Explaining the Short Careers of High Achieving Teachers in Schools with Low Performing Students*

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I. Introduction

Low-achieving students, particularly those in urban areas, often are taught by the least skilled teachers, a factor that likely contributes to the substantial gaps in academic achievement among income and racial/ethnic groups of students (Lankford, Loeb and Wyckoff, 2002; Clotfelter, Ladd and Vigdor, forthcoming). These disparities begin when teachers take their first jobs, and in urban areas are worsened by teachers' subsequent decisions to transfer and quit. Such quits and transfers increase disparities in at least two ways. First, more qualified teachers are substantially more likely to leave schools having the lowest-achieving students. For example, of the new teachers hired in New York City's lowest achieving schools in 1996-98, 28 percent scored in the lowest quartile on the general knowledge certification exam. Of those remaining in the same schools five years later, 44 percent had scores in the lowest quartile. In contrast, 22 percent of the new teachers in the higher achieving schools were in the lowest quartile, which only increased to 24 percent for those remaining after five years.[1] Second, the generally high teacher turnover in lower-performing schools disadvantage students in those schools since the effectiveness of teacher increases over the first few years of their careers Twenty-seven percent of first-year teachers in New York City's lower-performing schools do not return the following year, compared to 15 percent in the quartile of schools having the relatively highest student achievement.

In this paper we examine New York City elementary school teachers' decisions to stay in the same school, transfer to another school in the district, transfer to another district, or leave teaching in New York state during the first five years of their careers. As described below, we are not the first paper to look at teacher turnover. This paper differs from others before it by focusing on the contribution of teacher quits and transfers to the teacher quality gap. It does this by modeling observed heterogeneity in the turnover rates between high and low scoring teachers in high and low scoring schools, accounting for the effects of the distance from teachers home to the schools they teach in on teachers' career decisions. In particular, we employ a discrete-time competing-risk model to examine decisions of New York City elementary school teachers to stay in the same school, transfer to another school within the district, transfer to another district, or to leave teaching in New York State during the first five years of their careers. In contrast to past studies employing

[1] The 28 versus 22 percent comparison for entering, mostly certified, teachers understates the actual difference in the qualifications of new teachers across schools. For example, approximately half of the new teachers in the lowest-achieving schools were not certified, compared to 20 percent in the higher-achieving schools.

similar hazard models, the mixed-logit specification allows us to explore the importance unobserved heterogeneity.

We find that student achievement levels are correlated with teacher career outcomes, even after accounting for student and teacher race. This effect is differentially strong for higher performing teachers, though not quite as strong as the correlation between career outcomes and student racial composition for white teachers, on average. By modeling unobserved heterogeneity in the effects of student performance on teacher career decisions we find that many teachers are unaffected by these student characteristics; however, a group of teachers is strongly affected and are more likely to move away from low-performing schools. In addition, we find that teachers who lived farther from the school in which they teach prior to taking their job are much less likely to remain in their school. The distance effect is mildly more important for low-performing schools because teachers tend to travel farther to teach in these schools. The distance effect is important for explaining turnover in New York City, though it only explains a little of the differential quit rate of high and low scoring teachers in high and low performing schools.

II. Background

There is a relatively large literature on teacher transfers and quits. Many studies have addressed the effects of salary on teacher career decisions.[2] Predictably, most of these studies find that teachers respond positively to increased salary, though the variation in salary across districts is often not large enough to strongly affect teacher sorting. In this paper, we do not address the effect of salary on turnover. All teachers in our study initially teach in the New York City school district and are under the same salary schedule. Thus, there is no structured difference in salary across schools. While this is a disadvantage for studying the effect of salary on quit and transfer decisions, it allows us to remove from the model the concern of potential endogeneity of salary to teacher characteristics and working conditions, the foci of our study. In addition, by modeling a single district we reduce the problems caused by teachers in different areas having different alternative job opportunities than teachers in other areas. We discuss this issue in more detail in the methods section, below.

[2] As a group, these studies show that individuals are more likely to choose to teach when starting teacher wages are high relative to wages in other occupations (Baugh and Stone, 1982; Brewer, 1996; Dolton, 1990; Dolton and van der Klaaw, 1999; Dolton and Makepeace, 1993; Hanushek and Pace, 1995; Manski, 1987; Mont and Reece, 1996; Murnane, Singer & Willett, 1989; Rickman and Parker, 1990; Stinebrickner, 1998, 1999, 2000; Theobald, 1990; Theobald and Gritz, 1996). Baugh and Stone (1982), for example, find that teachers are at least as responsive to wages in their decision to quit teaching, as are workers in other occupations.

While salary is one job attribute that likely affects sorting, non-pecuniary job characteristics are important as well.[3] Differences in these non-pecuniary characteristics can be great across schools and across districts, especially in large urban areas. Many characteristics of schools such as class size, preparation time, facilities and school leadership are likely to be important factors in teachers' career decisions. In this study, we focus on characteristics of students to build on recent studies using state-specific data on teachers.[4] Scafidi, Stinebrickner, and Sjoquist (2003) using a competing risk model and data on Georgia elementary teachers found that teachers move away from schools with higher proportions of minority students. While teachers in Georgia are also moving away from low performing schools, this trend is completely explained by teacher preferences for fewer minority students. Teachers exhibit no additional preferences for higher performing students. In Texas, however, the story is different. Hanushek, Kain and Rivkin (2004) using a similar model and data on Texas teachers find that student achievement affects turnover independent of student racial composition effects. In this study we again assess the effects of student race and ethnicity and student achievement on teacher career decisions. In addition to simply exploring a different sample of teachers, we allow for possible heterogeneity in teachers' responses to the student population. The Georgia and Texas studies interact teacher race with student racial composition, allowing teachers of different races to have different preferences for student race. In this study, we include this interaction but also include an interaction between teacher test performance and student test-performance, similarly asking whether teachers with different levels of achievement express different preferences for student achievement. In addition to modeling this observed heterogeneity, we also allow for unobserved heterogeneity in career decisions as a whole and in the effects of student composition on these decisions, as described below.

