Do Teachers Really Leave for Higher Paying Jobs in Alternative Occupations?

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Abstract: In this paper we examine one of the fundamental beliefs underlying education policy – that the majority of teacher attrition is caused by the attractiveness of higher-paying alternative occupations. We find very strong evidence that this common perception is not correct. A simple theoretical framework indicates that correct information about what teachers do when they leave teaching is necessary from the standpoint of designing effective education policy, and that the current existence of incorrect information is likely to have quite harmful effects. Given that it is hard to imagine another use of taxpayer money of similar magnitude in which important decisions are being made on the basis of such incorrect information, the paper discusses how incorrect information of this type could arise and why it is able to persist. With respect to the former, the discussion indicates that certain groups such as teacher unions may have a strong incentive to convey incorrect information.

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"New college graduates as well as seasoned teachers are
being lured to other professions with handsome salary offers
while the teaching profession often isn't even in the horse race. (July 5, 2000)"[1]

Sandra Feldman, President American Federation of Teachers (AFT)

I. Introduction

In this paper we examine one of the fundamental beliefs underlying education policy – that the majority of teacher attrition is caused by the attractiveness of higher-paying alternative occupations. We find very strong evidence that this very common perception is not correct.

A reasonable measure of the contribution of policy-relevant research is the extent to which it directly assists policymakers in delivering cost-effective, high-quality services. Using this criteria, there are two interrelated reasons why the findings of this paper are important, both relative to other research in education and relative to policy relevant research more generally. First, our work provides strong evidence that an important and common policy assumption is incorrect. As the quote above and those in Figure 1 help to illustrate, the belief that teachers are lured away from teaching by high-paying jobs in other occupations is indeed very common. In addition, there is little doubt that this perception plays a central role in determining education policy since this perception is not only portrayed by union leaders and the popular press, but has also been adopted by school officials, politicians, and academics active in this issue. We cannot think of recent research which reveals an analogous misconception in any other "government program" of similar importance.

Second, the new information presented in this paper is directly and immediately useful from the standpoint of designing effective policy. As discussed in Section II, not only is correct information about what teachers do after they leave teaching necessary from the standpoint of designing effective and focused teacher policy, but the current existence of incorrect information is likely to have quite harmful

[1] This quote can be found in an AFT press release available at: http://www.aft.org/press/2000/070500.html

effects. This is important for the education system as a whole since teachers are an extremely important input in the education production function. From an educational quality standpoint, basic intuition suggests that teachers are likely to be the most important school input, and recent research by Rivkin et al. (1998) provides strong evidence that this is true. From a financial standpoint, teacher compensation easily represents the largest component of education expenditures and a large expenditure more generally. Using information in the *2001 Digest of Education Statistics*, we estimate that nationally about $124 billion was spent on wages for elementary and secondary school teachers in 1998-99, and this sum is more than the U.S. federal government spends on TANF, food stamps, SSI, and housing assistance combined.

It is of interest to consider how incorrect information of this type could arise and why it is able to persist. With respect to the former, the discussion in Section II suggests that certain groups such as teacher unions may have a strong incentive to convey incorrect information. With respect to the latter, the reason that incorrect information of this type is able to persist is almost exclusively due to a lack of available data that are suitable for studying this issue. While much previous research has studied the retention decisions of teachers, virtually all previous research in this area has utilized "teacher-specific" data that were constructed from the administrative records of a particular state or school district, and, as a result, contained no information on the labor force status of individuals after they left teaching.[2]

[2]An exception is Stinebrickner (2002) who found evidence that the common perception may not be true in the U.S. Using data from the National Longitudinal Study of the High School Class of 1972 (NLS72), he found that 67 percent of all exiting female teachers left the workforce altogether. Of those who remained in the workforce, only half earned a higher wage in their new occupation. Among general longitudinal data sources, the NLS72 was a logical choice because the survey design involved oversampling teachers and because the data includes information from a teacher supplement. However, even with oversampling, the number of teachers in the NLS72 is very small relative to the number of teachers in teacher-specific data used by other researchers. Perhaps more importantly from the standpoint of current policy debates, the majority of teachers in his sample graduated from college in 1976.

Our specific interest in this issue motivated the construction of a unique data set for the state of Georgia. The key feature of these data is that educational records related to schools and teachers are merged with wage records from the unemployment insurance system. Using these data we find very strong evidence that new female teachers are not leaving the teaching profession for higher paying jobs in alternative occupations. Among our findings, only 3.8 percent of female elementary teachers and 5.4 percent of female high school teachers who left full-time teaching during our sample period took a non-education sector job in Georgia that paid more than the state minimum teaching salary in Georgia.[3]

To focus the discussion as much as possible, we concentrate primarily on women because this group represents approximately 83 percent of the Georgia teaching force.[4] Given possible differences in the way that males and females respond to family changes, it is possible that males have different exit patterns and/or are more responsive to wage differences. We discuss this possibility in the conclusion (section V), at which point we refer to results that we have included, in the interest of space, in Appendix D. Although we do find certain differences between male and female teachers, the general spirit of the results for males is similar to that for females. For example, we find that males also exhibit very low rates of exit to relatively high paying non-education sector jobs.

Given that our results are in direct contrast to public discussion on the issue, we consulted the *1994-95 Teacher Followup Survey* (NCES, 1997) in an effort to provide independent validation of our conclusions. While this national survey does not provide direct evidence on what individuals actually do when they leave teaching, as discussed below its circumstantial evidence in the form of motives and anticipated activities is strongly consistent with our results.

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[3] Many teachers in Georgia are actually paid more than the state minimum since local school districts supplement the state salary. Thus, our results overstate the percentage of teachers that earn more when they leave teaching.

[4] This percentage has remained remarkably stable over the 1990s.

The remainder of the paper is organized as follows. In Section II we use a simple framework to illustrate the policy importance of understanding why teachers leave teaching. Section III describes the data and section IV contains an analysis of the transitions made by full-time teachers. Section V provides a discussion of the policy implications and concluding remarks.

II. Why does the exit reason matter to policymakers?

In this section we illustrate the policy importance of having correct information about why teachers leave teaching. In order to establish that the exit reason contains policy relevant information, consider the following simple framework.

Suppose that the relevant choices for each teacher are either to remain in teaching or to leave teaching, in which case she could either take a job in an alternative occupation or leave the labor force. Under the simplifying assumption that individuals make decisions myopically, a person with full information about all factors that influence utility will choose to leave teaching if either the utility from an alternative occupation (A) or the utility from being out of the workforce (H) in some year is greater than the utility from teaching (T) in that year. Assume for simplicity that the utility in each alternative is an additively separable function of the consumption purchased by her earnings (W) and non-pecuniary utility (NP) and that earnings are zero if the teacher leaves the workforce. It follows that the condition for leaving teaching can be written

$$(1) \qquad W^A+NP^A>W^T+NP^T \quad \text{or} \quad NP^H>W^T+NP^T$$

In reality, a person will not have full information about all aspects of the decision when she originally decides to enter teaching. As a result, individuals initially decide whether to enter teaching by comparing the expected utility associated with teaching to the expected utility associated with each

of the two alternatives, where the expectation is with respect to all aspects of the decision that the person is uncertain about. In this context, attrition arises because over time teachers learn new information about certain aspects that are relevant to the decision. Given the rigid wage structure in public schools, it is reasonable to assume that a person is well-informed about what her teaching earnings will be in the future. In this case, equation (1) and the previous discussion implies that there are four possible underlying causes of teacher attrition: 1) the teacher learns about the availability of a higher paying job in an alternative occupation; 2) the teacher learns about the availability of a job in an alternative occupation that has better non-pecuniary benefits than were originally expected (i.e., NP^A is higher than expected); 3) the teacher learns that teaching is less enjoyable than expected (i.e., NP^T is lower than was anticipated) or; 4) the non-pecuniary utility from being out of the workforce has increased, perhaps because of changes in a person's family situation such as the birth of a child (i.e., NP^H has increased).

Here we have used "cause" specifically to refer to something that has changed or something that a teacher has learned (since initially deciding to enter teaching) which implies that it is no longer optimal to remain in teaching. In the remainder of the paper we distinguish between the underlying "cause" of attrition and the teacher's activity in the period after leaving teaching by referring to the latter as the exit "reason." Using this terminology, equation (1) implies that, if the exit reason is that a teacher has taken a job in an alternative occupation (A), the possible causes of attrition are those described in 1-3 in the previous paragraph. If the exit reason is that a teacher has left the workforce altogether (H), the possible causes of attrition are those described in 3-4 in the previous paragraph.

Policy debates involving teachers are often premised on the assumption that teacher attrition rates are unacceptably high. Whether or not this is the case is a very complicated issue that depends on factors such as the supply of teachers in a geographic area, what types of teachers are leaving the occupation, and whether exiting teachers eventually return to teaching. At an intuitive level, knowledge of the exit

reason provides some information about this issue. For example, given evidence in Stinebrickner (2002) that the majority of teachers who leave the workforce altogether do so for family reasons, it would seem more reasonable to believe that a large percentage of exiting teachers are likely to eventually return to teaching if the exit reason is H than if the exit reason is A. However, we stress that the goal of this paper is not to take a stand on whether attrition rates should be reduced.

