

## **The Relationship Between School Characteristics and Teacher Mobility**

### **Abstract**

This paper provides new information about the interrelated issues of teacher turnover (both within and across school districts and inside and outside of teaching) and the importance of school characteristics using new administrative data on Georgia teachers and the elementary schools in which they teach. Simple descriptive statistics indicate that teachers are more likely to change schools if they begin their teaching careers in schools with lower student test scores, schools with lower income students, or schools that have higher proportions of minority students. A competing risks model of transitions out of first teaching jobs allows us to separate the importance of these highly correlated school characteristics. The estimates from the model imply that teachers are much more likely to exit schools with large proportions of minority students, and that the other bivariate statistical relationships associated with student test scores and poverty rates are largely spurious in nature. A simple theoretical framework is used to describe the conditions under which high turnover rates should be viewed as being indicative of lower school quality.

## I. Introduction

Recent literature has emphasized the importance of understanding the decisions of teachers regarding whether to continue to teach. Most of this work has focused on the binary outcome of whether an individual leaves the teaching occupation. This is perhaps satisfactory if one is concerned exclusively about the effects of teacher attrition on the educational system as a whole. However, given the high levels of sorting of student groups across schools and the concern about the educational opportunities of students from disadvantaged backgrounds, examining why teachers leave particular schools is an important research topic.<sup>1</sup> This paper provides new information about the interrelated issues of teacher turnover and the importance of non-pecuniary school characteristics using administrative data on Georgia teachers and the elementary schools in which they teach. Our particular interest is in documenting how attrition patterns vary across types of schools and examining whether these patterns suggest that some types of schools are likely to be at a significant disadvantage from the standpoint of providing a quality education for their students.

This paper is most closely related to a small literature on the movement of teachers among schools.<sup>2</sup> A primary contribution of this study is that it examines exits from individual schools (i.e. both teaching job changes within and across school districts as well as various types of exits out of teaching).

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<sup>1</sup> For example, there is a large degree of racial segregation in public elementary schools in Georgia. The index of dissimilarity for black and white students in Georgia public schools was 62.1 in the 2000-01 school year (Freeman, *et al.*, 2002). This index number implies that 62.1 percent of Georgia public elementary school students would have to change schools in order for there to be an equal racial makeup in all Georgia public schools. Freeman, *et al.* also report high degrees of segregation by income class as well. Metropolitan areas in the Northeast and Midwest tend to have the most racially segregated schools (Clotfelter, 1999).

<sup>2</sup>Theobald (1990) and Mont and Rees (1996) estimated models that explain the decisions of teachers in Washington state and New York state, respectively, to leave their school districts. Both of these studies combined attrition and moves across districts and did not consider moves within districts. Theobald and Gritz (1996) and Gritz and Theobald (1996) estimated models that explain the relationship between personal and school characteristics and the decisions of teachers in Washington state to move to a different school district, to move into public school administration, or to exit the state public education system. Hanushek *et al.* (2001) use data on Texas elementary teachers and schools to estimate multinomial logit models of teacher transitions that consider moves out of districts and out of teaching but not moves within districts.

From the standpoint of understanding the relationship between non-pecuniary characteristics of schools and teacher decisions, this is important because we find that approximately 63 percent of all teaching changes take place within a district. Further, substantial variation in non-pecuniary school characteristics exist among schools within districts; in 1995, eighty percent of the variation in 3<sup>rd</sup> grade test scores in the state of Georgia came from within-district variation, 41.3 percent of the variation in the proportion of students in a school who are black came from within-district variation, and 64.6 percent of the variation in the proportion of students in a school who are in poverty came from within-district variation.

Recent research by Rivkin et al. (1998) suggests that teachers are the most important school input and that teachers gain valuable experience in their first years on the job. However, these findings are not sufficient to conclude that a particular type of school is at a disadvantage in educating its students if it has a large amount of teacher attrition, and previous research provides very little guidance on this matter. As a result, before turning to the empirical work we describe in Section II a simple framework for thinking about this issue. Our discussion in Section II suggests that high rates of attrition are likely to be indicative of lower school quality if high attrition schools are less enjoyable places to work for reasons that are unrelated to teaching effectiveness. On the other hand, the manner in which attrition should be viewed is less clear if the reason for high attrition in certain schools is that some subset of teachers find that teaching effectively in these schools is difficult and therefore less enjoyable. Thus, without further information, theory alone is not capable of determining whether varying rates of attrition across school types are indicative of differences in school quality.

Our empirical work in Section III and Section IV documents the type of schools where mobility is highest. Simple descriptive statistics indicate that teachers are more likely to change schools—both within and across districts—if they begin their teaching careers in schools with lower student test scores, schools with lower income students, or schools that have higher proportions of minority students. A

competing risks model of transitions out of first teaching jobs allows us to separate the importance of these highly correlated school characteristics. The estimates from the model imply that teachers are much more likely to exit schools with large proportions of minority students, and that the other bivariate statistical relationships associated with student test scores and poverty rates are largely spurious in nature. Our results indicate that a one standard deviation increase in the proportion of black students in a school increases the probability that a “median type” teacher will exit a particular school in a particular year by approximately twenty-two percent, whereas one standard deviation changes in student test scores, poverty, or wages lead to virtually no change in the overall exit probability.

Recent discussion in the popular press has both suggested (based on largely anecdotal evidence) that teachers are more likely to leave high poverty schools and has made the assumption that high attrition rates are indicative of low school quality. With respect to the former, our empirical work indicates that while this is true, it occurs because teachers are more likely to leave a particular type of poor school - that which has a large proportion of minority students. With respect to the latter, our discussion in Section II implies that one must be cautious before drawing this conclusion because theory alone cannot provide conclusive evidence about whether it is true. However, our discussion in Section II does provide guidance for thinking about this issue and in Section V we examine whether anything can be said, given the lessons of Section II and specific empirical findings in Section IV, about the likely relationship between attrition rates and school quality in this specific context. Section V also includes other concluding remarks.

## **II. A simple theoretical framework**

Our empirical work will show that certain types of schools have higher rates of teacher turnover than other types of schools. The goal of this section is to provide some guidance in advance about how

these differences in turnover may relate to school quality. For ease of exposition the discussion in this section focuses on turnover caused by movements to other schools rather than out of teaching. In Section II.1 we outline the possible reasons that might cause a teacher to change schools. In Section II.2 we discuss some of the basic institutional details related to the movement and initial assignment of teachers. In Section II.3 we use the simple framework we develop to discuss what each of the possible reasons for mobility imply about the relationship between high turnover rates and school quality.