In addition to salaries and working conditions, another factor appears to drive teachers' choices. Teachers prefer schools and districts similar to those they attended when in high school and close in geographic proximity to their home (Boyd, Lankford, Loeb, and Wyckoff, 2004 and 2005). For example, over 60 percent of New York State teachers first teach within 15 miles of the

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[3] In Texas, Hanushek, Kain and Rivkin (1999) found teachers moving to schools with high-achieving students and, in New York City, Lankford (1999) found experienced teachers moving to schools with high-socioeconomic status students when positions became available. Loeb, Darling-Hammond and Luczak (forthcoming) find that in addition to salary and student composition, working conditions including large class sizes, facilities problems, multi-track schools, and lack of textbooks affect teacher career decisions.

[4] In a fall 2002 exit survey of teachers who entered New York City public schools during the 2001-02 school year, the two most frequently cited reasons for teachers' decisions to leave were school factors (this includes safety and discipline as well as typical issues of workload, facilities, etc.) extremely or very important) and student related issues (including motivation to learn, behavior, respect and ability to meet academic performance standards). More than 25 percent indicated that job-readiness was an extremely or very important reason for leaving. (Smith 2003)

school from which they graduated high school and 85 percent teach within 40 miles. Even of those who travel over 100 miles to college, most return home to teach. Distance may affect quit and transfer decisions, as well as the initial match of teachers to schools. Preference for proximity also may contribute to the teacher achievement gap between higher and lower performing schools if higher achieving teachers, on average live farther from lower performing schools. To our knowledge, this is the first study to look at the role of distance in teacher turnover.[5]

III. Data and Descriptive Analysis

Our empirical analysis employs a database that includes information for every teacher employed in a New York public school at any time from 1995-96 through 2003-2004, the environments in which these individuals make career decisions (school attributes), and the locations of teachers at various points during their lives. Given our focus on student characteristics rather than salaries, it is advantageous to use data for a single large district. All New York City teachers are under the same salary schedule, avoiding the potential endogeneity of salary with teacher characteristics and working conditions. In addition, by modeling a single district we reduce the problems caused by teachers in different areas having different alternative job opportunities.

This analysis examines transfers and quits by New York City teachers having one to five years of experience who started teaching in years 1995-96 through 2001-2002.[6] Our analysis focuses on teachers in the very early part of their careers, as attrition rates in these early years are highest. In addition, we restrict the sample to certified teachers. In prior years, New York City hired substantial numbers of temporarily licensed teachers; however, state policy no longer allows this. The behavior of uncertified teachers is likely to be quite different than that of certified teachers. For example, the 2002 exit survey of New York teachers found that job readiness was a much more important factor in the decision to leave for uncertified teachers compared to those with certification to teach.

Transfers and quits by New York City teachers are more common among those who teach low-performing and nonwhite students, have higher qualifications, are male, and lived outside New York City prior to teaching. Table 1 illustrates that those teaching at schools where students' academic performance is lowest are more likely to transfer – both to other schools in New York

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[5] Falch and Ronning (2004) include a binary variable for teachers born in the labor market in which they work in their study of teacher turnover in Norway.

[6] The administrative data we employ has missing teacher records for particular years. Thus, we characterize an individual as having left the NYS public system only if they are missing from the data for two consecutive years. Individuals missing a record for a single year are classified according to whether they reappear at the same school, another school in NYC or another NYS district. The career paths for teachers entering in years 1995-1996 through 1997-1998 were followed for a full five years, with the quits and transfers of subsequent cohorts tracked through 2001-2001.

City and schools in other districts – and to leave teaching in the New York State public system. In the table schools are grouped according to the performance of students on the 4th grade English Language Arts (ELA) exam measured by the proportion of students scoring at level 1 or level 2, which indicates failure on the exam. Among schools having relatively few students failing the exam, 85 percent of first year teachers remain in the same school the following year. In the quartile of schools having the highest failure rates, only 73 percent of first year teachers return to the same school the following year. These differences are consistent across experience levels and are reflected in each of the alternative career decisions (transfers within New York City, transfers between districts, and quits).

More qualified teachers are less likely to remain in the New York City schools where they began their teaching careers. Table 1 shows that teachers who scored higher on their general knowledge certification exam are systematically less likely to remain in teaching. Eighty five percent of first year teachers who scored in the bottom quartile remain in the same school the following year compared with 77 percent of those in the highest quartile. The quit rates of higher performing teachers are almost double those of lower performing teachers in the first year.

The interaction between teacher qualifications and student achievement is particularly striking – highly qualified teachers are more likely to quit or transfer than less-qualified teachers, especially if they teach in low-achieving schools. For example, 20 percent of new teachers in the top quartile on the general knowledge certification exam leave high-achieving schools after one year, but 34 percent of those in low-achieving schools leave after one year. By contrast, 14 percent of bottom-quartile teachers leave high-achieving schools after one year and 17 percent leave low-achieving schools.

Finally, teachers who were living in New York City when they applied for certification, typically prior to their first teaching job offer[7], are far less likely to transfer to another school district and are less likely to leave teaching altogether than are their colleagues who were living elsewhere (see Table 3). For example, less than one percent of NYC resident teachers transferred to another district after their first year, compared with almost ten percent of non-residents. Six percent of resident first year teachers left teaching, compared with eight percent of non-residents. Distance to work is also an important distinguisher among teachers who were residents of New York City. In particular, resident teachers living closer to the school in which they teach are far less likely to transfer to other schools in the city. Table 3 shows that seven percent of first year teachers living

[7] The residency and school distance measures employed here are based on address information provided when individuals applied for state certification. Because the address history data employed frequently contains multiple addresses for individuals, we utilized the latest address recorded prior to the start of the academic year in which each individual entered teaching. The NYC residency and distance to school measures are based on address zip codes.

within two miles of school transfer to other district schools, compared with 11 percent of those living six or more miles from school.

How might this relationship between distance and career decisions affect the differential achievement of teachers in high and low performing schools? Comparing the columns in Table 6 one sees that the percentages of new teachers who are from New York City are lowest in low performing schools and that their distances are greater in these same schools. Comparing rows, one sees that higher scoring new teachers in each school group are less likely to be from New York City and the new teachers who are residents have somewhat longer distances to their schools. Thus, higher scoring teachers in low performing schools are least likely to be in close proximity to their schools. Thus, some of the higher turnover in low-performing schools may be due to teachers' preferences for proximity to home, instead of direct preferences for higher achieving students. The multivariate models below begin to sort out these effects.

IV. Methods

We model whether an individual initially teaching in a particular school (1) remains in that school; (2) transfers to another school in the same district; (3) transfers to another district, or (4) leaves the NYS public system, either exiting the labor force or taking alternative employment. Our discrete-time competing-risk model reflects both the annual nature of the data and the fact that most job transitions occur at the end of the school year.[8] To simplify the analysis, we focus on the first job change and track individuals up to five years.

