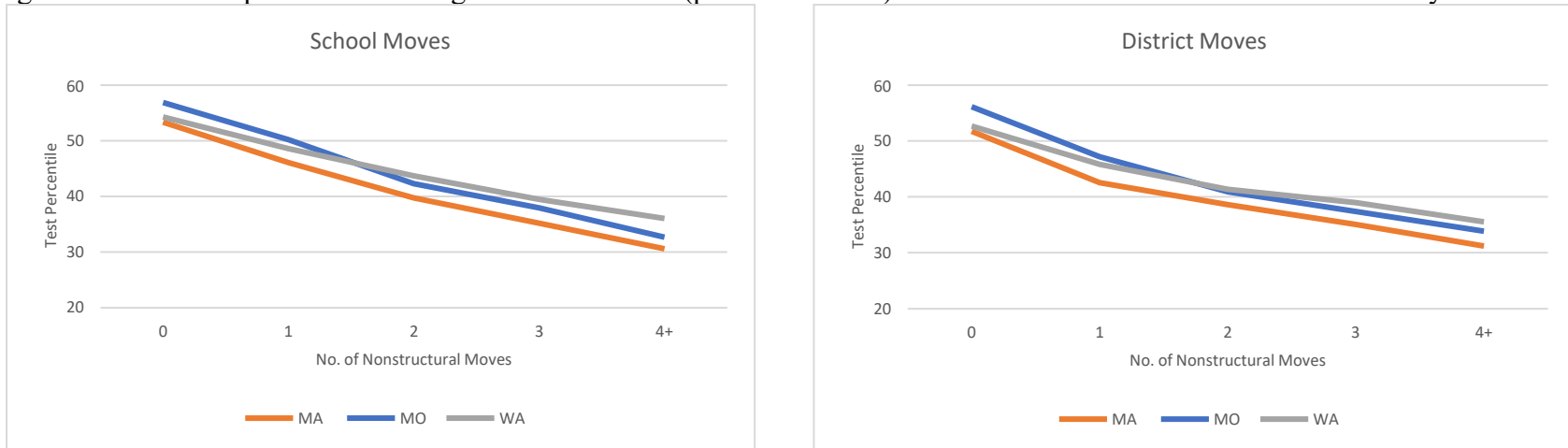


Figure 4. Relationships between third-grade achievement (percentile ranks) and school and district nonstructural mobility events.



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Appendix Supplementary Tables

Appendix Table 1. Fractions of Students with Different Numbers of School and District Nonstructural Moves, Overall and for Student Subgroups.

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	
		All	White	Asian	Black	Hispanic	Low Poverty (non-FRL)	High Poverty (FRL)	
Massachusetts	School Moves	0	0.550	0.597	0.582*	0.371*	0.387*	0.622	0.377*
		1	0.302	0.291	0.311*	0.334*	0.341*	0.283	0.344*
		2	0.102	0.081	0.086	0.180*	0.171*	0.072	0.173*
		3	0.033	0.022	0.017*	0.076*	0.067*	0.017	0.071*
		4+	0.014	0.008	0.003*	0.038*	0.034*	0.005	0.034*
	District Moves	0	0.724	0.754	0.771*	0.593*	0.619*	0.783	0.584*
		1	0.203	0.188	0.185	0.264*	0.253*	0.174	0.271*
		2	0.056	0.044	0.038*	0.104*	0.093*	0.036	0.103*
		3	0.013	0.010	0.006*	0.029*	0.025*	0.006	0.030*
		4+	0.005	0.003	0.001*	0.010*	0.009*	0.002	0.012*
Missouri	School Moves	0	0.610	0.681	0.689*	0.295*	0.539*	0.736	0.440*
		1	0.195	0.183	0.220*	0.236*	0.235*	0.171	0.227*
		2	0.096	0.076	0.057*	0.186*	0.123*	0.056	0.150*
		3	0.050	0.033	0.022*	0.128*	0.060*	0.022	0.088*
		4+	0.049	0.027	0.012*	0.155*	0.043*	0.015	0.096*
	District Moves	0	0.691	0.749	0.807*	0.421*	0.679*	0.809	0.531*
		1	0.157	0.139	0.140*	0.230*	0.186*	0.120	0.206*
		2	0.082	0.063	0.032*	0.170*	0.086*	0.045	0.132*
		3	0.038	0.027	0.017*	0.095*	0.029*	0.016	0.069*
		4+	0.032	0.022	0.004*	0.084*	0.021*	0.010	0.062*
Washington	School Moves	0	0.491	0.514	0.543*	0.304*	0.464*	0.576	0.366*
		1	0.255	0.250	0.276*	0.268*	0.260*	0.247	0.265*
		2	0.139	0.131	0.114*	0.192*	0.152*	0.111	0.180*
		3	0.068	0.063	0.042*	0.117*	0.076*	0.044	0.104*
		4+	0.048	0.043	0.025*	0.119*	0.049*	0.023	0.086*
	District Moves	0	0.670	0.685	0.734*	0.524*	0.657*	0.748	0.555*
		1	0.175	0.168	0.170	0.219*	0.183*	0.151	0.210*
		2	0.095	0.090	0.064*	0.143*	0.102*	0.068	0.134*
		3	0.038	0.036	0.023*	0.066*	0.037	0.022	0.061*
		4+	0.023	0.021	0.010*	0.048*	0.022	0.010	0.041*