## **II.1 Why do teachers move?**

We assume that the utility teacher  $i$  receives from teaching at a school of type  $j$  is given by  $U(E_{ij}, S_{ij})$  where  $E$  reflects teacher effectiveness and  $S$  represents school characteristics.  $E_{ij}$  captures everything about teacher  $i$ 's effectiveness at teaching in a school of type  $j$ . It is included in  $U$  because it seems natural to believe that the enjoyment that a teacher receives from teaching at a particular school will depend to some extent on how effective she is at teaching the students at the school. Evidence in Rivkin et al. (1998) suggests that some teachers possess (possibly unobservable) characteristics that make them generally more effective than other teachers. Whether a teacher feels that she is being successful may also depend on the type of students being taught or other characteristics such as the level of resources at a school of type  $j$ . Finally, teaching effectiveness may be determined by interactions between teacher characteristics and school characteristics. For example, some teachers may have higher amounts of energy, enthusiasm, and patience which may be needed to succeed at teaching in schools with certain types of "challenging" students. We simplify the discussion by assuming that, at a particular type of school  $j$ , each teacher  $i$  is either effective ( $E_{ij}=1$ ) or ineffective ( $E_{ij}=0$ ) and that  $E_{ij}$  is constant over time.

$S_{ij}$  is a set of school characteristics that teacher  $i$  receives at a school of type  $j$ . Although, as discussed in the previous paragraph, school characteristics may affect utility by influencing teaching

effectiveness,  $S_{ij}$  is also included separately as an argument of  $U$  because it seems likely that the enjoyment a teacher gets from teaching in a particular school may depend on the characteristics of that school for reasons that are unrelated to teaching effectiveness. For example, teaching in a nice building or teaching at a school in a safe neighborhood may seem desirable.  $S$  is written with an  $i$  subscript because, while most school characteristics are constant across all teachers in a particular school, it is possible that some characteristics are not. For example, commuting costs will depend on where teacher  $i$  lives relative to the location of school  $j$ . We simplify the discussion by assuming that there are two types of schools:  $j \in \{H, L\}$ .  $H$  denotes schools of the type where mobility is high and  $L$  denotes schools of the type where mobility is low. For the sake of discussion, we assume that all teachers prefer schools of type  $L$  at least as much as schools of type  $H$ , i.e.,  $U(E_{iL}, S_{iL}) \geq U(E_{iH}, S_{iH})$ , so that teachers move from  $H$  to  $L$  but not vice versa.

We assume that all movement between schools (both within and out of a particular school district) is voluntary. This is consistent with the reality that tenure in a particular school is, in effect, simply a formality and that teachers are typically not forced to move to other schools within a particular district. In this case, if teacher  $i$  moves from a school of type  $H$  to a school of type  $L$ , it must be the case that  $E_{iL} > E_{iH}$  or that the school characteristics  $S_{iL}$  are preferred to the school characteristics  $S_{iH}$  for reasons unrelated to teaching effectiveness. In the remainder of this section we discuss what each of these possible reasons imply about the relationship between high teacher turnover rates and school quality.

## **II.2 A simple institutional framework**

We assume that there is a market for all new teachers which matches each new teacher to a school. We note that the process by which new teachers and schools match is undoubtedly complex,

and, as a result, we do not attempt to describe this process in detail.<sup>3</sup> However, it seems natural to assume that the sorting process for new teachers has the following basic characteristics. First, a school of type  $j$  observes only a noisy signal of  $E_{ij}$  for each new teacher  $i$  and, as a result, forms a ranking of all new teachers based on a prior effectiveness probability  $P(E_{ij}=1)$  that it assigns to each new teacher. Second, teachers rank schools on the basis of  $U(E_{ij}, S_{ij})$ . To simplify the discussion we proceed under the assumption that teacher  $i$  knows  $E_{ij}$  and  $S_{ij}$  with certainty for all schools  $j$ , but we also note the implication of relaxing this assumption.

The teacher and school rankings produce a set of job offers and job acceptances which imply that each school of type  $j$  has some probability  $p_j$  of obtaining an effective teacher if it decides to hire from the new teacher market.<sup>4</sup> Without further assumptions, this general framework puts very little restriction on the values of  $p_H$  and  $p_L$ . For example, if schools are not willing or not able to learn anything about the potential effectiveness of teachers before hiring then school  $j$  will act as if  $P(E_{ij})$  is the same for all  $i$  and will make offers randomly. In this case, if schools pick from the entire pool of new teachers,  $p_H = p_L$ .<sup>5</sup> However, if schools are willing and able to learn something about whether a particular teacher will be effective,  $p_H$  and  $p_L$  are likely to be different.<sup>6</sup> (Unfortunately, our data do not provide any direct evidence about  $p_H$  and  $p_L$ .)

Subsequent to teacher  $i$ 's initial job placement, we assume that an additional noisy signal of what

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<sup>3</sup>See Lankford et al. (2002) for work that examines the initial sorting of teachers.

<sup>4</sup>The randomness takes into account that (1) for any teacher  $i$ , only the prior effectiveness probability  $P(E_{ij}=1)$  is observed by the school and (2) if  $P(E_{ij})$  varies across the teachers that are hired by schools of type  $j$ , then a particular school of type  $j$  will face uncertainty about what the  $P(E_{ij})$  will be for the teacher it hires.

<sup>5</sup>The assumption that all teachers prefer schools of type  $L$  as much as schools of type  $H$  implies that randomness in job offers implies randomness in actual hiring as long as each new teacher is willing to be considered by all types of schools and accepts the best job that is offered to her.

<sup>6</sup>As long as teaching quality is not perfectly observable, all schools have some chance of hiring a teacher who will turn out to be effective (i.e.,  $p_j < 1 \forall j$ ) and some chance of hiring a teacher who will turn out to be non-effective (i.e.,  $p_j > 0 \forall j$ ).

the teacher's effectiveness would be in each type of school is observed and this information is used by schools to compute posterior effectiveness probabilities  $P^*(E_{iH}=1)$  and  $P^*(E_{iL}=1)$ . For simplicity, we assume that the amount of information that is revealed about  $i$ 's effectiveness in schools of type H and L does not depend on the type of school at which  $i$  has been hired initially. Subsequent to an initial job placement, teachers in schools of type L attempt to move to schools of type H where working is more desirable. We assume that a movement is governed by the state of affairs in public schools which suggests that moving to a new school (inside or outside a particular district) typically requires that the principal at the new school is willing to hire the teacher  $i$ . The possibility that a teacher who initially received only offers in type L schools will receive subsequent offers in type H schools arises because  $P^*(E_{iH}=1)$  may be quite different than  $P(E_{iH}=1)$ . In terms of timing, we assume that schools decide in each year whether or not to hire experienced teachers before beginning the process of hiring new teachers.

### **II.3 Implications of turnover for school quality**

In this subsection, we use the simple framework developed above to examine the implications of each of the possible reasons for turnover. In the discussion we examine two questions. First, does turnover itself make schools worse off in the specific sense that departing teachers are replaced by new teachers who, on average, are less effective? It is very important to stress that our interest in this question is simply to highlight a particular factor that may indicate that high attrition schools have difficulty providing quality education for their students relative to other schools, and an affirmative answer to this question should not be taken to suggest that high attrition schools would be made better off by rules that, for example, removed all attrition from all aspects of the teaching institution.<sup>7</sup> Second

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<sup>7</sup> For example, suppose that new teachers were forced to commit to remaining in their initial job forever. Such a policy would clearly change the initial acceptance decisions of teachers and this change could harm high attrition schools. For example, some teachers may currently be willing to initially accept jobs in difficult schools only because they believe that they can move to more desirable schools in the future.

is the mobility indicative of lower school quality? As will be seen, these are related but not identical issues. For example, a finding that mobility itself is not harmful in the sense of the first question does not necessarily imply that schools of type H are of equal quality to schools of type L. It is also worth noting that in this section our assumption that  $E_{ij}$  is constant over time (each teacher is either effective or not effective at type j schools) is not restrictive from the standpoint of determining the answers to the two questions described in this paragraph. This is the case because affirmative answers would tend to strengthened and ambiguous results would remain ambiguous if, as suggested by Rivkin et al. (1998), teachers become more effective during their initial years of teaching.