Nonetheless, given the large amount of attention that is paid to the issue of reducing teacher attrition, we illustrate the policy relevance of understanding the relative importance of the possible reasons for teacher exits by considering a policymaker who is faced with the objective of reducing attrition. Teacher pay is undoubtedly the most commonly proposed policy option for achieving this objective. It is important to note that regardless of the reason that teachers are leaving, the simple framework above suggests that teacher attrition would be reduced by a policy that increases teacher pay. For example, even in the case where all exiting teachers leave the workforce (H) so that the causes (as defined above) of attrition (in 3-4 above) are unrelated to pay, an increase in W^T will decrease attrition because it affects how much NP^H-NP^T is able to change (after the initial decision to enter teaching) before a teacher leaves teaching.

However, equation (1) also indicates that there is a policy alternative to increases in teacher pay since it indicates that improvements in the non-pecuniary benefits of teaching will also reduce attrition. In order to determine whether policies that influence W^T or policies that influence NP^T are more cost effective, a policymaker must have knowledge of the responsiveness of exiting teachers to expenditures on each option. While from a theoretical standpoint the cause of attrition is not sufficient to determine whether teacher decisions would be more responsive to changes in W^T or NP^T, it seems reasonable to believe that, in practice, a policymaker may be more likely to conclude that raising teacher wages is the

most effective policy if she believes that the cause of attrition is directly related to teacher pay.[5] If this is the case, a policymaker would be more likely to conclude that policies should focus primarily on W^T if she believes that the primary exit reason is A than if she believes that the primary exit reason is H since a cause related to pay is a possibility under the former but not under the latter.

With this simple framework in mind, suppose that a policymaker takes the union quote at the beginning of this paper at face value. If teachers are indeed "lured away by handsome salary offers," the exit reason is A and the underlying cause of attrition is the first of the four possible causes – that teachers learn about the availability of higher paying non-teaching alternatives. In this case, it seems reasonable to believe that the policymaker will focus her attention on increasing teacher wages if she decides that it is necessary to reduce attrition. However, while this approach may indeed be reasonable if the information provided by the union quote is correct, suppose that in reality the primary exit reason is H so that the possible causes of attrition are unrelated to teacher pay. In this case, while increasing teacher pay may to some extent decrease attrition, the incorrect information about the primary exit reason may have the harmful effect of distracting the policymaker from considering other policies (e.g., those that influence the non-pecuniary benefits of teaching) that may be more cost effective given the reality that it is changes in non-wage factors that have made it no longer optimal to remain in teaching.

An additional cost of having incorrect exit reason information is that the policymaker may miss an opportunity to identify a specific group of teachers who are much more likely to leave teaching than other teachers. If a policymaker believes that the primary exit reason is A, it may be reasonable for her to conclude that it is very difficult to identify teachers who are likely to leave. However, if the primary exit reason is known to be H, then evidence in Stinebrickner (2002) and basic intuition related to the

[5]In many labor market contexts it seems that a common reaction to outside job offers is to attempt to match the financial aspects of the offer as closely as possible.

reality that the median starting teacher is young and female suggests that it is very appealing to believe that a substantial proportion of teaching exits are directly related to family reasons such as the birth of new children. As discussed in Section V, this information suggests a set of policies that are likely to be quite cost effective because they are able to specifically target those individuals who are likely to leave.[6]

In short, the discussion suggests that incorrect information about exit reasons can be quite harmful from the standpoint of designing effective policy. One motivation for unions to posit that teachers are leaving for higher paying jobs outside of teaching is to convey the message that increasing teacher salaries is the appropriate policy option to increase retention. The incentive that a union may have to provide incorrect information stems from the fact that its objective function is potentially quite different than that of the school system. In particular, a union may desire to increase rents to groups of teachers who are unlikely to leave teaching under current compensation packages. Given the reality that wage increases in public schools are virtually always of the across-the-board variety, this increase in rents may be more likely to happen if policymakers focus on wage related causes of attrition rather than other causes of attrition (such as changes in family situations) that may be affecting specific types of teachers.

III. Data

To analyze the transitions of teachers, we merged three sources of data on all public schools teachers and all public schools in Georgia. 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

[6]Research suggests that teachers with certain academic qualifications, such as a science certification, tend to be more likely to exit than other teachers. However, these academic qualifications are capable of explaining only a very small proportion of the variation in a dependent exit variable. On the other hand, Stinebrickner (2001b,2002) finds a very strong explanatory role for family variables. For example, for a "median-type" (female) person, the probability of leaving the workforce altogether increases from approximately .08 to approximately .63 if the person has a birth in the previous academic year.

the Georgia Professional Standards Commission (GAPSC). Characteristics of individual schools from 1994-95 to 1999-2000, including racial composition, average student achievement on standardized exams, and percent of students eligible for free or reduced lunch were provided by the Georgia Department of Education (GADOE). What makes the assembled database most unique comes from the third source of data. 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, referred to as 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 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.[7] Wages paid to former teachers are also observed in the ES202 data *if they are employed in Georgia*. When an individual teacher disappeared from the GAPSC data after teaching the previous year, we searched the ES202 data to see if the individual earned wages in another occupation in that and subsequent years.

Virtually all employees are subject to the UI tax, and thus virtually all wages in non-teaching occupations are observed.[8] As a result, if a former teacher does not have a wage in the ES202 file then

[7] As evidence of the quality of the ES202 data, we found that 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.

[8] The list of excluded employment is quite small. The three main categories perhaps most likely to apply to former teachers are the self-employed, elected officials, and occupations where the individual is paid solely by commission (However, many salespeople are paid a small wage along with any commission earnings.) Thus, individuals who were working solely in an excluded occupation would be mislabeled as not working in Georgia. Also, we would understate wages for individuals with more than one job during the year, where at least one job was not covered by UI. Other occupations not covered by UI include caddies, some maids, and newspaper carriers (Section 108.02(15) of the UI Handbook for Employers). Of course, ES202 will miss wages paid in the

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. In subsequent sections we pay careful attention to the implications of this classification. Appendix A discusses how we determine if someone is a teacher, determine if a teacher has left teaching, construct teaching wages, and define new teachers.

While use of national-level data would be preferred, the necessary national-level data are not currently available. However, reliance on state specific data has become quite common given the availability of administrative data in states such as Texas, North Carolina, and New York. There are a couple of reasons that Georgia is a good state on which to base this analysis. First, Georgia is a large state and an "average" state in many ways - including teacher salaries.[9] Second, as discussed more in Section IV, Georgia had a very healthy economy during the 1990s which suggests that Georgia would be a good state to examine if one hoped to find evidence that teachers leave teaching for higher paying jobs in alternative occupations.

IV. Transitions out of full-time teaching

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underground economy.

[9]Georgia's median household income in 1999 was about $39,500, ranking 26th in the U.S. Women working in Georgia earned $934 more than the national median for women. Georgia students in the 3rd, 5th, and 8th 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). Approximately 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 17th highest in the nation (Salzer, 2001). The rate of adults over age 25 with at least a college degree is 23.1 percent in Georgia versus 25.6 percent overall. In 1999, 71.3 percent of Georgians owned their homes versus 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.

For the primary analysis in this paper, we examine exits out of full-time public school teaching for the 10,145 new female elementary teachers and the 4,750 new female high school teachers who began their teaching careers between the academic years 1994-95 and 1999-00 and were less than twenty-seven years old at the time that their teaching careers began. Although our teacher identifiers and unemployment insurance records begin in 1991-1992, we use 1994-1995 as the initial period for our primary analysis because, as discussed in Section III, we do not observe school characteristics before this year. This information is needed to make a potentially important distinction between elementary and high school teachers.

We classify an individual as a full-time teacher if she receives at least the state minimum pay in any of the quarters during the teaching year.[10] The primary rationale for this definition, which is discussed fully in Appendix A, is that it allows us to avoid classifying very short spells out of the workforce as exits. Note that the use of quarterly wage data from the unemployment insurance system is beneficial in this regard because it allows us to differentiate between a full-time teacher who may have taken a short break from the labor force (perhaps, for example, for health or maternity reasons) and a teacher who is part-time for the entire year.

Figures 2a and 2b show Kaplan-Meier survivor functions associated with the first teaching spell of female elementary and high school teachers respectively. The Kaplan-Meier Survivor function takes into account that the first teaching spells are censored for 6,498 elementary teachers and 2,870 high school teachers. That is, these teachers remain in full-time teaching continuously through the end of the sample period, which occurs in 2000-2001. A given survivor function evaluated at time t shows the probability that a teacher in our sample will teach t or more years before leaving full-time teaching.

[10] Mandated by state law and updated annually, Georgia public schools systems face minimum salary schedules for all teachers they employ. The salary schedule lists the minimum teacher salary that can be paid based on teacher certification status, experience, and education. Local school districts may pay teachers a local supplement to the salary schedule and a large majority do so. Local supplements to the salary schedule vary widely.

Thus, only approximately half of all elementary and high school teachers have first teaching spells that last more than five (six or more) years. This is consistent with the findings of previous studies of teacher attrition.