Notes: All students are coded as having either 0, 1, 2, 3, or 4+ nonstructural moves. The poverty split divides students who are and are not eligible for free- or reduced-priced lunch in 3rd grade. Students coded as “other” race-ethnicity are omitted for brevity. Chi-square tests of statistical significance for the racial-ethnic subgroup shares are relative to white students; high-poverty students are compared to low-poverty students. * indicates significantly different mobility-count shares across groups at the 95% confidence level or higher.

Appendix Table 2. Nonstructural Mobility and 10th Grade Test Performance (in percentiles) Overall and for Student Subgroups.

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	
		All	White	Asian	Black	Hispanic	Low Poverty (non-FRL)	High Poverty (FRL)	
Massachusetts	School Moves	0	54.578	56.838	66.628	38.586	37.013	58.744	38.254
		1	46.905*	49.848*	64.007*	35.392*	33.419*	53.126*	34.739*
		2	38.318*	41.788*	58.369*	31.027*	29.461*	45.417*	31.292*
		3	32.125*	35.866*	47.230*	27.009*	26.891*	39.763*	27.881*
		4+	25.936*	29.831*	40.000	21.343*	23.215*	32.369*	23.688*
	District Moves	0	52.880	56.121	66.250	35.562	34.110	58.265	35.763
		1	42.525*	44.540*	60.565*	35.411	33.256	47.848*	34.429*
		2	36.407*	39.028*	56.088*	30.105*	30.506*	42.857*	31.086*
		3	32.420*	34.741*	43.529*	28.148	29.580	38.771*	29.178*
		4+	26.948*	28.626*	73.125	23.409*	24.216*	32.636*	25.118*
Missouri	School Moves	0	56.137	57.406	68.583	42.639	47.718	60.826	45.299
		1	49.656*	52.869*	64.159*	37.624*	42.265*	56.820*	41.943*
		2	41.774*	45.491*	51.954*	33.561*	44.212	49.566*	37.572*
		3	37.217*	41.600*	47.000	31.195*	38.161*	44.367*	34.690*
		4+	31.121*	35.072*	36.200	26.963*	35.937	34.761*	30.255*
	District Moves	0	55.525	57.324	67.545	40.649	47.165	60.716	44.506
		1	46.618*	49.881*	63.239*	36.342*	40.968*	53.663*	40.651*
		2	40.450*	44.560*	52.077*	32.082*	41.210	48.284*	36.560*
		3	36.568*	40.931*	36.190*	30.229*	34.767	42.326*	34.653*
		4+	31.395*	34.401*	50.333	26.620*	38.360	35.260*	30.506*
Washington	School Moves	0	56.900	60.325	64.078	46.096	41.114	62.538	44.001
		1	49.782*	53.265*	60.010*	39.724*	35.259	57.442*	39.394*
		2	43.054*	46.551*	52.224*	34.882*	32.517	51.106*	35.836*
		3	37.587*	41.283*	43.957*	29.693*	29.602	46.585*	32.082*
		4+	32.790*	35.932*	36.129*	26.152*	27.076	42.898*	28.893*
	District Moves	0	54.673	58.471	62.894	41.913	38.749	61.397	41.468
		1	46.587*	49.893*	56.933*	37.062*	34.460	54.467*	38.355*
		2	40.227*	43.512*	46.247*	33.237*	31.957	48.052*	34.419*
		3	36.485*	39.670*	40.618*	28.964*	30.445	44.919*	31.959*
		4+	32.413*	34.900*	36.833	25.033*	27.570	41.724*	29.080*