*Implications if mobility is caused by reasons unrelated to teaching effectiveness*

We first consider the implication for school quality at a school of type H if mobility arises because teaching in schools of type H is less enjoyable than teaching in schools of type L for reasons unrelated to teaching effectiveness. Given that in this scenario movement is not being caused by reasons related to teaching effectiveness, we focus the discussion by assuming that, while there may be heterogeneity in teaching ability, each teacher is equally effective in all schools (i.e.,  $E_{iH}=E_{iL} \forall i$ ). A necessary condition for teacher i to leave the school of type H is  $P^*(E_{iL}) > p_L$  since a school of type L will only be willing to hire teacher i if her posterior probability of being an effective teacher is greater than the probability that the school of type L will obtain an effective teacher if it hires a new teacher.<sup>8</sup> The cost to a school of type H of losing teacher i depends on what type of teacher is hired as a replacement. The school of type H will be forced to replace the departing teacher with a new teacher because no experienced teacher will choose to move to a school of type H. Thus, given that  $p_L \geq p_H$  in this section, turnover will cause the expected number of effective teachers in the school of type H to decrease

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<sup>8</sup>Recall that  $p_j$ ,  $j=L,H$  is the probability that a school of type j will obtain an effective teacher if it hires from the new teacher labor market.

because, for the teacher who is able to move,  $P^*(E_{iH}=1)=P^*(E_{iL}=1)>p_L \geq p_H$ . Because, schools of type H are less likely than schools of type L to hire effective new teachers and suffer harmful effects when experienced teachers leave, schools of type H will tend to be of lower quality than schools of type L.<sup>9</sup>

*Implications if mobility is caused by reasons related to teaching effectiveness*

The implications that schools of type H are likely to be harmed by turnover (in the specific sense described above) and that mobility is likely to be indicative of lower quality does not necessarily hold if mobility arises because some teachers are more effective at teaching in schools of type L than schools of type H. To see this consider the following example. Suppose that all teachers are effective at teaching the type of students in schools of type L but only a subset of teachers are effective teaching the types of students in schools of type H. For concreteness, if we refer to the students in the two types of schools as “non-challenging” and “challenging” respectively, this difference could arise if it takes substantial energy or patience to deal with the challenging students and only a subset of teachers have these attributes. If these teacher attributes are not fully observable for new teachers, a school of type H will hire some new teachers who do not have these attributes. These teachers will find working in a school of type L more desirable than working in the school of type H (because they are effective in the former but not the latter) and may be able to move because schools of type L are indifferent between hiring these experienced teachers or hiring new teachers (all teachers are effective at a school of type L).

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<sup>9</sup>In this subsection, we are assuming that mobility of experienced teachers arises because teaching in a school of type H is less enjoyable for reasons unrelated to teaching effectiveness. In this scenario, the maintained assumption that teacher  $i$  faces no uncertainty about  $E_{ij}$  and  $S_{ij}$  ensures that  $p_L \geq p_H$  because it guarantees that new teachers also prefer type L jobs to type H jobs. It is worth noting that if one introduces uncertainty about  $E_{ij}$  and  $S_{ij}$  then it is possible to construct situations in which  $p_L < p_H$ . For example, this would likely be the case if all teachers initially believe that teaching in type H schools is more enjoyable and rewarding than teaching in type L schools and only later learn that this is not correct. In this case, whether or not high attrition rates are indicative of low school quality is uncertain because the advantage of being more likely to hire effective new teachers may or may not offset the (possibly) harmful effects that are present due to attrition. However, while theoretically possible, learning scenarios, such as the one above, that would generate  $p_L < p_H$  do not seem particularly appealing from an intuitive standpoint. Further, consistent with the notion that  $p_L < p_H$ , Podgursky et al. (2002) find strong evidence that average (ACT) test scores of new teachers in Missouri are lower in the types of schools that we find to have high turnover.

The school of type H will benefit, on average, from these departures because it loses ineffective teachers and replaces these teachers with new teachers who each have some probability  $p_H > 0$  of being effective in the H type school.

Thus, in this example, mobility makes the school of type H better than it would be if no teachers left the school. However, whether or not the high attrition is indicative of lower school quality depends on what proportion of teachers are ineffective teaching in schools of type H. For example, if only a relatively small number of teachers are ineffective then the school of type H is only of lower quality (relative to L) to the extent that it may take time for the ineffective teachers to find their way into schools of type L. However, if virtually all teachers are ineffective then the school of type H will be of lower quality since only a subset of the ineffective teachers will be able to make their way to schools of type L. Thus, the leading case where attrition is not indicative of problems of providing quality education is one where only a subset of teachers are less effective teaching in the type H school and these teachers depart for type L schools leaving behind teachers who are equally effective at teaching in the H and L school.<sup>10</sup>

#### **II.4 Summary**

Thus, while the simple framework does not provide a final conclusion about whether high turnover at a particular type of school is indicative of lower school quality, it does give some guidance on this issue. It suggests that high mobility is likely to be indicative of lower school quality if the reason for mobility is that teachers find schools of type H to be less desirable places to work for reasons that are not directly related to teaching effectiveness. However, the simple theory tells us that the

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<sup>10</sup>Note that we have constructed this example to be consistent with our earlier assumption that all teachers prefer schools of type H at least as much as schools of type L. If we believe that some teachers are more effective at teaching in schools of type H than schools of type L, then some teachers would prefer type H to type L and it would be possible to modify the above example in a manner such that schools of type H are of higher quality than schools of type L.

conclusions about school quality at schools of type H is much less certain if mobility is caused by reasons related to teaching effectiveness. In Section III and IV we examine the issue of mobility using our unique data. In Section V we discuss whether these findings suggest anything about the reasons for mobility between teaching jobs.