The rate at which teachers leave teaching, as shown in Figure 2a and Figure 2b, is well-known. What is not well-known is what teachers do after leaving teaching. For each of the 3,647 elementary and 1,880 high school teachers who exited teaching during the sample period we examine the activity state in the first year that she is not a full-time teacher. Let T-1 be the last year of full-time teaching for individuals who exit the teaching force. Denoting the exit year as T, we determine whether each exiting teacher continued to work for the Georgia public educational system in some position other than as a full-time teacher in year T (e.g., as an administrator, counselor, part-time teacher, or substitute teacher) and whether the person held a job outside the public educational system in Georgia in year T.[11] We call the former the "education sector." We inflate all earnings to 2001 dollars (using the CPI-U) and discretize the earnings in each of the two "sectors" (education and non-education) into the following earnings categories: \$0, (\$0, \$10,000), [\$10,000, Minwage(T)), and [Minwage(T), ∞), where Minwage(T) is the mandated minimum teaching wage in Georgia in year T.

Table 1 shows bivariate sample probabilities at time T for the elementary teachers who exited during the sample period. A particular element in the table shows the proportion of these teachers who, in their first year out of full-time teaching, had a particular combination of earnings in the education and non-education sectors in Georgia. For example, the number 0.0359 indicates that, in the year following their exit from teaching, about 3.6 percent of all exiting teachers earned a wage between (\$0, \$10,000] in both the education and the non-education sector. The bivariate sample probabilities for high school teachers are shown in Table 2.

[11] Clearly the exit year, T, varies by person. We suppress person specific notation on this variable.

The marginal sample probabilities for earnings in the Georgia education sector are shown in the last columns of Table 1 and Table 2. The last column of Table 1 indicate that many elementary teachers who leave full-time teaching remain in the public education sector in some capacity.[12] We refer to (non-teaching) jobs in the education sector with earnings above the teaching minimum as administrative jobs. Six percent of exiting elementary teachers have earnings in the public education sector that are greater than the minimum teaching salary in the state. A total of twenty-three percent of exiting elementary teachers have earnings in the public education sector that are greater than $10,000.[13] The last column of Table 2 shows similar results for high schools teachers. This evidence from Georgia is consistent with circumstantial evidence from the *1994-95 Teacher Followup Survey* in which 22.2 percent of exiting teachers reported that they expected to be "working in a non-teaching occupation in education" in the year after leaving teaching (NCES, 1997).

The marginal sample probabilities for earnings in the non-education sector are shown in the last row of each of the two tables. The marginal probabilities provide strong evidence that the primary reason for teaching exits is not the attractiveness of non-teaching jobs. Only 3.8 percent of all exiting elementary teachers accept a non-education job in Georgia that pays more than the minimum teaching wage in the state. Note that, in an effort to be cautious, we characterize a non-education salary as "high" if it is above the minimum teaching salary in Georgia. However, many Georgia teachers are paid more than the minimum since local school district supplement the state salary. Thus, our estimate of 3.8 percent overstates the number of teachers who make more in a non-education position than they did as

[12] The jobs below the minimum are a combination of part-time teaching jobs and part-time administration jobs. The findings here are consistent with Brewer (1997) who reports that it is very common for administrators in New York State to be former teachers.

[13] Stinebrickner (2002) finds that 0.67 of exiting teachers leave the full-time workforce entirely after leaving teaching. Included in the remaining 0.33 are administrators, counselors, and others who remain in the education system. The importance of exits to other jobs in the education system suggests that the 0.33 number may substantially overstate the number of people who are working in the non-education sector.

a teacher. Only 9.9 percent of exiting elementary teachers work in a non-education job in Georgia that pays more than $10,000 in 2001 dollars. As shown in Table 2, these numbers are only slightly higher, 5.4 percent and 12.5 percent, for high school teachers.[14]

Our methodology of examining earnings in the first year after an exit from teaching will tend to understate the importance of high-paying alternatives if some teachers leave for occupations that initially pay below current teaching salaries but have higher future wage growth. To examine this possibility, we computed marginal sample probabilities based on the highest annual non-teaching wages earned after exiting the public education sector.[15] We found that only 6.4 percent of elementary and 9.5 percent of high school teachers had non-education earnings of more than the Georgia minimum teaching wage at any point before the end of the sample period. Further, this finding that teachers are not leaving for higher paying non-education jobs in Georgia was found to be robust to changes in the ages of the teachers that are examined and robust to a change in the sample period that allows us to follow teachers for more years after exit.[16]

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[14] One reason that a former teacher may have left the Georgia workforce is to pursue additional education. However, Stinebrickner (2002) finds that "The data indicate that returning to school full-time is not a common occurrence for teachers; only 8 of the 172 female teachers who are observed exiting the work force enter school full-time." Further, his data suggest that former female teachers are far less likely to go back to school than females who exit other occupations. Specifically, in his data, 66 out of 239 (28 percent) of females who left other occupations went back to school.

[15] This exercise may also allow us to capture the future wages of former teachers who initially went back to school after exiting the public education sector.

[16] For example, one group considered was female teachers who were aged 27 to 30 when they began their Georgia teaching career (although they may have been teachers in other states). This group is about 55 percent as large as the group of teachers considered in this paper (new female teachers aged 26 or less when they began). For the group aged 27 to 30, these teachers were much more likely to remain in full-time teaching than the younger female teachers considered in tables 1 and 2. More importantly, teachers in this slightly older age group had virtually the same rate of leaving for non-education sector occupations and earning more than Minwage. In another example, of all females (in all age groups) in the teaching force in 1991-92 who exited teaching in one of the next two years, less than 9 percent earned non-education sector wages in Georgia that exceeded the Minwage at at any point between 1992 and 2001.

Our evidence that very few teachers leave the profession for higher paying jobs in alternative occupations is consistent with circumstantial evidence from the *1994-95 Teacher Followup Survey* in which only 12.1 percent of teachers who left teaching reported that the "main reason for leaving the teaching profession" was to pursue another career and only 6.5 percent reported that they left teaching for better salary or benefits (NCES, 1997). When asked about their expected main activity for the following year, 9.4 percent of exiting teachers responded that it was "working outside the field of education" (NCES, 1997).

Recall that our data contain information regarding only individuals who are working in Georgia. Thus, we do not observe the number of exiting teachers who work in a non-education job in another state, and, as a result, we cannot calculate the total percentage of exiting teachers who work in a non-education job. Nonetheless, based on both supply and demand considerations, it seems natural to think that observing a non-trivial number of individuals leaving teaching for non-education jobs in Georgia would be a necessary condition for believing that many individuals are leaving teaching to work in non-education jobs outside of Georgia. From a supply perspective, it would seem that if teachers have a strong desire to work in non-education jobs, many would find searching for such jobs in Georgia to be desirable. In general, finding potential job matches and participating in the relevant interviewing/hiring process is likely to be more costly outside of one's current geographic location. In addition, all else equal, it seems likely that the individuals in our sample (who have already revealed a preference for living in Georgia) would tend to value jobs close to their current locations to minimize or avoid incurring costs of moving. From a demand perspective, the economy in Georgia was very strong in absolute and relative terms during the time period covered by our data. According to the Census Bureau, the population of Georgia increased from about 6.5 million residents in 1990 to 8.2 million in 2000, the 4th

largest increase in total population among states. Throughout the 1990s the unemployment rate in Georgia was below, and typically well below, the national unemployment rate.

Combining these supply and demand considerations, it seems highly unlikely that so few teachers would be observed in non-education jobs in Georgia if it is true that both a large number of teachers would like to leave teaching for non-education jobs and employers of high-paying jobs have a high demand for former teachers.[17] While we believe that this intuitive argument implies with near certainty that the total number of teachers who leave teaching for high paying non-education jobs is very small, it is worth exploring whether informative upper bounds can be established on the total proportion of exiting teachers that could be working in high paying jobs in the non-education sector (inside and outside of Georgia). These upper bounds are generated by making the very strong assumption that *all former Georgia teachers who leave the state are employed in a non-education sector occupation that exceeds Georgia's minimum teaching wage*. In reality, many teachers who leave Georgia are likely to remain in teaching or other education jobs or leave the full-time workforce altogether.

For our calculations, we require an estimate of the proportion of former female teachers who leave Georgia. We use two strategies. The first strategy assumes that all of the teachers who leave our teaching sample and never work in Georgia again during our sample period are individuals who left the state. This is likely to be an extremely conservative assumption given that Stinebrickner (2002) finds that women who leave teaching (often to care for young children) frequently remain out of the workforce entirely for a large number of years. The second strategy uses information on male teachers to construct an estimate of the proportion of former female teachers who leave the state. The appeal of this approach

[17] Explanations for a low demand for former teachers include teachers having lower average ability or that in order to become a teacher, one must invest in human capital that does not have a high market value in non-teaching occupations. Although this paper does not address this issue, if the latter were true, then this required investment in teaching-specific human capital could substantially hamper the recruiting of teachers.

is that male teachers who leave teaching and do not return to the workforce in Georgia within several years have almost certainly left the state.