Notes: see notes to Appendix Table 1. The tests of statistical significance in this table are for t-tests comparing pairs of mean values within a column moving from lower mobility to higher mobility categories. For example, in Missouri, the average percentile across all students with 0 school moves (56.137) is compared to the average percentile across all students with one school move (49.656). * indicates the means are significantly different at the 95% confidence level or higher and is reported on the higher mobility value.

Appendix Table 3. Nonstructural Mobility and High School Graduation Rates Overall and for Student Subgroups

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	
		All	White	Asian	Black	Hispanic	Low Poverty (non-FRL)	High Poverty (FRL)	
Massachusetts	School Moves	0	99.072	99.274	99.515	98.152	97.664	99.511	97.350
		1	97.738*	98.393*	99.059*	95.594*	95.412*	98.892*	95.481*
		2	94.676*	95.554*	97.434*	92.935*	92.859*	96.723*	92.652*
		3	90.161*	91.578*	96.495*	87.083*	88.594*	93.445*	88.337*
		4+	83.973*	88.143*	92.247	80.550*	81.766*	90.733*	81.612*
	District Moves	0	98.420	98.964	99.313	96.117	95.617	99.317	95.567
		1	97.220*	97.976*	98.793*	94.860*	95.249	98.558*	95.186
		2	93.056*	93.948*	96.637*	90.674*	91.485*	95.181*	91.303*
		3	91.026*	92.289	99.798	88.249	90.331	93.978	89.520
		4+	85.581*	86.987*	100.000	81.395	87.392	90.225	84.087*
Missouri	School Moves	0	98.509	98.595	99.377	97.557	98.084	99.189	96.968
		1	93.446*	93.696*	96.379*	93.077*	89.824*	96.104*	90.724*
		2	88.331*	88.472*	92.473	88.432*	84.689*	92.944*	85.988*
		3	80.383*	79.808*	83.333	81.740*	73.267*	84.032*	79.168*
		4+	67.734*	69.124*	57.895*	67.191*	57.823*	71.938*	66.820*
	District Moves	0	98.145	98.449	99.087	95.896	96.874	99.098	96.175
		1	89.909*	90.856*	94.298*	88.255*	82.698*	93.804*	86.832*
		2	86.305*	87.500*	90.385	84.792*	80.000	91.976*	83.704*
		3	77.633*	77.767*	71.429*	78.131*	67.010*	79.197*	77.131*
		4+	67.619*	68.889*	57.143	66.322*	64.286	72.389*	66.617*
Washington	School Moves	0	95.667	96.249	97.512	93.151	93.138	97.190	92.181
		1	86.775*	87.625*	92.880*	85.736*	82.101*	90.783*	81.330*
		2	78.207*	79.261*	86.492*	75.409*	74.569*	84.090*	72.933*
		3	68.426*	69.297*	78.758*	67.051*	65.818*	76.016*	63.778*
		4+	54.631*	55.210*	59.526*	53.652*	56.644*	64.107*	50.979*
	District Moves	0	92.635	93.776	95.742	88.285	88.265	95.596	86.820
		1	82.661*	83.240*	90.786*	79.538*	79.100*	87.469*	77.631*
		2	74.408*	75.453*	82.942*	67.782*	73.550*	81.034*	69.491*
		3	64.006*	64.043*	74.440*	62.750	66.837*	71.903*	59.766*
		4+	51.835*	52.017*	58.563*	51.910*	55.150*	59.776*	48.993*

Notes: see notes to Appendix Table 2.