### III. Data

To analyze the mobility and retention of new elementary school teachers, we merged three sources of data on all public elementary schools teachers and all public elementary schools in Georgia.<sup>11</sup> Data on the characteristics of individual teachers from the 1991-92 school year to the 2000-01 school year were obtained from the administrative records kept by the Georgia Professional Standards Commission (GAPSC). Characteristics of individual elementary schools from 1994-95 to 2000-2001, including racial composition, average student achievement on standardized exams, and percentage of students eligible for free or reduced lunch were provided by the Georgia Department of Education (GADOE). Actual quarterly wages paid to the teachers and former teachers comes from administrative payroll records from the state unemployment insurance (UI) system maintained by the Georgia Department of Labor (GADOL). These data are referred to as ES202 data.<sup>12</sup> Virtually all employees

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<sup>11</sup> Georgia is in many ways roughly an “average” state. Georgia’s median household income in 1999 was about \$39,500, ranking 26<sup>th</sup> in the U.S. Women working in Georgia earned \$934 more than the national median for women. Georgia students in the 3<sup>rd</sup>, 5<sup>th</sup>, and 8<sup>th</sup> grades scored very close to or at the national average on the battery of Stanford 9 exams administered in 2001 (Georgia Department of Education, 2002). Almost 83 percent of Georgia residents have at least a high school diploma, compared to 84 percent nationwide. According to the National Education Association, teacher salaries in Georgia are slightly below the national average, the highest in the southeast, and 17<sup>th</sup> highest in the nation (Salzer, 2001). The rate of adults over age 25 with at least a college degree is lower in Georgia relative to the nation—23.1 percent in Georgia and 25.6 percent overall. Georgia differs from the rest of the nation with respect to homeownership and racial composition as well. In 1999, 71.3 percent of Georgians owned their homes compared to a rate of 66.8 percent nationally. Nationally, 30.9 percent of individuals are nonwhite or of mixed race, compared to 37.4 percent of Georgians. Unless otherwise noted, all information in this footnote comes from the U.S. Department of the Census web site, [www.census.gov](http://www.census.gov).

<sup>12</sup> The ES202 data are described in detail by White, *et al.* (1990). All employers covered in the unemployment insurance system report each employee’s wages to the GADOL on a quarterly basis. The ES202

are subject to the UI tax, and thus virtually all wages in non-teaching occupations are observed. The ES202 data identify the industry (4-digit SIC code), but not the occupation of each individual.<sup>13</sup>

Merging these three sources of data allows us to differentiate between the reasons that a teacher may leave his/her first teaching job. If an individual is no longer working as a full-time teacher, but receives wages from a public school district, we classify him/her as working in “other education sector employment.” If a former teacher does not have a wage in the ES202 file then he/she is either living in Georgia but not working, living in another state and not working, living in another state and working as a teacher, or living in another state and working in a non-teaching occupation. The data do not allow us to differentiate between these possibilities so we group them together in a “leaving the Georgia workforce” category. Note that we also classify individuals who earn less than \$10,000 in annual wages as having left the Georgia workforce. Individuals who earn wages outside the Georgia public education sector are labelled as working in the “non-education sector.” Finally, the data allow us to identify the particular school and school district in which the teacher is employed so we are able to differentiate

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data identify the industry (4-digit SIC code), but not the occupation of each individual. Using ES202, the actual wages paid to teachers and former teachers were matched with the teacher records in the GAPSC files by social security number. For individuals listed in the GAPSC files as teachers for a given year, the match of wages to teachers was almost perfect--of the roughly 820,000 teacher records over the 10-year period, only 7 records could not be matched to wage information in the ES202 data files.

<sup>13</sup> Each record in the GAPSC data contains a job code, which is used to determine which individuals are teaching. Nevertheless, a large number of these teachers have low actual wages as reported by ES202. Perhaps these teachers were working for only part of the academic year. Since we do not know why these individuals are not earning a full-time annual teaching wage, we did not want to characterize their wage necessarily as their observed annual wage. Teaching wages are observed quarterly in the ES202 data: January-March, April-June, July-September, and October-December. Georgia teachers are paid on 12-month contracts. Since the quarterly data do not match the school year, care had to be taken in constructing annual teaching wages. In the 3<sup>rd</sup> quarter of the calendar year, the ES202 data will contain wages for teachers from two different academic years. To avoid this issue and the issue of teachers leaving in the middle of an academic year, we took the highest quarterly teaching wage from the other three quarters and annualized that figure. Teachers making decisions on whether to leave the profession surely consider the wage they would be paid for the entire academic year as the wage offered in teaching. One drawback of using actual wage information is that some variation in wages is true differences in wages across districts, while some variation is due to differences in educational attainment. In our data, just over 90 percent of the sample of new teachers never earned more than a bachelor's degree during the same period. We also conducted our analyses with only these teachers and obtained very similar results to those reported in this paper.

between exits to a new school within the district and to a new school in another district.

We study the seven years between the 1994-95 academic year and the 2000-01 academic year. Our sample contains 11,070 elementary teachers who began teaching between 1994-95 and 1999-00 in Georgia and were under the age of 27 when they began their teaching career.<sup>14</sup>

Variable definitions and summary statistics of the characteristics of teachers and their schools are listed in Table 1. We report summary statistics from the first year of each first teaching job. As shown in Table 1, individuals on average work in schools in which 0.464 of students live in poverty (POVERTY), i.e. eligible for free or reduced price lunch, and 0.388 of students are black (PBLACK). The mean percentile rank on the Iowa Test of Basic Skills (TEST) at teachers' first schools is 53.28.<sup>15</sup> Our sample of new teachers is overwhelmingly female (87.5 percent), and only 16.7 percent of teachers identify themselves as non-Hispanic blacks (BLACK).<sup>16</sup> Mean wages in the first year of teaching are approximately \$30,000, in constant year 2000 dollars.

Table 2 contains the number of teachers in each of the transition categories under study. For the six annual cohorts in the data, we observe a minimum of one, a maximum of 6, and an average of 3.46 yearly decisions before the end of the sample period, which takes place in 2000-2001 school year. A teacher is defined to make a transition when he or she leaves the teaching job at his or her first school. Of the 11,070 new teachers in our sample, 4,222 (38 percent) remain at the same school through the end

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<sup>14</sup> Limiting our sample to teachers aged 27 or younger, essentially ensures that our new teachers have not previously taught in Georgia. We cannot rule out the possibility that some of these teachers may have taught in other states before arriving in Georgia. However, the results in the paper are robust to reducing the cutoff age which removes teachers most likely to have taught elsewhere. Evidence in Rivkin et al. (1998) that teachers gain valuable experience during early years of teaching is one motivation for studying new teachers.

<sup>15</sup> For an individual elementary school, this test score is the mean of the 3<sup>rd</sup> grade Reading and Math exams.

<sup>16</sup> We use PBLACK to represent the proportion of students in a school that are black and we use BLACK to indicate whether a particular teacher is black. The proportion of the sample that is not non-Hispanic black or white is very small—less than 2 percent.

of the sample period, and thus have a censored spell. However, Table 2 indicates that a large proportion of new teachers end their first teaching spell by changing schools. During the sample period, 20.9 percent of all teachers end their first teaching job by moving to a new school in the same school district and 12.4 percent of all teachers end their first teaching job by moving to a teaching position in another school district. Disaggregating these numbers into yearly rates we find that approximately 15 percent of teachers change schools in a particular year during the sample period. Of the 28.5 percent who ended their first teaching spell by exiting the Georgia public school teaching force, almost two-thirds were not working in Georgia in the next year.<sup>17</sup>

#### **IV. The Role of School Characteristics in Teacher Mobility and Retention**

In this section, we analyze the role of school characteristics on teacher mobility and retention. First, we describe the bivariate patterns that exist between transitions out of first teaching jobs and the pecuniary and non-pecuniary school characteristics of these jobs. Second, we present estimates from a competing risks model of teacher transitions that show the relative importance of individual factors, including school characteristics, on exits from first teaching jobs. Third, we show how school characteristics change for teachers who move between schools.