Based on these two strategies, which are described in detail in Appendix B, our upper bound estimates of the proportion of exiting elementary school teachers who could be working in a non-education job and earning more than the minimum teaching wage are 0.355 and 0.266, respectively. Similar calculations for high school teachers lead to upper bounds of 0.358 and 0.272, respectively. We stress again that these upper bounds are almost certainly much too high since it is unlikely that a high percentage of teachers who leave Georgia work in high paying non-education jobs given that virtually no exiting teachers enter high paying non-education jobs in Georgia.[18] Nonetheless, the bounds are of interest because, despite being extreme, they still do not indicate the type of important role for high paying non-education jobs that is often portrayed in public discussion.

The above analysis considers the proportions of *exiting* teachers who take high paying alternative jobs. For policy purposes, it seems equally important to compute the proportion of *all* new teachers who leave teaching for high paying jobs in the non-education sector. For our sample of new teachers, less than one percent leave teaching for a high paying non-education job in Georgia after the first year of teaching. This is consistent with circumstantial evidence from the *1994-95 Teacher Followup Survey* (NCES, 1997) in which 0.6 percent of current teachers reported that they expected to be "working outside the field of education" in the following year. Further, using the most extreme estimate of the proportion of exiting teachers who accept high paying non-education sector jobs from above, only about five percent of new teachers exit to a high paying non-education jobs (inside or outside of Georgia) after

[18] For example, our findings within Georgia suggest that even assuming that 50 percent of all exiting teachers who leave Georgia do so to work in a non-education job that pays more than the minimum teaching wage would be very cautious. In this case the upper bounds for elementary teachers become 0.196 and 0.152 and the bounds for high school teachers become 0.206 and 0.163.

the first year of teaching.[19] These percentages decline with tenure because the hazard rate out of teaching declines with tenure. It is worth stressing again that this number is computed under the extremely conservative assumption that all former teachers who are not observed earning wages in Georgia after exit are living in another state, working in a non-education sector job, and earning more than the Georgia state minimum teaching wage. Thus, for policy purposes, it seems safe to conclude that exits to high paying jobs do not represent an important phenomena for young female teachers.

V. Conclusions and policy implications

In this paper we examine "where teachers go" when they exit the teaching profession. We find that leaving teaching for higher paying alternative occupations is the exception, not the rule. In fact, only 3.8 percent of exiting female elementary teachers and 5.4 percent of exiting female high school teachers in our sample took a non-education sector job in Georgia that paid more than the Georgia state minimum teaching wage, which is less than the actual salary of teachers since most local school districts provide salary supplements. Larger percentages of exiting teachers remained employed in the public education sector in an administrative or part-time capacity. These transitions into other education sector jobs have been largely ignored in previous work on teacher attrition.[20] For our sample of new teachers, less than one percent leave teaching for a high paying non-education job in Georgia after the first year of teaching. Extremely conservative upper bounds suggest that, at most, approximately 5 percent of new teachers leave teaching for a "high-paying" non-education sector job (inside or outside of Georgia) after their first year of teaching. As discussed throughout the paper, our findings are remarkably consistent

[19] These calculations are (0.136*0.355=0.048) for female elementary teachers and (0.153*0.358=0.055) for female high school teachers. The first number in each parentheses is the probability of leaving after the first year of teaching as displayed in figures 2a and 2b. The second number in each parentheses is the most conservative estimate of the total proportion of exiting teachers who earn more than the minwage in a non-education sector job.

[20] An exception is Brewer (1997).

with circumstantial evidence about the motives and anticipated activities of teachers from the *1994-95 Teacher Followup Survey* (NCES, 1997).

Policy debates involving teachers often seem to be premised on the assumption that teacher attrition rates are unacceptably high. This paper does not attempt to examine or take a stand on this issue directly, but does provide guidance for thinking about policies involving teacher retention.[21] Teacher pay is undoubtedly the most commonly discussed policy lever. The empirical findings summarized in the previous paragraph imply that the first cause of teacher attrition listed in Section II - that teachers learn about the availability of high paying jobs in alternative occupations - is not very relevant. This suggests that increasing the salary of teachers may not be the most cost effective policy for increasing retention.

Nonetheless, as also discussed in Section II, we should still expect that making teaching more attractive by increasing teaching wages will, to some extent, decrease attrition. In an effort to examine the sensitivity of teacher decisions to salary, we also estimated a competing risks model of teacher exits that includes both information about teaching wages and information about other school characteristics. In the interest of space considerations, the details of the specification and a detailed description of the results are described in Appendix C for females and in Appendix D for males. The basic result is that we find no evidence of an important relationship between teacher pay and attrition. More specifically, simulations indicate that increasing teaching wages by $5,000 decreases the probability of leaving teaching before the second year by very little for a "median type" person – from 0.162 to 0.160 if the median person is an elementary teacher and from 0.147 to 0.141 if the median person is a high school teacher.

[21]While we do not address this issue directly, our findings about the scarcity of exits to non-education jobs raise the possibility that many exiting teachers may eventually return to teaching (e.g., after children reach school-age). A thorough examination of the extent to which this is true would provide valuable information for policymakers, but would require a longer panel than that used in this paper.

Although this finding is not particularly surprising given the discussion in Section II and is consistent with both the recent work of Hanushek et al. (2001) and with the circumstantial evidence from the *1994-95 Teacher Followup Survey* (NCES, 1997), we do not believe that it should be viewed as the final word on this issue.[22] Nonetheless, the possibility that teacher decisions may not be particularly sensitive to teacher pay further strengthens the intuitive notion that it is important to seriously consider policy initiatives that are directly related to the third and fourth causes of teacher attrition listed in Section II - that changes occur in the non-pecuniary benefits of being out of the workforce relative to being in teaching - which our empirical work suggests are the primary causes. For example, if as suggested by Stinebrickner (2001a, 2001b, 2002), exits are related to family changes such as the birth of new children, it seems very possible that schools, which already have the infrastructure in place to take care of young children, might find it cost-effective to provide inexpensive on-site child-care.[23] In effect, this would give teachers with young children the new, potentially appealing option of being able to both work and be close to their young children. Other non-wage initiatives such as job-sharing may also be promising. From the standpoint of being cost-effective, these policies have the obvious advantage (over, for example, across the board pay increases) of specifically targeting individuals who are more likely to leave. The advantage of targeted programs also suggests that, if wage increases are determined by a policymaker to be a desirable policy instrument, it may be worthwhile to explore wage

[22] For teachers in the *Teacher Followup Survey* who left the teaching profession at the end of the 1993-94 academic year and expressed "dissatisfaction with teaching as a career" as one of three main reasons for leaving the profession, only 10.7 percent listed "poor salary" as the main area of dissatisfaction with teaching (NCES, 1997).

[23] Using NLS72, Stinebrickner (2001a, 2001b, 2002) finds a very strong relationship between the birth of children and teacher attrition. The fact that the types of exits in our data are very similar to those in the NLS72 data suggests that family reasons are likely to still be important determinants of teacher exits. However, we cannot examine this directly because our administrative data do not contain family information.

related policies that attempt to direct compensation specifically to teachers who are most likely to leave. One possibility would be to introduce a day care subsidy for women with young children.[24]

In an effort to focus the discussion as much as possible, we have concentrated on female teachers, who represent over 80 percent of the new teachers in Georgia. In Appendix D we present analogous results for men, including results from the competing risks model. We do find some differences between male and female teachers. For example, men, who are presumably less likely to leave the workforce for family reasons, are less likely to disappear from our data entirely after leaving teaching, and males who leave teaching are roughly twice as likely as females who leave teaching to appear in non-teaching jobs that pay more than the Georgia minimum teaching wage. In addition, simulations using the competing risks model indicate that the relationship between wages and exits for males is somewhat stronger than for females. Nonetheless, the general spirit of the results for males is very similar to that for females. Specifically, many males who leave full-time teaching remain in the education sector in some capacity, and extremely conservative estimates indicate that, at most, one in twenty male teachers leave teaching after the first year for a non-education job that pays more than the minimum Georgia teaching wage.

In a similar vein, our data do not allow us to examine the extent to which our results are representative of certain subgroups of teachers such as math/science teachers and teachers with high academic ability.[25] Thus, even if salary increases are not the most cost effective global policy for increasing retention, they may be important from the standpoint of retaining particular types of current

[24]However, simulations in Stinebrickner (2001b) suggest that the birth of new children leads to a very large increase in the non-pecuniary benefit of being out of the workforce and that large wage increases would be required to induce exiting teachers to return to teaching soon after the birth of children.

[25]While these specific groups should be of interest to policymakers, it is worth noting that, in part due to the strength of teacher unions, the majority of current policy decisions are made on the basis of beliefs about the set of teachers viewed as a single entity. Thus, our results seem to provide timely new information that is directly relevant to current policy discussions.

teachers, recruiting gifted teachers (Loeb and Page, 2000), and luring former teachers back into the teaching profession. However, our findings suggest that careful thought should be given to whether all future wage changes should be of the standard across-the-board variety, particularly if the policy objective is to increase retention.

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Appendix A

In this data appendix we discuss three issues particular to our database that had to be addressed in order to conduct the analysis of teacher attrition: who is a teacher, how should teaching wages be constructed, and how should "new teachers" be defined.