In formulating the empirical model of job transition, it is instructive to first consider the case where a teacher could freely choose between the four outcomes. This ignores the fact that a job transfer – to another school within a district, to another district, or to another job outside the NYS pubic education system – is a two-sided decision in which the individual both must want to move and have the opportunity to do so. Similarly, this ignores the possibility that, in at least some circumstances, teachers may not have the option of remaining in the schools in which they currently teach.

In a setting where individual i is free to choose among all the alternatives, rational choice implies that an individual will choose the one that yields the highest satisfaction. Let an individual's utility associated with alternative k be represented by $U_{it}^{k} = V_{it}^{k} + \varepsilon_{it}^{k}$ where V_{it}^{k} typically is

[8] The data do not distinguish between transitions made during versus at the end of the school year.

assumed to be a non-stochastic component of utility that is a linear function of the attributes of that alternative. In this case, the assumption that the ε_{it}^{k} are drawn from the Gumbell distribution yields a multinomial logit competing risks model. For an individual who was teaching in the same school in year t, $P_{it}^{k'}$ in (1) is the conditional probability that the individual continues to do so the following year if $k'=1$ or makes transition k', $k'=2,3,\text{or}\,4$.

$$p_{it}^{k'} = \frac{e^{V_{it}^{k'}}}{e^{V_{it}^{1}} + e^{V_{it}^{2}} + e^{V_{it}^{3}} + e^{V_{it}^{4}}} = \frac{e^{\tilde{V}_{it}^{k'}}}{1 + e^{\tilde{V}_{it}^{2}} + e^{\tilde{V}_{it}^{3}} + e^{\tilde{V}_{it}^{4}}}. \qquad (1)$$

$\tilde{V}_{it}^{k} \equiv V_{it}^{k} - V_{it}^{1}$, $k=2,3,4$, in the last expression making clear that the transition probability is a function of the *differences* in attributes of the alternatives.

Here it is pertinent that each transition is associated with a composite alternative that aggregates "elemental alternatives" (e.g., individual schools). For example, the second outcome includes transfers to any of the other schools in the same district. To the extent that the attributes of a teacher's initial job placement affect the probability of transferring to another school in the same district, it is the attributes of the current job relative to the attributes of the alternatives schools that is important. In general, the specification of $\tilde{V}_{it}^{k} \equiv V_{it}^{k} - V_{it}^{1}$ for the kth aggregate alternative should account for both the attributes of the individual's initial school as well as the attributes of the kth composite alternative (e.g., summary measures for the student-body attributes in the pertinent set of schools).[9]

Prior empirical analyses of teacher transfers and quits have included various measures characterizing current jobs but not measures characterizing the alternative jobs to which one could transfer. Yet a school having a particular set of school attributes might be a relatively attractive alternative in one district but relatively unattractive in another setting. If the attributes of a school are correlated with the omitted attributes of the alternative schools in the same district, not accounting for those other attributes could lead to substantial bias in the estimated direct effects of the school's own attributes. Similar issues arise when considering how the attributes of one's initial job affects between-district transfers and individuals leaving teaching. Thus, in an analysis which includes schools from multiple districts within a local labor market or schools and districts from multiple local labor markets, one should include variables that explicitly characterize the alternative schools and districts.

[9] Exact aggregation in the case of the MNL model.

Our empirical analysis employs the specification in (2):

$$\tilde{V}_{it}^{k} = \beta_0^k + \beta_1^k z_{it} + \beta_2^k x_{it} + z_{it}^{'}\theta^k x_{it} + \tau_t^k + \delta_i^k x_{it} + \eta_i^k \quad (2)$$

where z_{it} includes measures of the i[th] individual's own attributes and x_{it} represents pertinent attributes of the school where the individual first teaches.[10] The scalar β_0^k, the vectors β_1^k and β_2^k as well as the matrix θ^k represent parameters to be estimated. θ^k is included to represent the possibility that the effects of various school attributes vary with individuals own attributes. τ_t^k is a year fixed-effect. The individual teacher effects η_i^k and δ_i^k are discussed below. Substituting (2) into (1) yields the expressions in (3).

$$p_{it}^1 = p^1\left(x_{it},\ z_{it}\ \middle|\ \delta_i^k, \eta_i^k; k=2,3,4\right) = \frac{1}{1+\sum_{k=2}^{4} \beta_0^k + \beta_1^k z_{it} + \beta_2^k x_{it} + z_{it}^{'}\theta^k x_{it} + \tau_t^k + \delta_i^k x_{it} + \eta_i^k +}$$

$$p_{it}^{k'} = p^{k'}\left(x_{it},\ z_{it}\ \middle|\ \delta_i^k, \eta_i^k; k=2,3,4\right) = \frac{\exp\left(\beta_0^{k'} + \beta_1^{k'} z_{it} + \beta_2^{k'} x_{it} + z_{it}^{'}\theta^{k'} x_{it} + \tau_t^{k'} + \delta_i^{k'} x_{it} + \eta_i^{k'}\right)}{1+\sum_{k=2}^{4} \beta_0^k + \beta_1^k z_{it} + \beta_2^k x_{it} + z_{it}^{'}\theta^k x_{it} + \tau_t^k + \delta_i^k x_{it} + \eta_i^k +};\ k' = 2,3,4. \quad (3)$$

Given the need to account for the attributes of the schools in the composite alternatives as noted above, an explanation is warranted as to why (2) does not include variables that explicitly characterize the alternative schools and districts. This omission reflects the fact that we are focusing on the factors affecting teacher quits and transfers in a single district, New York City. Given that individuals face a common set of school in each composite alternative, the alternative specific constant will absorb the effects of variables characterizing the alternative schools. Variation over time in the attributes of a composite will be accounted for in the year fixed effect.[11]

As noted above, whether an individual makes a job transition typically will reflect the individual both desiring such a change and having the opportunity to transfer. Thus, transition probabilities like those in (3) must be viewed as reduced-form specifications. For example, enrollment growth and increases in the number of teachers retiring resulted in increasing numbers

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[10] By including years of teaching experience in x_{it}, we allow for simple state dependence where transition rates vary with experience. This could be due to the additive effect $\beta_2^k x_{it}$ or the fact that the effects of school attributes might differ depending upon a teacher's teacher experience, as could be captured in $z_{it}^{'}\theta^k x_{it}$.