##### **IV.1 Bivariate Analysis of Teacher Turnover**

A teacher's decision to leave his/her first teaching job may depend on both wages and non-pecuniary characteristics of schools.<sup>18</sup> In this subsection, we examine whether teachers who remain in

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<sup>17</sup> This is consistent with Stinebrickner (2001) and Stinebrickner (2002) who found that women who leave teaching often leave the workforce altogether for reasons related to marriage and fertility. Using the data in this paper, Scafidi *et al.* (2002) pay careful attention to the reasons that teachers leave teaching altogether.

<sup>18</sup> Mandated by state law and updated annually, Georgia public schools districts face a minimum salary schedule that lists the minimum teacher salary that must be paid based on teacher certification status, experience, and education. Variation in salary arises because local school districts may pay teachers a local supplement to the salary schedule, and many do so. The standard deviation of salary for new teachers with no more than a bachelor's

their first teaching job have, on average, different school characteristics than those who leave their first teaching job for each of the possible exit reasons that we described above. Specifically, using all person-years in the first teaching jobs of all individuals in our sample, Table 3 shows the average school characteristics at time  $t$  for those who remained in the first teaching job at time  $t+1$ , those who accepted a new teaching job in the same school district at time  $t+1$ , those who accepted a new teaching job in a different school district at time  $t+1$ , those who accepted an administrative or other non-teaching job in the education sector at time  $t+1$ , those who accepted a non-education sector job at time  $t+1$ , and those who exited the Georgia workforce entirely at time  $t+1$ .<sup>19</sup>

With respect to changing teaching jobs, the first three entries in the first row of Table 3 show that wages of teachers at time  $t$  do not differ substantially between teachers who remain at their first teaching job at time  $t+1$  and teachers who change teaching jobs at time  $t+1$ . By contrast, the first three entries of the fourth row of Table 3 show that the racial composition of schools (PBLACK) at time  $t$  does differ significantly between teachers who remain at their first teaching job at time  $t+1$  and teachers who change teaching jobs at time  $t+1$ . Teachers who remain at their first school at time  $t+1$  served a student population at time  $t$  that was on average 0.372 black. Teachers who move to other schools within the same district at time  $t+1$  served a student population at time  $t$  that was on average 0.393 black, while teachers who change districts at time  $t+1$  served a student population at time  $t$  that was on average 0.466

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degree in 1994-95 was about \$3,500. Unlike parts of the U.S., there is no collective bargaining between teacher unions and local school districts.

<sup>19</sup> The total number of years contributed by a particular person is the total number of years that he remained in his first teaching job. For example, if a person chose to remain in her first teaching job at the end of the first three years of teaching and then changed to a new teaching job in the same district after the fourth year, then the school characteristics in each of the first three years would contribute to the average associated with remaining in the first teaching job and the school characteristics in the fourth year would contribute to the average associated with changing to a new teaching job in the same district. An alternative descriptive approach that would produce substantially bigger differences in average school characteristics would be to have school characteristics contribute to the average associated with remaining in the first teaching job only if the person never leaves the first teaching job during the sample period.

black. A similar pattern exists for both the poverty status of students (POVERTY) and the achievement test score (TEST). Teachers who move to other schools at time  $t+1$  taught in schools at time  $t$  that had higher poverty rates and lower test scores than teachers who did not move to other schools, with larger differences for teachers who change school districts than for teachers who change schools within a district.

With respect to leaving teaching for other education jobs, Table 3 indicates that teachers who accept administrative or other non-teaching education jobs at time  $t+1$  had lower wages and were in schools with lower test scores, higher poverty rates, and higher proportions of minority students at time  $t$  than teachers who remain in their same teaching job at time  $t+1$ . With respect to leaving education jobs altogether, Table 3 indicates that teachers who leave teaching for a non-education sector job or leave the Georgia workforce altogether at time  $t+1$  were, on average, in schools with higher proportions of black students at time  $t$  than teachers who remain in their same teaching job at time  $t+1$ . By and large, there are no differences in the means of other school characteristics at time  $t$  for those teachers who remain in their same teaching jobs at time  $t+1$  and those who left teaching for non-education jobs or left the Georgia workforce entirely at time  $t+1$ .

#### **IV.2 A Competing Risks Analysis of Teacher Mobility and Retention**

The analysis in the previous section indicates that teachers who leave their first schools for new teaching jobs were more likely to serve minority, disadvantaged, and lower achieving students in the year prior to exiting than teachers who did not leave their first teaching jobs. These three school characteristics are highly correlated. The correlation between PBLACK and POVERTY is 0.74. The correlation between PBLACK and TEST is -0.54, and the correlation between POVERTY and TEST is -0.62. In contrast, teaching wages are not highly correlated with student test scores, student poverty rates, or student racial composition (the correlations are 0.09, -0.07, and 0.04, respectively).

The reality that school characteristics are highly correlated combined with the policy significance of determining the relative importance of the various characteristics motivates our estimation of a discrete-time competing risks model. A hazard function for discrete-time data in a single risk duration model represents the probability that a person leaves full-time teaching for any reason in a given year  $t$ , conditional on not having left before year  $t$ . The competing risks hazard model used here makes further distinctions between various possible reasons that a person may leave his/her first teaching job. Specifically, the model distinguishes between remaining in the same school ( $F$ ) and exiting to a teaching job in another school within the same district ( $W$ ), exiting to a teaching job in another district ( $D$ ), exiting to a non-teaching job (other than full-time teaching) within the Georgia public education system ( $E$ ), exiting to another job outside the Georgia public education system ( $N$ ), and exiting out of the Georgia workforce altogether ( $O$ ).<sup>20</sup>

The model is estimated by maximum likelihood. Define  $P_{it}^j$  to be the probability that at the end of his/her  $t^{\text{th}}$  year in teaching, teacher  $i$  chooses activity  $j$ ,  $j=F, W, D, E, N, O$ , for time  $t+1$ . There are two cases to consider. First, suppose a person's spell in teaching at his/her first job is censored after  $S$  years in teaching. In this case, the likelihood contribution for teacher  $i$  is the probability that at the end of years  $1, 2, \dots, S-1$ , the person decides to return to teaching at the first school for the next year

$$(1) \quad L_i = P_{i1}^F \cdot P_{i2}^F \cdot \dots \cdot P_{iS-1}^F.$$

The likelihood contribution is similar in the alternative case where the person is not censored. Suppose a person teaches for  $S$  years in his first teaching job and then leaves teaching at the first school for option  $k \in \{W, D, E, N, O\}$ . In this case, the likelihood contribution for the person is the joint probability that at the end of years  $1, 2, \dots, S-1$ , the person decides to return to teaching for the next year and decides

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<sup>20</sup> An alternative would be to specify a continuous time competing risks model and to compute likelihood contributions on the basis of the interval in which a person left his/her first teaching job. This is the approach taken by Dolton and van der Klaauw (1999) and Stinebrickner (2002). Some preliminary experimentation indicated that our results are not sensitive to our choice of a continuous time or a discrete time model.