Who Is a Teacher?

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 (see discussion about wages below).

In addition, some individuals who were a teacher in a given year and not listed in the GAPSC teacher files in a later year have a wage from the school district reported in ES202. The employer numbers in ES202 correspond to school districts, not individual schools. Therefore, we cannot identify which individual school or whether the district office employs these individuals. Furthermore, what they do for the school district is not observed. Although the work performed (teaching or non-teaching) by these individuals is unobserved, many of them have low annual wages relative to the minimum teaching wages mandated by Georgia's statewide salary schedule.[26]

Regarding the work performed by these individuals, who are not reported to be teachers but have reported wages from a school district, there are several possibilities. Some could be administrators in the district's central office. Others may be temporary, substitute, or part-time teachers or teachers who left teaching for part of the academic year. It is possible that some teachers were not reported to the state–either through a reporting error by the district or because these individuals were not teaching at the times teacher data are sent to the state. Districts are mandated to send information on all employed teachers to the state twice per academic year. Districts typically have a three week window in which to report teacher information. The first time window begins in mid-October and the second begins in mid-March. Perhaps some teachers who were employed only before, only after, or only in-between these windows are not reported to the state. Districts may report information on teachers outside this time window, but they are not required and have no incentive to do so.

[26] Mandated by state law and updated annually, Georgia public schools systems face minimum salary schedules for all teachers they employ. Local school districts may pay teachers a local supplement to the salary schedule and many do so. The salary schedule lists the minimum teacher salary that must be paid based on teacher certification status, experience, and education.

To analyze teacher transitions, we had to classify these individuals (who are paid by the district, but are not recorded as teachers in the GAPSC teacher files) in some manner. Given the method of data reporting and typical low wages paid to these individuals, we deemed the most appropriate classification as "part-time teachers/administrators." That is, these individuals may typically be former full-time teachers who have transitioned into part-time teaching, teaching only part of an academic year, or administration. In the empirical work discussed below, whether we include these individuals in this manner or treat them as full-time teachers does not impact the results.

Constructing Teaching Wages

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.[27] Since the quarterly data do not match the school year, care had to be taken in constructing annual teaching wages. In the 3rd 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 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.

Who is a New Teacher?

The time period that covers the sample of new teachers is the 1994-95 academic year through the 1999-00 academic year, giving us six years of data. In this paper, we focus on new teachers who were under the age of 27 when they began their teaching career. Georgia does not collect consistent information on teacher experience. Therefore, teachers are defined as "new teachers" if they had not been a teacher in Georgia since the 1991-92 academic year, the first year of our teacher files. Thus, teachers deemed new in 1994-95 will have not taught in a Georgia public school in any of the previous three years. This method of defining new teachers would include teachers who are new to Georgia, but have taught previously in another state.

[27] In the early 1990s, some school districts gave teachers the option to be paid over 10 months. For districts this was difficult because money from the state earmarked for teacher salaries was paid in 12-month installments. Although ended in the mid 1990s, the 10-month option was grandfathered in some districts. Thus, it is possible that some veteran teachers are paid over ten months. However, the GAPSC has assured us that "99 percent" of teachers are paid on a 12-month calendar, and have been during our sample period. Since we are considering only new teachers in this paper, this issue is not a concern.

Appendix B

In this appendix, we describe the methods used to construct an upper bound of the total number of former teachers who earn a wage in a non-teaching occupation that exceeds the minimum Georgia teacher salary (Minwage).

For sake of argument, consider the set of elementary teachers in year T-1 who exit teaching and live either inside or outside of Georgia in year T. The proportion of this group working in year T in non-education jobs that pay more than the Georgia minimum teaching wage is

(B1) PR(exiting teacher work in non-education sector, earnings>Minwage(T)) =

PR(exiting teacher remains GA in T ∩ work in non-education, earnings>Minwage(T))

+PR(exiting teacher leaves GA in T ∩ work in non-education, earnings>Minwage(T))

= .038 + PR(exiting teacher leaves GA in T)

* PR(work in non-education, earnings>Minwage(T)| leave GA in T),

where PR represents probability.[28] We have no information about the term on the last line of equation (B1). Therefore, set this number to unity and compute an upper bound for equation (B1) as

(B2) .038 + PR(exiting teacher leaves GA in T).

This implies that our bound assumes that **all** individuals who leave the state work in a high-paying non-education job in year T. This is not realistic since many of the teachers who leave the state will remain in teaching and many are likely not to work. Thus, we stress that the bound in (B2) is undoubtedly extremely conservative.

We use two approaches for obtaining the necessary information about PR(exiting teacher leaves GA in T). The first stems from the likelihood that virtually all teachers who leave the workforce at time T will eventually return to work in the future.[29] This implies that

(B3) PR(exiting teacher leaves GA at T)

≈PR(exiting teacher doesn't work in GA at T or after)

= PR(exiting teacher doesn't work in GA in T)

*PR(exiting teacher doesn't work in GA after T|exiting teacher doesn't work in GA at T)

=.458*PR(exiting teacher doesn't work in GA after T|exiting teacher doesn't work in GA at T)

[28] Recall that Minwage(T) equals the minimum teaching wage in Georgia at time T.

[29] Here we ignore the possibility that people leave Georgia and return at a future time.

where the .458 is the upper left entry in Table 1. If we had many years of UI records after T we could compute the probability term on the last line of equation (B3). Unfortunately, this is not the case. Instead, we compute the approximation of (B3) given by

(B4) 0.458*PR(exiting teacher doesn't work in GA after T **and before** 2001/2002|exiting teacher doesn't work in GA at T).

This will be a conservative approximation of 0.458* PR(exiting teacher leaves GA at T), if, as reported by Stinebrickner (2002), some women remain out of the workforce entirely for a non-trivial number of years before returning. Thus, using the approximation in equation (B4) to when computing equation (C2) will serve to make our upper bound even more conservative.

In an effort to tighten the bound as much as possible we estimate the probability in equation (B4) using only the exit years T=1993,1994,1995, 1996, 1997. Note that here we use several years that are earlier than our standard sample period in an effort to obtain a reasonable number of exits where we observe a minimum of four years after T.[30] We observe a total of 970 exits during this time for which the exiting teacher received no earnings at time T.[31] Of these 970, 673 (69.4%) do not return to teaching after time T and before 2002. Thus, our estimate of equation (B4) is 0.458*0.694 = 0.317, and thus our upper bound in equation (B2) of the proportion of exiting teachers who could be working in a non-education job earning more than the minimum teaching wage is 0.038 + 0.317 = 0.355.

Our second approach is similar in spirit to the first but attempts to obtain information about departures from Georgia using information about male teachers. This approach is justified under an assumption that the proportion of young female teachers who leave Georgia is similar to the proportion of young male teachers who leave Georgia. The benefit of examining men is that we can potentially form a more accurate approximation of the proportion of exiting teachers who leave Georgia because few men are expected to leave the workforce for extended periods of time. This implies that if a young male does not have an income in Georgia for several years it is almost certainly the case that the person has left the state while, as discussed earlier, this may be less true for young females. We return to using teachers from our original sample period because observing a large number of years after T does not seem as important as it was for the females. Males

[30] Our data contain information for the years 1991-92 to 2000-01. In other parts of the paper we have concentrated on new teachers who began teaching in 1994-95 or after. One reason for this is that information on school characteristics that will be used in subsequent analysis is only available during this period.

[31] For this exercise we have pooled all elementary, middle school, and high school teachers. This is necessitated by fact that we do not observe what type of school a teacher works in before 1995.

spend a total of 5,450 person years in their first teaching spells between 1995 and 1999.[32] Of these person years, 160 (2.93%) are followed by an exit from teaching in which no earnings are observed in the exit year or any year after. Thus, this 2.93% is our upper bound estimate of the percentage of total teachers that leave the state in a particular year. This state exit rate estimate combined with information about the number of women who are teaching in each of the sample years and how many exiting teachers have zero earnings in time T yields an estimate that 49.9% of all the exiting female teachers who have no earnings in year T leave the state.[33] Thus, our estimate of equation (B4) is 0.458*0.499 = 0.228 and our upper bound in equation (B2) of the proportion of exiting teachers who could be working in a non-education job and earning more than the minimum teaching wage is 0.038 + 0.228= 0.266.

Similar calculations for high school teachers lead to upper bounds of 0.358 and 0.272 respectively under the two strategies.[34]

Appendix C: How Sensitive are Teaching Decisions to Pay? A Competing Risks Model

As suggested in Dolton and Van der Klaauw (1999), it is intuitively appealing to think that teachers who are considering leaving full-time teaching for higher paying jobs in alternative occupations would be more sensitive to changes in pay than teachers who are considering a reduction in hours worked or a complete departure from the workforce (perhaps e.g., for reasons related to children). As a result, our new findings about the rarity of teacher exits to high-paying alternative jobs suggest that it is worthwhile to examine the relationship between teaching exits and wages.