[11] The pertinent summary measures for the attributes of schools in the second alternative would include all New York City Schools excluding the school where the individual initially taught. However, such a composite measure will vary little across schools in New York City since there are approximately 600 elementary schools. This justifies our use of alternative-year fixed effects.

job opening for teachers in the New York City region over the period studied. This tightening of the teacher labor market has meant that more teachers have had the opportunity to act on their desire to switch jobs. Similarly, changes in employment opportunities outside teaching will affect the probability that individuals leave teaching. Such changes over time will be reflected in the estimates of the year fixed effects. Note that other parameters of the model also can reflect demand-side factors. For example, in addition to individuals having relatively stronger academic backgrounds possibly having a greater desire to change jobs, those same attributes may result in them having more opportunities to do so. Thus, the estimated effects of teachers' own attributes must be interpreted with caution.

Even though our framework is not a fully specified structural model, insights regarding behavioral relations are possible. If a teacher has the option of remaining in his current schools and the hiring authorities in other schools base their hiring decisions on the attributes of the candidate – not the attributes of the school where they previously taught – the attributes of the initial school would affect the probability of transferring only by changing the relative attractiveness of the school from the perspective of the teacher. In this case, the estimated effects of current-school attributes would reflect those attributes entering the teacher's preferences rather than those attributes affecting whether school authorities choose to dismiss a teacher.[12]

Consider an individual who started teaching in year t^o+1. Conditional on given values of the individual effects, $\eta_i=(\eta_i^2,\eta_i^3,\eta_i^4)$ and $\delta_i=(\delta_i^2,\delta_i^3,\delta_i^4)$, the likelihood that the individual remains in the same school beyond v years is $p_{it^o+1}^1\, p_{it^o+2}^1 \cdots p_{it^o+v}^1$. Similarly, the likelihood of observing that the individual remain in the same school v-1 years but then makes transition k' in year t^o+v is $p_{it^o+1}^1 \cdots p_{it^o+v-1}^1 p_{it^o+v}^{k'}$.

In the special case where the individual teacher effects, η_i and δ_i are zero for all i, this specification reduces to the discrete-time hazard models other have employed to analyze teacher

[12] The same cannot be said for the effects of the attributes of the schools to which one could transfer. Such school attributes could affect the other side of the two-sided choice – whether other employers are willing to make the teacher an offer – for at least two reasons. First, hiring authorities in schools having particular attributes might value particular teacher attributes differently. Second, the effects of school attributes in such a probability model could reflect how discriminating a particular school is able to be in its hiring decisions. Indirectly, this will reflect the school's relative attractiveness – from the perspective of teachers generally. For example, the school might be in close proximity to the locations of many teachers or in some way be of a relatively scarce type. The problem here is that the estimated effects of particular school attributes rather than reflecting how that variable affects the school's attractiveness as viewed by the particular teacher instead could reflect this linkage as well as the relevance of this variable to other teachers, as well as the relative demand and supply of this and other attributes.

quits and transfers.[13] By introducing the random effects in δ_i, our model allow for the possibility that there are unobserved differences in the quit and transfer propensities of individuals that persistent over time.[14] It is also possible that there is heterogeneity in how teachers respond to various school attributes. For example, how teachers respond to differences in school racial composition may differ depending upon their own race. Entering $z_{it}^{'}\theta^{k} x_{it}$ in the specification of $\tilde{V}_i^k$ allows for such interactions in the observed attributes of teacher and schools. Going a step further, the introduction of $\delta_i^k x_{it}$ in $\tilde{V}_i^k$ allows for unobserved heterogeneity in individuals' responses to differences in school attributes.

Let $g\left(\eta_i, \delta_i\right)$ represent the joint distribution of the individual effects. Allowing for the unobserved heterogeneity, the survival probability that a starting teacher will continue to teach in the same school more than v years is as shown in (4). Similarly, the probability of observing a new teacher remain in the first school v years and then make transition k' is as shown in (5).

$$S_{it^o}^{v} = \int p_{it^o+1}^{1} p_{it^o+2}^{1} \cdots p_{it^o+v}^{1} \; g\left(\cdot\right) d\omega \; . \quad (4)$$

$$\mathrm{P}_{it^o+1}^{v-k'} = \int p_{it^o+1}^{1} \cdots p_{it^o+v-1}^{1} p_{it^o+v}^{k'} \; g\left(\cdot\right) d\omega \quad (5)$$

Such expressions enter the log-likelihood function we employ in estimation, where first-job spells are right censored if they last more than five years. In the analysis, the random effects are assumed to be independent, normal random variables having zero means and standard deviations that are estimated.

Our model is a special case of a mixed-logit panel data model which can easily allow for a wide range of unobserved heterogeneity in repeated discrete choices.[15] We are unaware of other researchers having employed discrete-time hazard models explicitly linked to the mixed logit literature. However, we believe this is a natural and potentially very fruitful application of the increasingly popular mixed logit model.[16]

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[13] Dolton and van der Klaauw (1999) have estimated a competing risk model of teacher turnover which allows for unobserved heterogeneity. However, their formulation is of the proportional hazard type rather than the inherently discrete model employed here.

[14] Researchers have used a variety of models to account for such unobserved heterogeneity in other applications of hazard models. The model in Blau and Riphahn (1999) is one example.

[15] See Revelt and Train (1997) for the development of the mixed logit with repeated choices. Train (2003) is one of a number of sources providing useful discussion of the general mixed logit framework. Publicly available software written by Train, Revelt, and Ruud was employed in estimation.

[16] The random-effects logit discrete-time competing risk model of Enberg andGottschalk and Wolf (1990) has feature similar to some of those in our specification and is one of many examples of models that fall within the mixed-logit framework.

V. Results

First we estimate a baseline model similar to previous research, which includes student characteristics, teacher characteristics, and interactions between teacher race and the racial composition of students. Model 1 (Table 5) is similar to those estimated by Scafidi, Stinebrickner, and Sjoquist (2003) using data on Georgia teachers and by Hanushek, Kain and Rivkin (2004) using data on Texas teachers in that the model does not include interactions between teacher test score and student performance, unobserved heterogeneity in the effects of test scores or the separate, additive effect of unobserved heterogeneity captured by $\eta_i = (\eta_i^2, \eta_i^3, \eta_i^4)$. It is not identical to these previous models, partially because the available data is different. In particular, unlike the Georgia and Texas models, Model 1 also includes whether or not the teacher was a resident of New York City when applying for certification and, for residents, distance from their home address to their school.