at the end of year  $S$  to have activity state  $k$  in time  $S+1$

$$(2) \quad L_i = P_{i1}^F \cdot P_{i2}^F \cdot \dots \cdot P_{iS-1}^F \cdot P_{iS}^k$$

We define  $P_{it}^j$  to have a multinomial logit form

$$(3) \quad P_{it}^j = \frac{e^{X_{it}\beta^j + B^j(t)}}{e^{X_{it}\beta^F + B^F(t)} + e^{X_{it}\beta^W + B^W(t)} + e^{X_{it}\beta^D + B^D(t)} + e^{X_{it}\beta^E + B^E(t)} + e^{X_{it}\beta^N + B^N(t)} + e^{X_{it}\beta^O + B^O(t)}}$$

where  $X_{it}$  is the vector of observable personal and school characteristics of teacher  $i$  at time  $t$  and are described in Table 1.  $B^j(t)$  is a function which is used to determine how the probability of choosing a particular option  $j$  changes with the number of years,  $t$ , that a person has been in her teaching spell. We assume a non-parametric form

$$(4) \quad B^j(t) = \delta^j_1 I(t=1) + \delta^j_2 I(t=2) + \delta^j_3 I(t=3) + \dots + \delta^j_6 I(t=6)$$

where  $I$  is an indicator function that is equal to one if its argument is true. The number of terms in equation (4) comes from the fact that a maximum number of six decision years can be observed for teacher  $i$ .<sup>21</sup>

The likelihood function for the sample is given by  $\prod_i L_i$ .<sup>22</sup> The coefficient vector  $\beta^F$  and the coefficients in  $\beta^F(t)$  are normalized to zero so that the remaining coefficient vectors  $\beta^j$ ,  $j=W,D,E,N,O$  and the parameters of  $\beta^j(t)$ ,  $j=W,D,E,N,O$  are the effects relative to the option of remaining in the first

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<sup>21</sup> The first teaching year is 1994-95. The last year of our sample is 2000-01.

<sup>22</sup> In this specification, conditional on the observable characteristics, the year specific likelihood contributions are independent. We have also estimated the model allowing for unobserved heterogeneity. In this case, the likelihood contributions for person  $i$  are found by integrating equations (1) and (2) over the distributions of the heterogeneity. The results from this estimation were very similar to those from the homogenous model that is described below.

teaching job.<sup>23</sup>

The estimation results from the competing risks model are shown in Table 4. There is little evidence in Table 4 that wages impact teacher exits from their first teaching job. In particular, we find no evidence of a relationship between teaching wages and exits to occupations outside of the public education sector or exits out of the Georgia workforce and generally only weak evidence of a relationship between teaching wages and other types of exits.<sup>24</sup>

While wages are the characteristic that has been most often studied in the past, by far most striking in Table 4 is the effect of student racial composition. Relative to remaining in the same school, teachers in schools with higher proportions of black students (PBLACK) are significantly more likely to change teaching jobs within the same district, to change teaching jobs by moving to new districts, to leave teaching for non-education jobs, and to leave the Georgia workforce altogether. The t-statistics associated with these effects are 3.15, 9.31, 6.49, and 10.72, respectively. The interaction of PBLACK with the indicator of whether a teacher is black (BLACK) indicates that black teachers are significantly less likely to leave minority schools than are white teachers. Table 4 also reveals that the poverty and test score variables have an insignificant effect on transitions to both types of new teaching jobs.<sup>25</sup> Thus,

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<sup>23</sup> As is typical in studies of teacher retention, this competing risks analysis can be characterized as descriptive, since we are not estimating a structural model. Estimating a structural model that formally specifies supply and demand equilibrium conditions would be very difficult for teacher labor markets and is beyond the scope of this paper.

<sup>24</sup> There is a negative and statistically significant relationship between teaching wages and exits to non-education jobs (t-statistic of -4.56). However, as shown in Table 2, very few teachers (3.1 percent) make this transition. In addition, teaching wages also have a negative relationship with movements to new districts (t-statistic of 1.65), but the estimated coefficient on wages is relatively small.

<sup>25</sup> POVERTY is found to have a positive effect on transitions to other education sector jobs (t-statistic of 2.21), and, curiously we find a negative and statistically significant effect of POVERTY on transitions to non-education sector jobs and out of the Georgia workforce. This result is consistent with the findings in Hanushek *et al.* (2001) and Clotfelter *et al.* (2002). Both studies find that the percent of students in poverty has a negative effect on exits from teaching. In earlier work, Scafidi, *et al.* (2002) find that adding measures of local labor market conditions (county and region unemployment rate and earnings, and region dummy variables) as explanatory variables does not have much of an impact on the magnitude or significance of the impact of wages or school

the results suggest that the bivariate relationships between teacher job changes and the POVERTY and TEST variables that were found in Section IV.1 are spurious in nature and driven by the racial makeup of schools.

However, to provide more information that the insignificant effects found for POVERTY and TEST in the competing risks specification are driven by their relationship with PBLACK rather than by the econometric specification, we estimated two additional specifications which confirmed that the spirit of the bivariate relationships (between teacher job changes and POVERTY and teacher job changes and TEST) described earlier is also present in our competing risks framework. In one alternative specification we excluded the TEST and PBLACK variables and found that the estimated coefficient on POVERTY was 1.201 (t-statistic of 11.04) in the change districts transition and 0.353 (t-statistic of 4.14) in the new school/same district transition. In a second alternative specification we excluded the POVERTY and PBLACK variables and found that the estimated coefficient on TEST was -0.017 (t-statistic of -8.97) in the change districts transition and -0.004 (t-statistic of -3.07) in the new school/same district transition.

In order to quantify the importance of the various school characteristics, we use our estimates in Table 4 to compute the first-year exit probability associated with each of the exit reasons for a “baseline” person at a “baseline school” and then compare these probabilities to those obtained after changing the values of the school characteristics one at a time.<sup>26</sup> As shown in Table 5, for the baseline person the sum of the first-year exit probabilities associated with the five possible transition risks is 29.7 percent. Increasing wages by one standard deviation (\$4,674) decreases the predicted probability of leaving the first job in the first year by only one percentage point. Increasing test scores at the baseline school by one standard deviation (14.69 points) decreases the probability of leaving the first job in the

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characteristics on teacher transitions.

<sup>26</sup> The baseline person is a non-black female teacher with all other explanatory variables set to the sample means.

first year by only one-half of one percentage point. Increasing the school's poverty rate by one standard deviation (0.27) decreases the probability of leaving the current school by about eight-tenths of a percentage point. Thus, although there are statistically significant impacts of student test scores, poverty rates, and wages on a small number of teacher transitions, the overall impacts of these school characteristics on teacher mobility and retention are very small. By contrast, increasing the proportion of black students by one standard deviation (0.32) increases the probability of leaving the first job in the first year by 6.5 percentage points—a 22 percent increase.

### **IV.3 Changes in School Characteristics Associated with Changing Schools**

The analyses in the previous section suggest that teachers who serve higher proportions of minority students are more likely to leave their first teaching job – by moving to new schools within their districts, by moving to new districts, and by taking jobs outside of the public education sector. Although this analysis utilizes only the school characteristics in a teacher's first teaching job, it suggests that we should perhaps expect that the schools to which teachers move will be substantially different than the schools that they leave. In this section, we examine this issue by computing the changes in wages and school characteristics that are experienced by teachers who move to new schools. These results are displayed separately in Table 6 for teachers who change schools within the same district (column 1) and teachers who change districts (column 2).