The large literature on teacher attrition typically finds a negative relationship between teaching wages and teaching exits. The joint presence of three valuable features of our data allows us to make a new contribution to this literature. First, we are able to differentiate between different reasons for exits. From the standpoint of understanding why higher wages matter, this will be important if higher wages have stronger effects on certain types of exits than on other types. Second, we are able to include information about non-

[32] Given the relatively small number of male teachers, for this exercise we pool all elementary, middle school, and high school male teachers in our data. We make 1999 the last year to ensure that each individual will have at least two years before the end of the sample period after his last year of full-time teaching.

[33] Assuming male and female former teachers have the same rate of interstate moves, the approximate proportion of female teachers who leave the state in year T after teaching in in T-1 is 0.029. The proportion of exiting females with zero earnings in year T who leave the state is found by dividing the total number of women who leave the state by the total number of exiting teachers with zero earnings in their exit year. We also computed numbers that took into account that the proportion of people who exit the state may vary with how many years a person has spent in teaching. This approach led to results very similar to the ones obtained by pooling all years.

[34] These numbers are calculated as 0.054+0.438*0.694 and 0.054+0.438*0.499 respectively.

wage characteristics of jobs. As discussed in Loeb and Page (2000) and Hanushek et al. (2001), this will be important if wages are correlated with school characteristics. Finally, as discussed in Appendix A, our access to quarterly wage data allows us to pay careful attention to the construction of appropriate salary measures. In other studies that use actual yearly earnings records from educational data sources, a spurious relationship between earnings and exits may be generated by the fact that a teacher who leaves teaching before the end of a year will have lower earnings than a person with the same salary who does not leave teaching during the year.[35]

To examine the effects of wages (and other characteristics) on teacher exits, we estimate 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 (F) for any reason in a given year t, conditional on not having left before year t. The competing risks hazard model used here makes a further distinction between exits to other jobs within the Georgia public education system (E), exits to other jobs not in the Georgia public education system (N), and exits out of the Georgia workforce (O).[36] We classify individuals who earn less than $10,000 in annual wages as out of the Georgia workforce.

The model is estimated by maximum likelihood. Define P_{it}^{j} to be the probability that at the end of her t^{th} year in teaching, teacher i chooses activity j, j=F,E,N,O, for time t+1. There are two cases to consider. First, suppose a person's spell in teaching 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,...,S-1, the person decides to return to teaching for the next year

(C1) $L_i = P_{i1}^{F} \cdot P_{i2}^{F} \cdot \ldots \cdot P_{iS-1}^{F}$.

The likelihood contribution is similar in the alternative case where the person is not censored. Suppose a person teaches for S years and then leaves teaching for option $k \in \{E,N,O\}$. In this case, the likelihood contribution for the person is the joint probability that at the end of years 1, 2,...,S-1, the person

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[35] By using the highest quarterly wage to construct our measure of annual teaching wages, we more closely obtain a measure of wages on which individual teachers base their transition decisions. Administrative or survey data that have information only on total wages paid during the year would be more likely to find larger effects of teaching wages on exits on full-time teaching–because teachers with artificially low observed "annual" wages (artificial, because teachers left in the middle of a year) may be more likely to not be teaching in the following year.

Given the rigidity of the salary structure in most public schools, a reasonable alternative approach is to construct salary information for individual teachers from district or school specific salary schedules as was done in Hanushek, et al. (2001). For most studies of teacher attrition the source of information on teaching wages is not reported.

[36] Stinebrickner (2002) uses a continuous-time hazard model. There is no obvious benefit to the continuous-time model here given that our activity data are at a yearly level. Results did not change in important ways when we estimated the continuous-time analog to the specification described below.

decides to return to teaching for the next year and decides at the end of year S to have activity state k in time S+1

(C2) $L_{i=}P_{i1}^{F}\cdot P_{i2}^{F}\cdot\ldots\cdot P_{iS-1}^{F}\cdot P_{iS}^{k}$.

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

$$(C3)\qquad P_{it}^{j}=\frac{e^{X_{it}\beta^{j}+B^{j}(t)}}{e^{X_{it}\beta^{F}+B^{F}(t)}+e^{X_{it}\beta^{E}+B^{E}(t)}+e^{X_{it}\beta^{N}+B^{N}(t)}+e^{X_{it}\beta^{O}+B^{O}(t)}}$$

where X_{it} is a vector of observable characteristics of person i and the school at which person i works at time t. $B^{j}(t)$ 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

$$(C4)\qquad B^{j}(t) = \delta^{j}_{1}I(t=1)+ \delta^{j}_{2}I(t=2) + \delta^{j}_{3}I(t=3)+\ldots+\delta^{j}_{6}I(t=6)$$

where I is an indicator function that is equal to one if its argument is true. The number of terms in equation (C4) comes from the fact that a maximum number of six decision years can be observed for person i.[37]

The likelihood function for the sample is given by $\prod_{i} L_{i}$.[38] The coefficient vector β^{F} and the coefficients in $B^{F}(t)$ are normalized to zero and the remaining coefficient vectors β^{j}, j=E,N,O and the parameters of $B^{j}(t)$, j=E,N,O are estimated by maximum likelihood.

The observable characteristics which are included in X_{it} are described in Table C.1 for the 10,145 elementary teachers and 4,750 new high school teachers who fit the sample criteria--female and under age 27 when they began teaching in Georgia. Along with log teaching wages, variables included in X_{it} are whether the teacher is nonwhite and three school-level characteristics: an average test score of the students, proportion of students eligible for free or reduced lunch (poverty), and percent of students who are black. To capture

[37] The first teaching year is 1994-95. The last year of our sample is 2000-01.

[38] 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.

local labor market conditions, we included proximity to Atlanta and other cities,[39] a dummy variable to indicate metropolitan statistical area, and county unemployment rate.[40]

The estimation results from the competing risks models are shown in Tables C.2 and C.3 for elementary and high school teachers, respectively. As discussed above, for both models the reference activity is full-time teaching (F). Here we focus the discussion primarily on the effects of wages.[41] Higher teaching wages are found to decrease the benefit of non-education jobs relative to remaining in full-time teaching for high school teachers (t-statistic of -2.24) but not for elementary teachers (t-statistic of -0.88). For both elementary and high school teachers, higher teaching wages decrease the benefit of other public education sector jobs (administration or part-time teaching) relative to staying in full-time teaching (t-statistics of -1.8 and -2.0 respectively). However, our results indicate no relationship between teaching wages and the benefit of leaving the Georgia workforce relative to remaining in full-time teaching.[42]

In order to quantify the importance of the wages, we use our estimates in Table C.3 and Table C.4 to compute the first-year exit probability associated with each of the exit reasons for a "baseline" elementary teacher and a "baseline" high school teacher at "baseline schools" and then compare these probabilities to those obtained after increasing the teaching wage by $5,000.[43] The sum of the first-year exit probabilities associated with the three transition risks is 0.162 and 0.147 for the elementary and high school baseline teachers respectively. Increasing wages by $5,000 decreases the predicted probability of leaving the first job

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[39] Distances to Atlanta and to medium-sized cities were measured from the geographic centroid of each school district to the centroid of Atlanta and the centroid of the nearest city with over 75,000 population (excluding Atlanta).

[40] Murnane and Olsen (1989, 1990) and Dolton and Van der Klaauw (1999) constructed estimates of "opportunity wages" for individual teachers based on wages paid to non-teachers. Both studies found that opportunity wages were positively and significantly related to exits from teaching. Given that identification of opportunity wages is tenuous, we do not attempt to construct estimates of them. There are many other variables such as fertility, number of children, total household income, and ability that could also explain exits out of full-time teaching but are not available in our data. Many of these variables have been used in other studies and have been found to be related to teacher exits.

[41] See Scafidi, Sjoquist, and Stinebrickner (2002) for an examination of the relationship between school characteristics and teacher decisions that uses these data.

[42] Dolton and van der Klaauw (1999) estimated two competing risks models of teacher transitions and found a negative and statistically significant relationship between teaching wages and exits out of the workforce.

[43] The teaching wage used in all simulations in the paper is $31,571. This is the wage of a person who has the average log wage of elementary teachers in our sample. The baseline person is a white teacher with all other explanatory variables set to the sample means.

in the first year by very little–to 0.160 and 0.141 respectively.[44] [45] This evidence that the relationship between teaching wages and exits may be weak is consistent with circumstantial evidence from the 1994-95 Teacher Followup Survey. For teachers who left the teaching profession at the end of the 1993-94 academic year and expressed "dissatisfaction with teaching as a career" as one of three main reasons for leaving the profession, only 10.7 percent listed "poor salary" as the main area of dissatisfaction with teaching (NCES, 1997).[46]

We estimated a variety of specifications of the competing risks models that are not reported here. Specifically, we included different variables measuring local labor market conditions (region unemployment rates, median county earnings, median region earnings, and dummy variables for 12 regions of the state). We also estimated models that allowed for the presence of unobserved heterogeneity. The results reported here are robust to these alternative specifications.

Appendix D

In this appendix we replicate the analyses for new male teachers. Given the small number of new teachers who are male (and the small proportion of males in the Georgia teaching force as a whole), we treat them as one group in this analysis. Thus, in all analyses that follow, male elementary and male high school teachers are analyzed together.