Consistent with these earlier studies, the level of student achievement and the racial composition of the student body are important determinants of teachers' decisions to remain teaching in the same school, transfer or leave teaching. In addition, interactions of teacher race with the racial composition of students are evident, especially for the probability of transferring within the New York City district.

Simulated probabilities (Table 6), based on the estimates of Model 1, indicate that teachers[17] in schools where students performed less well on a standardized English Language Arts exam are more likely to leave that school, most frequently transferring to a different school within New York City. Although these are meaningful effects, they are not large. Moving one standard deviation from the mean in either directions results in a 5 percentage point change in teacher retention. Reduced retention from such a move results in a 60 percent increase in transfers to other schools in New York City (from 6.6 to 10.7 percent). White and Hispanic teachers are much more likely to leave schools as the proportion of white students falls and the proportion Black students increases. When the students in the school are largely nonwhite (90 to 95 percent Black and Hispanic, which is typical in schools where students are performing in the lowest quartile on achievement tests and is about 1 standard deviation above the mean), white teachers are twice as likely to transfer to other

[17] Unless otherwise specified, the reference teacher is white with one year of experience, has a masters degree and performed in the top quartile of the General Knowledge portion of the teacher certification exam, and who prior to beginning to teach lived in New York City 3.8 miles from the school where she currently teaches. All attributes of schools are held constant at their mean values.

schools in NYC and twice as likely to leave public school teaching in New York State relative to when the students are largely white (80 percent, which is typical in schools where students perform in the upper quartile of achievement tests and is about one standard deviation below the mean). The importance of the race interactions is consistent with the findings of Scafidi, Stinebrickner, and Sjoquist (2003). Hispanic teachers behave very similarly, while for Black teachers there is little relationship between career outcomes and the racial composition of the student body.

The large difference in how teachers of different races react to student race is a good example of why it can be important to investigate heterogeneity. To understand this better we introduce two potential sources of observed heterogeneity: the interaction of teacher qualifications (teacher certification scores and experience) with school-level student achievement and distance between the residence of a teacher immediately prior to beginning her career and the location of her first teaching assignment. We also model unobserved heterogeneity in the effects of (a) student-body racial composition and (b) the proportion of a school's students who fail the ELA 4th grade exam, both captured by δ_i . We also include generic unobserved heterogeneity, η_i . These estimates are found in Model 2 in the second panel of Table 5 and the simulation results appear in Table 7.[18]

Recall the findings from Model 1 that showed only a modest relationship between student achievement and teacher retention. When the performance of teachers on the General Knowledge portion of the certification exam are interacted the proportion of students in a school who fail the ELA achievement exam, a more striking pattern emerges. Teachers who performed in the top 75 percent of that exam react much more strongly to poor students than do teachers in the bottom 25 percent. For first year teachers in the top quartile, retention falls by 4 percentage points (80.7 to 76.8) when the portion of students failing the ELA exam varies from one standard deviations below the mean to one standard deviations above the mean. For new teachers scoring in the middle 50 percent of the General Knowledge exam the effect is about six percentage points (85.2 to 79.5). Contrast these reductions in retention with those of teachers in the lowest quartile of the General Knowledge exam, whose retention slightly increases. Faced with increasingly low performance of students, teachers in the top three quartiles move to other schools in New York City and quit teaching in public schools in New York State in roughly equal proportions. Similar results hold for teachers with two or more years of experience.

[18] In addition to Models 1 and 2, we have estimated a range of other models which increasingly allow for observed and unobserved heterogeneity. The estimates of these models imply simulated probabilities that are remarkably similar to those presented here. These estimates are available from the authors.

Even after accounting for differences due to prior teaching experience, certification exam performance and their interaction, there is substantial unobserved heterogeneity in how the school-level student achievement affects transfers and quits; the estimated standard deviation for the element of η_i^4 corresponding to student achievement is statistically significant (robust t = 2.44) and large (2.12). To investigate this unobserved heterogeneity in the responses of teachers to this measure of student performance, we employ the parameter estimates to evaluate the transition probabilities where the integration is with respect to all the random effects other than $\eta_i^{f\,4}$. In this way, we can investigate how the transition probabilities vary over the range of values. Table 8 shows results for one standard deviation differences in this random effect. We find large differences across teachers—some appear not to consider student performance in their career decisions, while others are far more likely to leave their school when the proportion of low performing students are higher. For example, those teachers one standard deviation higher in unobserved heterogeneity are approximately seven percentage points more likely to leave a school with one standard deviation more low performing students than a school with one standard deviation fewer low performing students relative to the mean.

Race and ethnicity of teachers and their students are also an important determinant of teacher retention with results very similar to those of Model 1. White teachers are much more likely to transfer to other schools within New York City, transfer to schools outside New York City and to leave teaching in New York State as the proportion of their students who are Black increases. They react less strongly to Hispanic students. These effects are bigger than those of any other teacher or school variables in our model. Of note, once we account for the observed heterogeneity through the teacher-student race interactions, there is little remaining unobserved heterogeneity in teachers' reactions to student race and ethnicity; the estimated standard deviations on student race and ethnicity are small in magnitude and statistically insignificant.

School attributes are typically correlated, which compounds the difficulty of staffing schools where academic performance is low. Simulations for simultaneously altering al the observable effects of schools to reflect typical values of schools at various points in the student academic achievement distribution (see the panel labeled school attributes of ELA failure levels in Table 7).[19] These changes in school attributes imply substantial changes in teacher retention. For both new and more experienced teachers moving from the attributes of schools at the 20th percentile to those at

[19] For example, at the 10th percentile 21 percent of the students failed the ELA exam, 12 percent of the students are Black, 16 percent Hispanic, 9 percent are LEP, and 35 percent are eligible for free lunch. At the 90th percentile, 91 percent failed the ELA exam, 48 percent are Black, 49 percent Hispanic, 19 percent are LEP and 87 percent free lunch.

the 80th percentile reduces retention by over ten percentage points. For new teachers, quits double and within district transfers increase by about 50 percent. For more experienced teachers, most of the reduced retention is caused by increasing transfers among schools in New York City.