Given annual changes in salary, our data indicate that teachers who remained in their first teaching jobs received an annual wage increase of approximately \$1,820 during the sample period. Thus, Table 6 shows that the wage increases experienced by teachers who changed teaching jobs are not substantially higher (less than 1 percent) than the increases experienced by teachers who did not change jobs. However, consistent with what we might expect given our previous findings, Table 6 indicates that teachers who changed schools did experience changes in non-pecuniary school characteristics. Teachers

who moved to new schools within their first school district experienced an average increase in TEST of 3.37 points and average decreases in POVERTY and PBLACK of 5.4 and 3.9 percentage points, respectively.<sup>27</sup> Teachers who moved to new schools in different districts experienced an average increase in TEST of 8.0 points and average decreases in POVERTY and PBLACK of 11.7 and 13.3 percentage points, respectively.

The changes in school characteristics for movers in the present study are consistent with the bivariate analysis in Lankford, *et al.* (2002), which reports that New York State teachers tend to move away from disadvantaged students in a similar fashion. These changes for movers are also broadly consistent with evidence from the California class size reduction that began in the mid 1990s. The sudden and large decrease in class sizes mandated by the state of California created new teacher positions in virtually every school in the state. As reported in Reichardt (2000) and Betts, *et al.* (2001), incumbent teachers who served lower achieving, minority, and low-income students were more likely to transfer to schools that had less of these types of students.

## **V. Discussion and Conclusions**

Consistent with information that has appeared recently in the popular press, our results indicate that teachers are more likely to leave schools where students come from low income families. However, our results provide strong evidence that this occurs because teachers tend to leave a particular type of poor school - that which has a large proportion of minority students.

An implicit assumption in the popular press is that high rates of attrition are indicative of difficulties in providing high quality education. Our discussion in Section II, which provides a simple

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<sup>27</sup> Test scores are recorded only for teachers who move to another elementary school. A handful moved to middle or high schools.

framework for thinking about this issue, suggests that one should be cautious in drawing this conclusion. Specifically in this context, the discussion in Section II suggests that the high attrition rates at black schools will tend to be indicative of low quality education if teachers receive less enjoyment in these schools for reasons unrelated to teaching effectiveness. However, results about school quality are ambiguous if *some subset* of teachers are less effective teaching in black schools and the high attrition rates result from these teachers finding better school matches. In the next paragraph we examine under what conditions the latter possibility is true. If it is not true, our empirical findings suggest that black schools are likely to be of lower quality than other schools.

At first glance, the discussion in Section II might suggest that it is quite plausible to believe that some subset of teachers are less effective teaching in black schools; one might think that black schools like other high poverty schools may be challenging places to teach effectively and teacher characteristics such as energy, motivation, and patience, which are presumably valuable in these types of schools, may be possessed by only a subset of teachers. However, if race per se does not make a particular student more difficult to teach, our empirical finding that high attrition rates do not appear in high poverty, low test score, non-minority schools casts a serious doubt on the plausibility of believing that the force driving mobility in minority schools is differences in teaching effectiveness generated by general characteristics such as motivation, energy, and patience. In particular, it would have to be the case that (1) the TEST and POVERTY variables do not fully measure the factors that determine how challenging it is to teach effectively in a particular school and (2) the portion not captured by these variables is both spuriously being attributed to the PBLACK variable in our empirical work and happens to be the portion that requires general teacher attributes such as energy, motivation, and patience. If these conditions are not satisfied, one needs explanations in which some subset of teachers are more effective teaching black students for reasons directly related to race. One obvious possibility is that black teachers are more

effective at teaching black students than non-black teachers.<sup>28</sup> However, as discussed in detail in Section II, while this explanation may imply that minority schools tend to replace departing teachers with teachers who on average are more effective, it suggests that minority schools will be of lower quality if there does not exist enough black teachers to staff all black schools.

We note that the competing risks specifications undoubtedly suffer from omitted school variables that are potentially correlated with our PBLACK variable. As a result, it is important to note that even if attrition is caused by preferences that are unrelated to teaching effectiveness, it is very possible that teachers find teaching in black schools to be less enjoyable for reasons unrelated to simple racial bias. However, given that black teachers are not more likely to leave black schools than white schools, omitted school variables of relevance must influence white teachers differently than black teachers. One possibility suggested in Section II is that white teachers may tend to live further from black schools than black teachers.

In this paper we have treated wages symmetrically with other school characteristics. However, policy issues related to wages are important if teachers find that minority schools are less desirable working environments. For example, the rigid wage structure that is common within public school districts implies that districts may not be able to offer the compensating wage differentials that would provide incentives for experienced and high quality teachers to remain in working environments they deem undesirable.<sup>29</sup> However, the estimates from the competing risks model also suggest that the impact

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<sup>28</sup>There is a large literature focused on how the race and gender of faculty relate to students of different race and gender. Generally, the focus of this research has been on such issues as the attitudes towards and expectations of students, but not student performance; this research is discussed by Ehrenberg and Brewer (1995). We identified one paper that addressed the relationship between the race of a teacher and the performance of students. Using the National Educational Longitudinal Study of 1988, Ehrenberg, Goldhaber and Brewer (1995) find that “for the most part [the race, gender and ethnicity of the teacher] did not affect how much students learned.”

<sup>29</sup> Given the decentralized public finance of K-12 education in the U.S., it is also possible that compensating wage differentials are negative in some cases. That is, schools that serve students deemed more desirable by teachers or schools that are in more desirable places to teach may offer higher wages.

of wages on teacher transitions may be small. Therefore, even with very flexible wage structures, the wage differentials necessary to retain teachers in these schools could be quite large.

In conclusion, it is not possible to provide conclusive evidence that attrition is harmful using our data. Nonetheless, the discussion in this section and Section II combined with the strength of our empirical findings suggest that, at the very least, it is very possible that minority schools are having a difficult time providing quality education to their students and the same difficulties may not be encountered by poor, non-minority schools. Further research which attempts to provide additional information about why teachers are leaving minority schools is warranted.

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**Table 1**  
**Summary Statistics**  
**First Year of Teaching Spell**

<u>Variable</u>	<u>Mean</u>	<u>Std. Dev.</u>
<b>WAGE</b>	29,783	4,674
<b>TEST - Test score students*</b>	53.28	14.69
<b>POVERTY - Proportion of students in poverty**</b>	0.464	0.273
<b>PBLACK - Proportion of black students</b>	0.388	0.319
<b>MALE - Teacher is male</b>	0.125	0.330
<b>BLACK - Teacher is black</b>	0.167	0.373
<b>BLACK*PBLACK</b>	0.112	0.281

N=11,070

\* Student test score equals the average 3rd grade percentile rank on the Iowa Test of Basic Skills Exam (ITBS Math + ITBS Reading)/2.

\*\* POVERTY is the proportion of children in school eligible for free or reduced price lunch.