Attrition of Male Teachers

Figure D.1 shows the Kaplan-Meier survivor function associated with the first teaching spell of all male teachers in the sample. Although males exhibit similar exit rates as females in the first couple of years,

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[44] For the elementary teacher, the baseline probabilities associated with the non-education job, new education job, and out of the Georgia workforce alternatives are 0.015, 0.033, and 0.114 respectively. The probabilities associated with the wage increase are 0.014, 0.031, and 0.115 respectively. For the high school teacher, the baseline probabilities associated with the non-education job, new education job, and out of the Georgia workforce alternatives are 0.015, 0.040, and 0.091 respectively. The probabilities associated with the wage increase are .012, .036, and .091 respectively.

[45] We find a statistically significant and positive impact of percent black students on exits from the education sector, and, curiously, a negative effect of percent students in poverty on these transitions. Both results are consistent with the findings in Hanushek et al (2001) and Clotfelter et al (2002). Hanushek et al (2001) and Clotfelter et al (2002) use administrative data on public school teachers from Texas and North Carolina, respectively, to estimate models of exits from teaching. Although both studies find that percent of students in poverty has a negative effect on exits from teaching, neither study can differentiate reasons for exits from teaching.

[46] In descending order, teachers who were dissatisfied with teaching were most likely to report student discipline problems, poor student motivation to learn, inadequate support from administration, and lack of recognition and support from administration as the main reason for leaving the teaching profession.

they are slightly more likely to teach more than five years. This is consistent with the findings of previous studies of teacher attrition.

Where Do Male Teachers Go?

Table D.1 shows bivariate sample probabilities for male teachers in year T, where a particular element in the table shows the proportion of exiting teachers in the sample who, in their first year out of full-time teaching, have a particular combination of earnings in the education and non-education sectors in Georgia. Relative to females, higher proportions of exiting males have non-education sector wages in the year after leaving the Georgia teaching force. However, the proportions remain low: 9.5 percent of exiting male teachers accept a non-education sector job that pays more than the minimum teaching wage and 21.5 percent earn more than $10,000 in the non-education sector.[47] As expected given likely differences in the way that males and females respond to family changes such as the birth of children, exiting males teachers are less likely to be observed earning without wages in Georgia after leaving teaching. Therefore, even though males are more likely to accept higher paying non-education sector jobs within Georgia, the extremely conservative upper bound estimates of the total proportion of exiting male teachers who earn more than the minimum Georgia teaching wage are only 0.315 and 0.264. These numbers represent extremely conservative upper bounds of the proportions *exiting* teachers who take high paying alternative jobs. For policy purposes, it seems equally important to compute the proportion of *all* new teachers who leave teaching for high paying jobs in the non-education sector. Using the most conservative estimates of the proportion of exiting teachers who accept high paying non-education sector jobs from above, about 4.5 percent of new teachers will exit to a high paying alternative job after the first year of teaching.[48]

As was the case for females, a non-trivial proportion of male teachers have earnings in the public education sector in the year after exiting teaching. However, males are much more likely to receive relatively high earnings in the public education sector. Exiting male teachers are more than twice as likely as exiting female teachers to accept non-teaching jobs in the education sector that pay more than the teaching minimum wage (marginal probability for exiting males equals 0.136).

Competing Risks Results

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[47] Only 17.7 of males have non-education sector earnings greater than the Minwage in any year after leaving teaching.

[48] This calculation is (0.143*0.315=0.045) for all male teachers. The first number is the probability of leaving after the first year of teaching as displayed in Figure D.1. The second number is the most conservative estimate of the total proportion of exiting male teachers who earn more than the Minwage in a non-education sector job.

Summary statistics are reported in Table D.2, and the competing risks results for all male teachers can be found in Table D.3. Statistically significant and negative relationships exist between wages and exits to non-teaching jobs and exits out of the Georgia workforce. This latter finding is in contrast to females. [49] Simulations indicate that the relationship between wages and exits is somewhat larger than for females. The sum of the first-year exit probabilities associated with the three transition risks is 0.137 for the baseline male teacher. Increasing wages by $5,000 decreases the predicted probability of leaving the first job in the first year to 0.125.[50]

[49] Males also seem to be more sensitive to local labor market conditions as there is a negative and statistically significant relationship between unemployment rates and exits to non-teaching jobs. Finally, there is no statistically significant relationship between student poverty and exits for males.

[50] For the male teacher, the baseline probabilities associated with the non-education job, new education job, and out of the Georgia workforce alternatives are 0.019, 0.028, and 0.090 respectively. The probabilities associated with the wage increase are 0.015, 0.028, and 0.082 respectively.

Figure 1

"We must begin to think about making teacher salaries competitive with other professions in order to convince our good teachers to remain and to attract college students who are pursuing other professions because of better salaries, benefits, and working conditions."

Ralph Noble, President Georgia Association of Educators
October 24, 2001
http://www.gae.org/about/communications/press/01/01salaryupdate.html

"There is a little bit of data about where people go when they leave teaching ... In general, people who leave teaching go into fields that don't pay a significantly higher salary, but I believe working in Silicon Valley these days, that's probably not the case for math and science teachers."

Linda Darling-Hammond, Charles E. Ducommun Professor of Teaching and Teacher Education
Stanford University
quoted in "Before It's Too Late: A Report to the
Nation from the National Commission on
Mathematics and Science Teaching for the 21st Century."
(September 23, 1999)
http://www.ed.gov/inits/Math/glenn/LDHtran2.html

"Pay teachers respectable salaries. I have proposed a 10 percent pay raise for our teachers. Some say that is "unreasonable," but we are in the middle of a major teacher shortage and Georgia needs to be able to attract and retain quality teachers for our children. How can we expect to keep our teachers in the classroom when the private sector can give them a higher salary? For the past two years, the governor has only recommended 3 percent pay raises for our teachers. That is unacceptable."

Linda Shrenko, Georgia State School Superintendent (elected) and candidate in 2002 Governor's race
July 2001 Guest Editorial available at:
http://www.doe.k12.ga.us/communications/releases/00/103000.html

"The demand for new teachers is primarily due to teachers moving from or leaving their jobs and while it is true that teacher retirements are increasing, teacher turnover appears to have little to do with a graying workforce. In contrast, the high rates of teacher turnover that plague schools, teachers report, are far more often a result of two related causes: teachers seeking to better their careers and/or teachers dissatisfied with teaching as a career."

Statement of Richard M. Ingersoll
Graduate School of Education
University of Pennsylvania
Testimony to the Subcommittee on Early Childhood, Youth and Families
Committee on Education and the Workforce
United States House of Representatives
(February 24, 1998)