Appendix Table 4. Nonstructural Mobility and 3rd Grade Test Performance Overall and for Student Subgroups

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	
		All	White	Asian	Black	Hispanic	Low Poverty (non-FRL)	High Poverty (FRL)	
Massachusetts	School Moves	0	53.316	56.315	56.419	35.844	35.293	57.406	37.287
		1	46.049*	49.879*	54.223*	32.749*	32.302*	52.064*	34.283*
		2	39.710*	45.085*	48.731*	30.034*	29.316*	47.204*	32.295*
		3	35.161*	41.354*	40.536*	27.773*	27.416*	43.685*	30.426*
		4+	30.566*	36.713*	37.882	24.937*	25.209	38.727*	27.715*
	District Moves	0	51.735	55.600	56.187	33.914	33.187	56.882	35.375
		1	42.544*	46.024*	50.694*	32.075*	31.721*	48.132*	34.047*
		2	38.620*	43.396*	47.823	29.240*	30.366*	45.469*	32.971*
		3	35.060*	39.446*	37.029*	29.474	29.176	42.666*	31.177*
		4+	31.213*	34.790*	55.625	25.727	25.670	37.233*	29.277
Missouri	School Moves	0	56.873	58.491	64.062	42.193	45.657	61.229	46.991
		1	50.204*	53.886*	59.130*	38.060*	41.196*	57.125*	43.119*
		2	42.291*	47.268*	46.194*	33.258*	38.945	50.138*	38.305*
		3	37.935*	43.402*	42.986	31.406*	36.287	45.866*	35.293*
		4+	32.672*	38.769*	38.632	27.752*	31.439	36.018*	31.944*
	District Moves	0	56.113	58.305	62.993	40.555	44.880	61.023	45.968
		1	47.160*	51.394*	57.195*	35.962*	39.420*	54.589*	41.290*
		2	40.904*	46.557*	47.760*	31.478*	36.619	48.350*	37.490*
		3	37.378*	42.957*	37.482	30.266	34.005	44.668*	35.043*
		4+	33.839*	38.573*	48.214	28.200*	33.229	36.716*	33.235*
Washington	School Moves	0	54.275	58.337	57.685	43.463	37.799	59.844	41.532
		1	48.603*	52.812*	54.891*	37.789*	33.776*	55.667*	39.008*
		2	43.688*	47.799*	49.936*	35.194*	31.979*	51.278*	36.885*
		3	39.474*	43.436*	42.846*	33.151	29.941*	47.410*	34.615*
		4+	36.048*	39.795*	35.401*	29.910*	28.979	43.915*	33.016*
	District Moves	0	52.664	57.028	57.088	40.592	36.252	59.050	40.121
		1	45.793*	49.843*	51.977*	36.246*	33.074*	52.942*	38.316*
		2	41.329*	45.142*	44.551*	34.219*	31.485*	48.663*	35.888*
		3	38.945*	42.504*	40.754*	31.108*	31.075	45.826*	35.251
		4+	35.518*	38.665*	36.642*	28.819	29.141	42.876*	32.884*

Notes: see notes to Appendix Table 2.

Appendix Table 5. Nonstructural Mobility and High School Outcomes, Conditional on Persistent Poverty