The geographic location of a teacher immediately prior to beginning her teaching career is also an important determinant of retention. New York City residents who lived further from their schools are more likely to leave. There is an even larger difference reflecting whether or not an individual was a New York City resident. Non-residents are five times more likely to transfer to positions outside New York City, both after their first year of teaching and in subsequent years. This is true holding all other attributes of teachers, including their qualifications constant. We estimate that of the teachers who resided outside New York City prior to beginning their teaching careers, only 20 percent remain teaching in the same school after five years of teaching, with over 30 percent of the teachers transferring to the schools outside New York City. By contrast teachers who lived in New York City about 3 miles from school are twice as likely, 40 percent, to remain in the same school and only 7 percent, four times fewer, have transferred to schools outside of New York City.

The differences related to geography are as large as any other factors considered.[20] They also exceed a simulation where we moved all of the school attributes simultaneously to take the values of the schools with varying percentages of students failing the 4th grade ELA exam (see school attributes by ELA failure rate). Moving from values of school variables at the 10th percentile to those at the 90th percentile alters retention by 7 percentage points for first-year teachers and 13 percentage points for more experienced teachers. These findings are consistent with analyses we have performed examining the importance of geography in where teachers conduct job search (Boyd, Lankford, Loeb & Wyckoff, 2005) and the match of teachers to their first job (Boyd, Lankford, Loeb & Wyckoff, 2004). In both cases, we find that teachers much prefer to locate in areas that are closer to home and in schools similar to those where they went to high school.

VI. Conclusion

Schools with low-performing students find it far more difficult to retain teachers, especially teachers with better qualifications. Within New York City, over a five year period, 48 percent of teachers who score in the top quartile on their certification exam remain at a school at the 20th percentile of student achievement, while a school at the 80th percentile retains 28 percent of its more

[20] As another indication of this, the likelihood for the full model is 8427. When student performance alone is removed from the model, the likelihood drops 12 points to 8439. When race alone is removed from the model, the likelihood drops 38 points to 8465. When distance alone is removed, the likelihood falls by 227 points to 8654.

qualified teachers. For less qualified teachers the comparable retention rates are 58 and 50 percent, respectively. More qualified teachers are much more sensitive to the attributes of schools with low-performing students than are less qualified teachers and this difference translates into substantial differences in the composition of teachers in low-performing schools.

Our analysis suggests that the direct preference of higher scoring teachers for higher performing students accounts for a portion of this differential. The preferences of white teachers, and to a less extent Hispanic teachers, over the race of their students or other factors that are correlated with student racial composition are also important for explaining the differential quit rates of high scoring teachers in schools with low performing students. In addition, there remains substantial unexplained variation in the preferences of teachers for student achievement. Some teachers appear to care strongly about the achievement levels of the students in their schools. Other teachers do not. This paper is the first paper that we know of to use a mixed-logit model to assess unobserved heterogeneity in models of career decisions.

Finally, the geographic location of a teacher's residence is an important determinant of retention. For example, in the period studied, 34 percent of all certified teachers newly hired in New York City and 38 percent of those scoring in the highest quartile on the general knowledge certification exam resided outside New York City at the time they sought certification. Distance helps explain the high transfer and quit rates of teachers in urban schools. Additionally, since teachers tend to live farther from schools with low-performing students, these schools are somewhat disadvantaged in this regard. However, geography does not explain very much of the differential retention rate of more and less qualified teachers in schools with high and low-performing students.

The policy implications of our findings are not straight forward. While teachers are leaving schools with low-performing students, we do not know whether this is due to the students or to correlates of student body composition. In addition, we cannot tell whether school leadership strategies, hiring practices, pre-service preparation, or mentoring and induction could change the evident patterns. The administrative data we employ does not lend itself well for understanding the inner workings of schools. For this we need to supplement this data with more detailed data on schools and teachers.

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Table 1: Teacher Turnover by Teacher Test-Performance and by Student Test Performance

Teaching Experience	Remain in School	Transfer Within NYC	Transfer out of NYC	Quit Teaching
	Highest Scoring 25% of Schools			
1 Year	84.87	7.09	2.63	5.41
2-5 Years	88.12	2.99	3.21	5.67
	Middle 50% of Schools			
1 Year	83.05	6.77	3.98	6.21
2-5 Years	84.60	4.80	5.27	5.33
	Lowest Scoring 25% of Schools			
1 Year	73.72	10.73	5.02	10.53
2-5 Years	77.19	8.77	7.76	6.28
	Highest Scoring 25% of Teachers			
1 Year	77.43	8.37	4.36	9.85
2-5 Years	80.95	5.34	6.25	7.46
	Middle Scoring 50% of Teachers			
1 Year	82.32	7.5	3.99	6.19
2-5 Years	84.79	4.46	5.47	5.28
	Lowest Scoring 25% of Teachers			
1 Year	85.41	6.96	2.93	4.69
2-5 Years	87.8	5.05	2.97	4.18

Table 2: The Interaction of Teacher and Student Test Scores for Teacher Turnover

	Remain in School	Transfer Within NYC	Transfer out of NYC	Quit Teaching
		First Year Teachers		
Bottom 25% of Schools				
Bottom 25% of Teachers	82.91	8.97	1.28	6.84
Top 25% of Teachers	65.85	11.62	6.34	16.2
Top 25% of Schools				
Bottom 25% of Teachers	85.71	5.41	3.47	5.41
Top 25% of Teachers	80.1	8.53	3.10	8.27
		Teachers with 2-4 Years Experience		
Bottom 25% of Schools				
Bottom 25% of Teachers	82.76	8.62	4.6	4.02
Top 25% of Teachers	76.07	9.51	7.06	7.36
Top 25% of Schools				
Bottom 25% of Teachers	89.81	3.87	1.76	4.57
Top 25% of Teachers	84.86	2.57	3.78	8.78

Table 3: Teacher Turnover by City Residence and Distance from Home to School

Teaching Experience	Remain in School	Transfer Within NYC	Transfer out of NYC	Quit Teaching
		New York City Resident		
1 Year	84.94	8.06	0.86	6.14
2-5 Years	87.69	5.09	2.25	4.97
		Non-New York City Resident		
1 Year	75.32	6.75	9.69	8.25
2-5 Years	76.35	4.17	12.38	7.32
		Distance less than 2 miles for NYC Residents		
1 Year	87.19	7.49	0.64	4.67
2-5 Years	90.12	3.69	1.75	4.45
		Distance 2-4 miles for NYC Residents		
1 Year	84.74	7.58	1.19	6.49
2-5 Years	86.97	5.59	2.19	5.26
		Distance 4-6 miles for NYC Residents		
1 Year	85.91	6.35	0.99	6.75
2-5 Years	87.51	5.42	2.81	4.26
		Distance 6 or more miles for NYC Residents		
1 Year	80.61	10.88	0.70	7.81
2-5 Years	84.1	6.88	2.88	6.14