**Table 2**  
**Teacher Transitions**

<b><u>Transition Category</u></b>	<b><u>Number of Teachers</u></b>	<b><u>Percent of Teachers</u></b>
<b>Same School*</b>	4,222	38.1%
<b>New School / Same District</b>	2,319	20.9%
<b>New District</b>	1,374	12.4%
<b>Other Education Sector Job</b>	803	7.3%
<b>Non-Education Sector job**</b>	343	3.1%
<b>Out of GA Workforce</b>	2,009	18.1%
<b>Total</b>	11,070	100.0%

\* Teachers who remained at the same school the entire sample period.

\*\* Former teachers who earned less than \$10,000 in a non-education sector job were classified as out of the GA workforce.

**Table 3**

**School Characteristics in Prior Year by Transition Category**

	(1)	(2)	(3)	(4)	(5)	(6)
	Same School	New School / Same District	New District	Other Educ Sector Job	Non-Educ Sector Job	Out of GA Workforce
<b>WAGE</b>	31,711	31,595	31,422*	30,617***	31,704	31,833
<b>TEST</b>	54.47	53.25***	51.00***	53.00***	52.47*	54.17
<b>POVERTY</b>	0.461	0.481**	0.535***	0.501***	0.436	0.458
<b>PBLACK</b>	0.372	0.393**	0.466***	0.397*	0.427***	0.406***

\*\*\* statistically significant from mean in column (1) at  $p < .001$

\*\* statistically significant from mean in column (1) at  $p < .01$

\* statistically significant from mean in column (1) at  $p < .05$

**Table 4**  
**Competing Risks Model**  
**of Teacher Transitions**

<u>Risk</u>	<u>Variable</u>	<u>Coefficient</u>	<u>Std. Error</u>	<u>T-Stat</u>
<b>New School / Same District</b>	<b>Log Teaching Wage</b>	-0.274	0.172	-1.60
	<b>δ1</b>	-1.383	0.411	-3.37
	<b>δ2</b>	-1.485	0.422	-3.52
	<b>δ3</b>	-1.468	0.432	-3.40
	<b>δ4</b>	-1.290	0.444	-2.90
	<b>δ5</b>	-1.217	0.458	-2.66
	<b>δ6</b>	-1.143	0.484	-2.36
	<b>MALE</b>	0.116	0.066	1.75
	<b>BLACK Teacher</b>	0.124	0.134	0.92
	<b>TEST Score Students</b>	-0.003	0.002	-1.51
	<b>POVERTY Students</b>	0.057	0.131	0.43
	<b>PBLACK Students</b>	0.373	0.118	3.15
	<b>BLACK x PBLACK</b>	-0.611	0.196	-3.12
<b>New District</b>	<b>Log Teaching Wage</b>	-0.361	0.219	-1.65
	<b>δ1</b>	-2.105	0.524	-4.02
	<b>δ2</b>	-2.034	0.538	-3.78
	<b>δ3</b>	-1.874	0.549	-3.41
	<b>δ4</b>	-2.103	0.566	-3.71
	<b>δ5</b>	-2.031	0.586	-3.47
	<b>δ6</b>	-1.856	0.620	-3.00
	<b>MALE</b>	0.0004	0.090	0.005
	<b>BLACK Teacher</b>	0.661	0.172	3.85
	<b>TEST Score Students</b>	-0.005	0.002	-1.81
	<b>POVERTY Students</b>	0.212	0.166	1.27
	<b>PBLACK Students</b>	1.325	0.142	9.31
	<b>BLACK x PBLACK</b>	-2.122	0.255	-8.32
<b>Other Education Sector Job</b>	<b>Log Teaching Wage</b>	-1.322	0.290	-4.56
	<b>δ1</b>	-0.177	0.685	-0.26
	<b>δ2</b>	-0.790	0.706	-1.12
	<b>δ3</b>	-0.842	0.724	-1.16
	<b>δ4</b>	-0.523	0.744	-0.70
	<b>δ5</b>	-0.320	0.768	-0.42
	<b>δ6</b>	0.241	0.799	0.30
	<b>MALE</b>	0.099	0.111	0.89
	<b>BLACK Teacher</b>	-0.112	0.232	-0.48
	<b>TEST Score Students</b>	0.002	0.003	0.56
	<b>POVERTY Students</b>	0.481	0.217	2.21
	<b>PBLACK Students</b>	0.148	0.197	0.75
	<b>BLACK x PBLACK</b>	-0.004	0.330	-0.01

Table 4, continued

<u>Risk</u>	<u>Variable</u>	<u>Coefficient</u>	<u>Std. Error</u>	<u>T-Stat</u>
<b>Non-Education Sector Job</b>	Log Teaching Wage	-0.238	0.430	-0.55
	$\delta_1$	-2.573	1.023	-2.52
	$\delta_2$	-2.908	1.053	-2.76
	$\delta_3$	-2.518	1.074	-2.35
	$\delta_4$	-2.662	1.107	-2.40
	$\delta_5$	-3.504	1.186	-2.96
	$\delta_6$	-4.245	1.516	-2.80
	MALE	0.553	0.138	4.02
	BLACK Teacher	0.321	0.327	0.98
	TEST Score Students	-0.011	0.004	-2.57
	POVERTY Students	-1.882	0.326	-5.78
	PBLACK Students	1.832	0.282	6.49
	BLACK x PBLACK	-1.238	0.472	-2.62
	<b>Out of GA Workforce</b>	Log Teaching Wage	0.124	0.184
$\delta_1$		-2.542	0.442	-5.75
$\delta_2$		-2.658	0.454	-5.86
$\delta_3$		-2.592	0.464	-5.59
$\delta_4$		-2.467	0.476	-5.18
$\delta_5$		-2.751	0.495	-5.55
$\delta_6$		-2.611	0.526	-4.96
MALE		-0.188	0.078	-2.42
BLACK Teacher		-0.056	0.159	-0.36
TEST Score Students		0.001	0.002	0.41
POVERTY Students		-0.719	0.142	-5.06
PBLACK Students		1.318	0.123	10.72
BLACK x PBLACK		-1.173	0.228	-5.14

N=11,070

**Table 5**  
**Effect of Wages and School Characteristics**  
**on Leaving Current School\***

**Probability of Leaving Current School**

<b>Baseline**</b>	<b>WAGE</b>	<b>TEST</b>	<b>POVERTY</b>	<b>PBLACK</b>
29.74%	28.86%	29.22%	28.91%	36.25%

\*Table shows the probability of leaving first teaching job after the first year for any reason. .  
The first column shows the probability for a baseline person.  
The 2nd-5th columns show probabilities when WAGE, TEST, POVERTY, and PBLACK are increased by one standard deviation respectively.

\*\* Baseline probabilities are computed from the estimates of the competing risks model for a non-black female teacher with all other variables set to their sample means.

**Table 6**  
**Changes in Wages and School**  
**Characteristics of Movers**

	(1)	(2)
	<u>New School / Same District</u>	<u>New District</u>
<b>WAGE</b>	2,134	1,916
<b>TEST*</b>	3.37	7.98
<b>POVERTY</b>	-0.054	-0.117
<b>PBLACK</b>	-0.039	-0.133