			Distribution of nonstructural mobility		Average 10 th grade test performance (in percentiles)		Average high school graduation rate	
			Not persistently FRPL eligible	Persistently FRPL eligible	Not persistently FRPL eligible	Persistently FRPL eligible	Not persistently FRPL eligible	Persistently FRPL eligible
Massachusetts	School Moves	0	56.77	42.51	56.492	36.904	99.236	97.557
		1	29.85	32.44	48.900*	34.046*	98.044*	95.718*
		2	9.37	15.62	40.122*	31.124*	95.192*	93.021*
		3	2.82	6.42	33.357*	27.931*	90.403*	89.835*
		4+	1.18	3.01	26.494*	25.111*	83.335*	83.921*
	District Moves	0	73.41	65.26	55.162	35.028	98.720	96.148
		1	19.93	22.69	43.928*	33.979*	97.494*	95.546*
		2	5.06	8.63	38.030*	30.153*	93.641*	90.779*
		3	1.18	2.5	33.162*	29.146*	90.364*	91.102*
		4+	0.42	0.92	27.833	26.399*	85.029*	87.838*
Missouri	School Moves	0	64.09	48.34	58.651	42.211	98.791	96.984
		1	18.50	23.46	52.788*	39.136*	94.241*	90.880*
		2	8.44	14.37	43.909*	36.467*	89.077*	86.536*
		3	4.33	7.65	38.800*	33.439*	80.515*	80.079*
		4+	4.64	6.18	31.549*	29.822*	67.150*	69.530*
	District Moves	0	71.46	59.52	58.323	41.365	98.549	96.161
		1	14.42	20.70	49.374*	38.309*	91.219*	86.174*
		2	7.37	11.55	42.118*	35.942*	86.892*	84.772
		3	3.51	5.19	37.757*	33.268*	77.371*	78.357*
		4+	3.24	3.05	31.853*	29.466*	67.045*	70.115*
Washington	School Moves	0	49.18	48.4	59.834	41.678	96.228	92.754
		1	25.44	25.49	52.112*	37.805*	87.114*	85.028*
		2	13.76	14.42	44.687*	35.122*	78.256*	77.966*
		3	6.76	6.96	38.608*	32.558*	67.812*	71.447*
		4+	4.85	4.74	33.567*	28.689*	53.107*	62.684*
	District Moves	0	67.26	65.35	57.413	40.199	93.235	89.465
		1	17.26	18.6	48.561*	37.236*	82.438*	83.721*
		2	9.4	10.01	41.430*	34.525*	73.962*	76.524*
		3	3.8	3.88	37.415*	31.879*	62.837*	69.801*
		4+	2.28	2.17	33.116*	28.606*	49.750*	63.125*

Notes: see notes to Appendix Table 2. “Persistent poverty” is defined as being FRL-eligible in all grades 3-12. Comparisons using less strict measures of repeated poverty status are shown in Appendix Table 6.

Appendix Table 6. Nonstructural Mobility and High School Outcomes, Conditional on Number of Years of FRL Eligibility