Table 4: New York City Residence and Distance to Work for Teachers by Achievement Level and Student Performance

Teachers – General Knowledge Exam Score	**Schools – 4th Grade ELA Exam Scores** 25% Lowest	50% Middle	25% Highest
	New York City Resident at Certification		
25% Lowest Scoring	0.67	0.69	0.77
50% Middle Scoring	0.59	0.64	0.76
25% Highest Scoring	0.57	0.61	0.70
	Miles from Home to School for New York City Residents		
25% Lowest Scoring	4.42	3.66	3.22
50% Middle Scoring	4.21	4.05	3.31
25% Highest Scoring	4.69	4.09	3.36

Table 5: Models of Teacher Retention, Transfer and Quit, New York City, 1996-2002

	Model 1			Model 2		
Variables	Transfer within NYC	Transfer outside NYC	Leave NYS schools	Transfer within NYC	Transfer outside of NYC	Leave NYS schools
constant	-3.11(9.85)	-5.74(10.17)	-3.67(11.22)	-2.74(6.37)	-6.93(8.64)	-4.75(8.00)
Std Dev				0.56(1.01)	1.20(3.96)	0.64(1.52)
Test Score						
Score Top 4^{th}	0.20(2.24)	0.11(1.11)	0.34(4.24)	-0.01(0.03)	0.69(1.64)	0.89(2.75)
Score Bottom 4^{th}	-0.04(0.49)	-0.47(4.06)	-0.26(2.63)	0.41(1.06)	0.44(0.82)	0.89(2.13)
% Students Failling ELA Exam	1.33(4.13)	0.81(2.32)	0.10(0.32)	0.70(1.50)	1.21(1.90)	-0.19(0.16)
Std Dev				-0.04(0.17)	0.21(0.88)	2.12(2.44)
Exp Teacher*% Failing				1.54(3.25)	0.36(0.64)	-0.45(0.70)
Score Top 4^{th} *% Failing				0.11(0.21)	-0.93(1.33)	-0.67(1.21)
Score Bottom 4^{th}*% Failing				-0.93(1.51)	-1.30(1.55)	-1.94(2.71)
Exp Tcher * Top *% Failing				0.31(1.13)	0.04(0.12)	-0.14(0.44)
Exp Tcher * Bottom *% Failing				0.26(0.93)	-0.56(1.33)	-0.06(0.16)
Race/Ethnicity						
Black Teacher	1.88(2.83)	0.76(0.83)	0.94(1.21)	1.88(2.53)	0.74(0.63)	1.12(1.18)
Hispanic Teacher	-0.63(1.03)	0.93(1.58)	-0.01(0.02)	-0.66(1.04)	1.23(1.71)	0.08(0.12)
% Students Black	1.43(5.36)	0.62(2.12)	1.23(4.59)	1.37(3.42)	0.73(2.04)	1.49(4.12)
Std Dev				-0.81(1.27)	0.26(0.82)	0.18(0.22)
% Hispanic Students	0.50(1.63)	0.95(2.84)	1.19(3.84)	0.55(1.70)	1.11(2.64)	1.41(3.52)
Std Dev				-0.09(0.61)	-0.57(1.06)	0.05(0.19)
Black Tcher *% Black	-1.74(2.47)	-1.26(1.21)	-1.24(1.50)	-1.73(2.19)	-1.28(0.98)	-1.62(1.56)
Hispanic. Tcher *% Black	0.99(1.43)	-0.54(0.73)	-0.05(0.08)	1.04(1.43)	-0.74(0.84)	-0.27(0.35)
Black Tcher *% Hispanic	-1.51(1.87)	-0.99(0.92)	-1.27(1.37)	-1.41(1.61)	-1.08(0.80)	-1.42(1.20)
Hispanic Tcher*% Hispanic	0.64(0.91)	-1.67(2.25)	-0.40(0.58)	0.66(0.90)	-2.06(2.30)	-0.56(0.72)
Distance						
Distance to Address for NYC	0.03(3.06)	0.02(0.88)	0.02(1.89)	0.04(2.85)	0.02(0.81)	0.03(1.94)
Address in NYC	0.05(0.46)	1.91(15.25)	0.37(3.81)	0.05(0.48)	2.32(9.45)	0.46(3.22)

Note: T-statistics in parentheses. This model also includes dummies for years 1996-2002, male teacher, teacher age 30 to 40, teacher age 40 and older, teacher holding master's degree or more, teacher FTE grades K through 2, teacher FTE grades 3 and 4, Special Education Teacher, Other teacher, teacher experience 2 or 3 years, teacher experience 4 or 5 years, school enrollment, percent of free lunch eligible students in the school, percent of limited English proficient students in the school. The full results are available from the authors.

Table 6: Probabilities of Retention, Transfer and Quits Based on Model 1

Teacher or School Attributes	Remain in school	Transfer within NYC	Transfer out of NYC	Leave NYS public schools
General Knowledge Exam				
Top Quartile	0.782	0.084	0.022	0.111
Middle 50 percent	0.823	0.073	0.021	0.083
Bottom Quartile	0.849	0.072	0.013	0.066
% Students Fail Eng Lang Arts Exam				
-1 SD (40%)	0.803	0.066	0.019	0.112
mean (60%)	0.782	0.084	0.022	0.111
+1 SD (80%)	0.758	0.107	0.025	0.110
White teach				
65% Black, 30% Hisp	0.726	0.116	0.023	0.136
35% Black, 56% Hisp	0.753	0.089	0.025	0.133
Mean (35% Black, 38% Hisp)	0.782	0.084	0.022	0.111
10% Black, 10% Hisp	0.863	0.057	0.016	0.065
Black Teach				
65% Black, 30% Hisp	0.723	0.155	0.016	0.106
35% Black, 56% Hisp	0.740	0.134	0.019	0.106
Mean (35% Black, 38% Hisp)	0.720	0.156	0.019	0.105
10% Black, 10% Hisp	0.670	0.209	0.021	0.100
Hisp Teach				
65% Black, 30% Hisp	0.721	0.140	0.024	0.114
35% Black, 56% Hisp	0.776	0.096	0.020	0.107
Mean (35% Black, 38% Hisp)	0.798	0.082	0.025	0.095
10% Black, 10% Hisp	0.870	0.036	0.032	0.061

For an otherwise white, female, elementary teacher with a masters degree, with one year of experience who scored in the top quartile of the General Knowledge portion of the certification exam, teaching in a school with mean student attributes

Table 7: Probabilities of Retention, Transfer and Quits for Selected Teacher and Student Attributes Based on Model 2

Simulation	First Year Teachers				Teachers with 2 or More Years Experience			
	Remain in same school	Transfer within NYC	Transfer outside of NYC	Leave NYS schools	Remain in same school	Transfer within NYC	Transfer outside of NYC	Leave NYS schools
% Students Failling for Top 4th Scoring Teachers								
-1 std dev (40%)	0.807	0.070	0.018	0.105	0.850	0.044	0.024	0.082
Mean (60%)	0.790	0.080	0.018	0.112	0.834	0.072	0.027	0.068
+1 std dev (80%)	0.768	0.091	0.019	0.122	0.801	0.113	0.029	0.056
% Students Failling for Middle 50% Scoring Teachers								
-1 std dev (40%)	0.852	0.071	0.014	0.063	0.887	0.040	0.019	0.055
Mean (60%)	0.826	0.079	0.017	0.078	0.863	0.059	0.024	0.053
+1 std dev (80%)	0.795	0.087	0.021	0.097	0.832	0.086	0.031	0.051
% Students Failling for Bottom 4th Scoring Teachers								
-1 std dev (40%)	0.844	0.073	0.013	0.070	0.882	0.045	0.014	0.059
Mean (60%)	0.853	0.071	0.013	0.063	0.882	0.061	0.013	0.044
+1 std dev (80%)	0.858	0.068	0.012	0.062	0.872	0.081	0.013	0.034
Distance, New York City residents								
0 miles	0.809	0.071	0.018	0.102	0.848	0.064	0.026	0.063
3 miles	0.794	0.078	0.018	0.110	0.837	0.070	0.027	0.067
6 miles	0.778	0.085	0.019	0.117	0.825	0.077	0.028	0.071
10 miles	0.756	0.096	0.020	0.128	0.809	0.087	0.029	0.076
Reside Outside NYC	0.682	0.063	0.125	0.129	0.734	0.059	0.131	0.077
White Teachers								
65% Black, 30% Hisp	0.730	0.112	0.019	0.138	0.792	0.098	0.029	0.081
35% Black, 56% Hisp	0.760	0.085	0.022	0.133	0.813	0.077	0.032	0.078
Mean (35% Black, 38% Hisp)	0.790	0.080	0.018	0.112	0.834	0.072	0.027	0.068
10% Black, 10% Hisp	0.871	0.053	0.012	0.064	0.893	0.047	0.018	0.042
Black Teachers								
65% Black, 30% Hisp	0.731	0.152	0.013	0.103	0.789	0.127	0.020	0.064
35% Black, 56% Hisp	0.745	0.132	0.016	0.107	0.795	0.116	0.024	0.066
Mean (35% Black, 38% Hisp)	0.730	0.150	0.015	0.106	0.781	0.131	0.023	0.065
10% Black, 10% Hisp	0.690	0.190	0.016	0.104	0.744	0.167	0.024	0.064
Hispanic Teachers								
65% Black, 30% Hisp	0.730	0.137	0.022	0.111	0.785	0.115	0.032	0.068
35% Black, 56% Hisp	0.785	0.092	0.018	0.106	0.828	0.082	0.026	0.065
Mean (35% Black, 38% Hisp)	0.806	0.078	0.022	0.094	0.841	0.069	0.032	0.058
10% Black, 10% Hisp	0.873	0.033	0.031	0.063	0.888	0.029	0.041	0.041
School attributes by ELA Failure Attributes								
10th percentile	0.848	0.063	0.014	0.075	0.881	0.028	0.019	0.072
20th percentile	0.851	0.062	0.015	0.073	0.883	0.037	0.020	0.060
50th percentile	0.792	0.074	0.019	0.115	0.835	0.069	0.028	0.067
80th percentile	0.741	0.097	0.021	0.141	0.782	0.124	0.032	0.062
90th percentile	0.718	0.110	0.021	0.151	0.750	0.159	0.033	0.058

Table 8: Probabilities of Retention, Transfer and Quits for Unobserved Heterogeneity Based on Model 2

	First Year Teachers				Teachers with 2 or More Years Experience			
Simulation	Remain in same school	Transfer within NYC	Transfer outside of NYC	Leave NYS schools	Remain in same school	Transfer within NYC	Transfer outside of NYC	Leave NYS schools
% Students Failling for MINUS 1 Standard Deviation in Unobserved Heterogeneity								
-1 std dev (40%)	0.8895	0.0741	0.0143	0.0221	0.9244	0.0283	0.0248	0.0225
Mean (60%)	0.8838	0.0843	0.0180	0.0139	0.9113	0.0431	0.0328	0.0129
+1 std dev (80%)	0.8735	0.0953	0.0226	0.0087	0.8857	0.0646	0.0425	0.0072
% Students Failling with Average Unobserved Heterogeneity								
-1 std dev (40%)	0.8645	0.0721	0.0140	0.0495	0.8985	0.0275	0.0242	0.0497
Mean (60%)	0.8539	0.0815	0.0175	0.0471	0.8831	0.0418	0.0319	0.0432
+1 std dev (80%)	0.8415	0.0919	0.0218	0.0448	0.8588	0.0627	0.0414	0.0370
% Students Failling for PLUS 1 Standard Deviation in Unobserved Heterogeneity								
-1 std dev (40%)	0.8329	0.0650	0.0120	0.0901	0.8655	0.0213	0.0202	0.0930
Mean (60%)	0.7908	0.0707	0.0144	0.1240	0.8260	0.0316	0.0260	0.1164
+1 std dev (80%)	0.7663	0.0734	0.0158	0.1445	0.8030	0.0382	0.0293	0.1294
% Students Failling for Middle 50% Scoring Teachers - AVERAGES								
-1 std dev (40%)	0.852	0.071	0.014	0.063	0.887	0.040	0.019	0.055
Mean (60%)	0.826	0.079	0.017	0.078	0.863	0.059	0.024	0.053
+1 std dev (80%)	0.795	0.087	0.021	0.097	0.832	0.086	0.031	0.051