		Distribution of nonstructural mobility					Average 10 th grade test performance (in percentiles)					Average high school graduation rate					
		Number of Years of FRL Eligibility					Number of Years of FRL Eligibility					Number of Years of FRL Eligibility					
		0	1-3	4-6	7-9	10	0	1-3	4-6	7-9	10	0	1-3	4-6	7-9	10	
Massachusetts	School Moves	0	67.71	53.02	45.52	39.09	42.51	61.25	50.16	45.56	40.22	36.90	99.72	98.96	98.20	97.79	97.56
		1	26	32.13	32.88	34.58	32.44	56.85*	46.24*	41.69*	37.17*	34.05*	99.45*	97.86*	97.52	96.87*	95.72*
		2	5.21	10.96	14.74	16.35	15.62	50.92*	40.91*	38.59*	33.76*	31.12*	98.20*	96.60*	96.08*	93.24*	93.02*
		3	0.87	2.91	4.92	6.67	6.42	46.89*	38.78	33.29*	30.04*	27.93*	95.89*	95.75	93.08*	89.77*	89.84*
		4+	0.21	0.99	1.93	3.3	3.01	38.80*	28.67*	28.48*	26.01*	25.11*	94.70	86.31*	87.92*	82.74*	83.92*
	District Moves	0	83.01	67.06	59.44	54.47	65.26	61.15	49.91	44.74	38.79	35.03	99.65*	98.63	97.92	96.77	96.15
		1	14.48	25.08	27.66	30.45	22.69	51.25*	43.20	40.08	35.86*	33.98*	99.31*	97.73*	97.20*	96.15*	95.55
		2	2.21	6.3	9.36	10.52	8.63	48.73*	39.62*	37.48*	33.50*	30.15*	97.13*	95.28*	95.68*	92.14*	90.78*
		3	0.25	1.21	2.68	3.21	2.5	45.60	38.27	31.92*	31.28	29.15	96.42	97.15	89.60*	90.14	91.10
		4+	0.06	0.34	0.85	1.36	0.92	41.11	23.87*	32.98	28.06	26.40	95.93	83.97*	89.09	83.12*	87.84
Missouri	School Moves	0	81.34	63.51	51.79	35.62	49.93	63.32	55.316	51.138	46.847	42.141	99.52	98.655	97.554	97.094	96.633
		1	14.83	22.57	22.82	21.65	23.03	61.87*	53.517*	47.892*	41.487*	39.313*	97.55*	95.534*	91.674*	86.429*	94.798*
		2	3.04	8.87	12.52	16.95	14.06	55.56*	47.272*	45.563*	37.863*	36.331*	96.10*	91.137*	85.944*	83.093*	91.700*
		3	0.61	3.46	6.10	11.46	7.28	54.37	48.429	38.392*	35.202*	33.304*	90.08*	84.938*	77.430*	75.000*	87.782*
		4+	0.18	1.60	6.77	14.32	5.70	47.94	40.209*	35.304	29.653*	29.727*	72.22*	75.936*	56.612*	65.149*	79.783*
	District Moves	0	88.43	71.52	58.75	42.98	61.62	63.37	55.448	50.995	45.874	41.279	99.50	98.495	97.553	96.219	95.670
		1	8.88	17.83	20.74	21.49	19.28	59.36*	51.342*	46.452*	40.141*	38.608*	95.74*	93.966*	88.124*	80.709*	94.160*
		2	2.20	7.00	10.46	16.15	11.43	55.86*	46.784*	43.958*	36.411*	35.573*	96.68	90.842*	83.942*	80.885	89.883*
		3	0.39	2.55	5.08	9.64	4.79	52.15	46.307	38.161*	34.802*	33.303*	85.90*	81.940*	72.079*	72.962*	87.970
		4+	0.10	1.10	4.98	9.74	2.87	43.47	41.126	35.094	30.146*	29.799*	66.67*	72.868*	54.949*	66.847*	80.501*
Washington	School Moves	0	66.92	47.44	43.59	34.67	48.52	64.78	55.77	52.86	46.33	41.68	98.10	95.69	94.24	92.42	92.80
		1	22.01	26.91	26.59	26.04	25.46	60.82*	51.07*	48.77*	39.85*	37.83*	94.61	88.79	87.12	80.23	84.72
		2	7.89	15.07	16.4	18.78	14.36	55.74*	46.35*	44.68*	36.28*	35.25*	89.99	81.90	80.44	73.23	78.44
		3	2.33	6.94	7.78	11.07	7.05	52.83*	43.20*	39.38*	33.20*	32.23*	81.98	75.83	71.61	65.23	71.57
		4+	0.85	3.64	5.65	9.44	4.61	49.35*	40.61	38.44	30.64*	28.39*	74.86	67.47	59.12	54.41	59.68
	District Moves	0	82.34	63.8	60.26	53.89	65.35	64.17	54.41	51.26	43.01	40.15	97.41	93.50	91.36	86.59	89.41
		1	12.05	20.13	20.44	20.67	18.74	58.34*	49.30*	47.59*	38.96*	37.21*	92.45*	86.55*	85.27*	76.77*	83.55*
		2	4.3	10.53	11.67	14.22	9.9	52.30	44.59*	42.77*	35.24*	34.66*	87.03*	79.74*	78.73*	70.72*	76.11*
		3	1	3.82	4.78	6.6	3.89	52.81	42.31	39.93	32.36*	32.08*	80.28*	73.03*	66.65*	61.25*	70.34*
		4+	0.31	1.72	2.85	4.62	2.13	45.07*	41.41	36.93	31.21	28.75	72.34*	63.34*	52.11*	52.25*	61.49*

Notes: see notes to Appendix Table 2.