Figure 2a. Kaplan-Meier Survivor Functions for Elementary Teachers

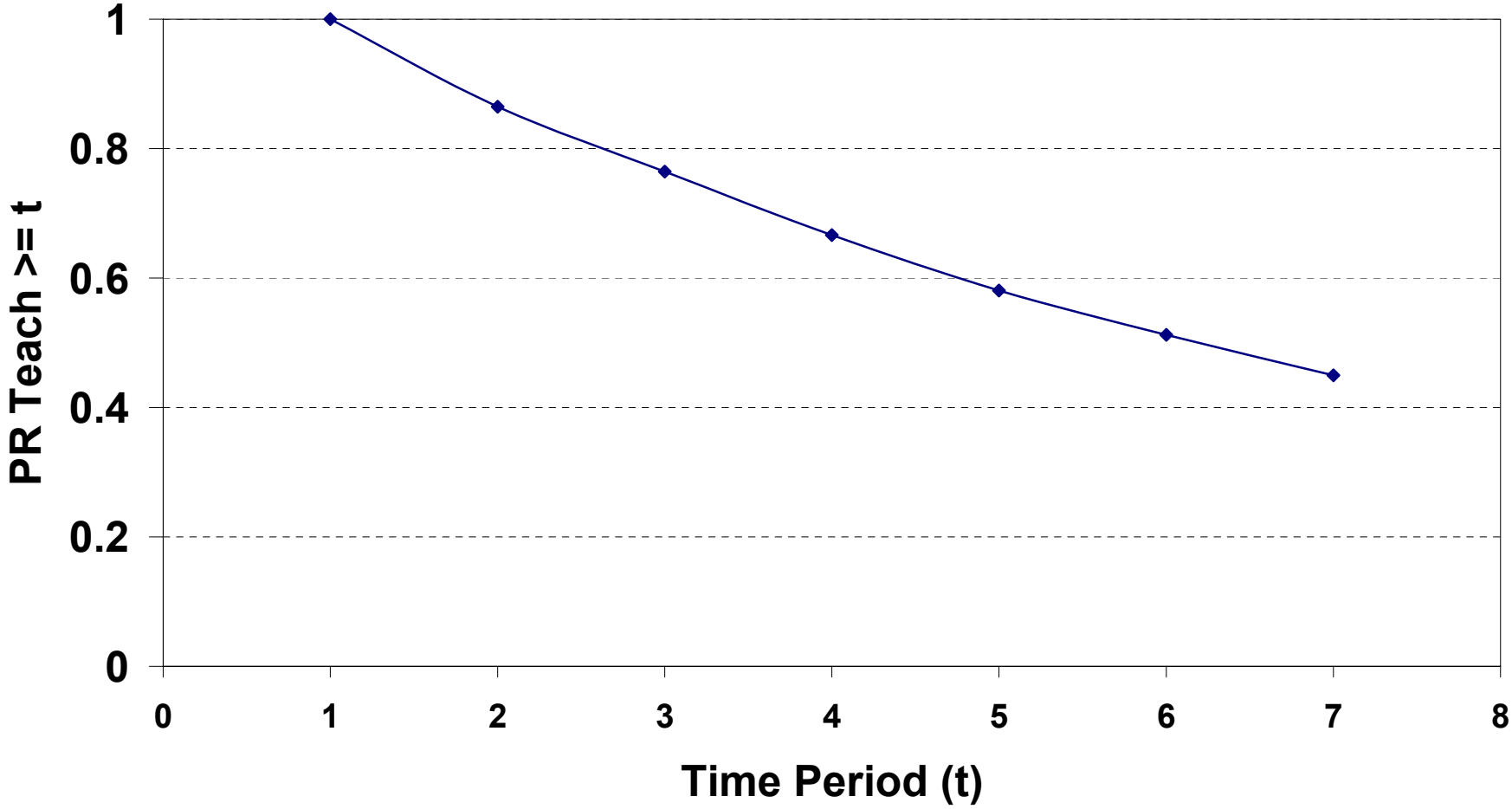

Figure 2b. Kaplan-Meier Survivor Function for High School Teachers

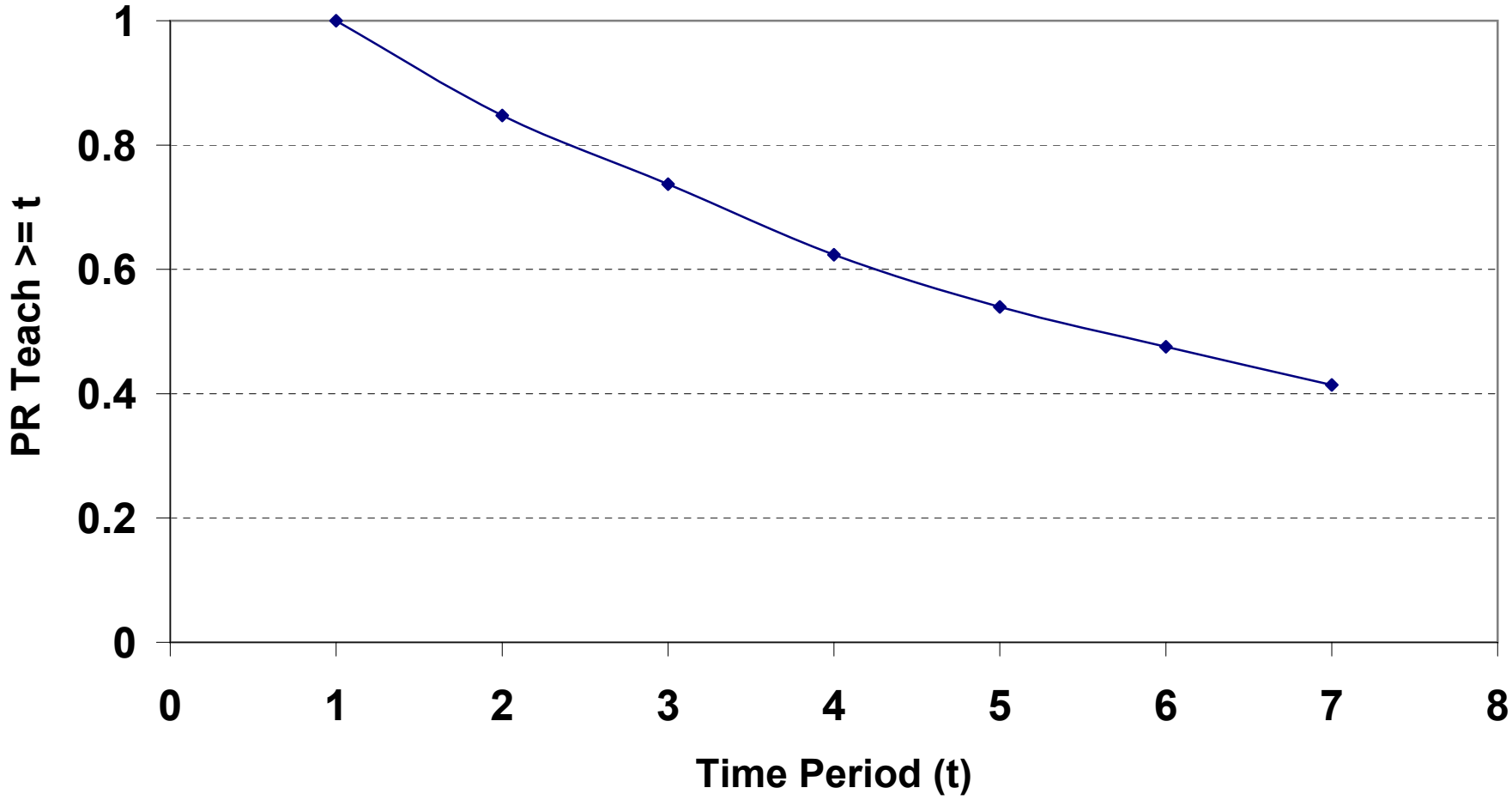

Table 1

Education Sector Wages and Non-Teaching Wages of Former Full-Time Elementary School Teachers

		Non-Education Sector Wages				
		0	(0-10,000]	(10,000-Minwage(T))	[Minwage(T), infinity)	Marginal Probability
Education Sector Wages	0	0.4579	0.0751	0.0455	0.0302	0.6087
	(0-10,000]	0.1012	0.0359	0.0148	0.0071	0.1590
	(10,000-Minwage(T))	0.1382	0.0332	0.0008	0.0003	0.1725
	[Minwage(T), infinity)	0.0458	0.0137	0.0003	0.0000	0.0598
	Marginal Probability	0.7431	0.1579	0.0614	0.0376	1.0000

Table 2

Education Sector Wages and Non-Teaching Wages of Former Full-Time High School School Teachers

		Non-Education Sector Wages				
		0	(0-10,000]	(10,000-Minwage(T))	[Minwage(T), infinity)	Marginal Probability
Education Sector Wages	0	0.4378	0.1011	0.0559	0.0447	0.6394
	(0-10,000]	0.0883	0.0356	0.0133	0.0096	0.1468
	(10,000-Minwage(T))	0.1165	0.0314	0.0016	0.0000	0.1495
	[Minwage(T), infinity)	0.0489	0.0154	0.0000	0.0000	0.0644
	Marginal Probability	0.6915	0.1835	0.0707	0.0543	1.0000

Table C.1

Summary Statistics

	Elementary Teachers		High School Teachers	
Variable	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**
Log Teaching Wages	10.36	0.154	10.36	0.159
Nonwhite*	0.172	0.377	0.185	0.388
Test Score**	54.83	14.56	68.90	16.57
Poverty***	0.462	0.273	0.366	0.249
Percent Black Students	0.369	0.314	0.378	0.309
Urban	0.771	0.420	0.756	0.430
Close to Atlanta	0.600	0.490	0.562	0.496
Close to City with >75K	0.152	0.368	0.182	0.386
County Unemployment Rate	4.28	1.75	4.40	1.89
N	10,145		4,750	

*** Mean and SD reported for first year of teaching spell only.**

**** For teachers in elementary schools test score equals the average 3rd grade percentile rank on the Iowa Test of Basic Skills Exam (ITBS Math + ITBS Reading)/2. For high school teachers, the test score is the average overall score on the Georgia High School Graduation Test. For a given school, both test scores could range from 1 to 100.**

***** Poverty equals the proportion of children eligible for free or reduced price lunch.**

****** Close to Atlanta equals "1" if school district is within 50 miles of Atlanta. Close to a city with 75,000 residents equals "1" if the school district is within 50 miles of a city that contains at least 75,000 residents, not including Atlanta.**

Table C.2

Competing Risks Results for Elementary School Teachers

Risk	Variable	Coefficient	Std. Error	T-Stat
Non-Teaching Job				
	Log Teaching Wage	-0.443	0.502	-0.88
	δN1	-2.437	1.161	-2.10
	δN2	-2.668	1.194	-2.23
	δN3	-2.564	1.213	-2.11
	δN4	-2.587	1.245	-2.08
	δN5	-3.171	1.262	-2.51
	δN6	-2.553	1.322	-1.93
	Test Score	-0.0096	0.0047	-2.03
	Poverty	-1.960	0.363	-5.39
	Percent Black Students	1.732	0.316	5.47
	Nonwhite	-0.232	0.150	-1.55
	Urban	0.439	0.226	1.94
	Close to Atlanta	-0.061	0.215	-0.28
	Close to City with >75K	0.108	0.210	0.52
	County Unemployment Rate	-0.041	0.048	-0.85
Education Sector Job				
	Log Teaching Wage	-0.460	0.256	-1.80
	δE1	-1.902	0.637	-2.99
	δE2	-2.530	0.656	-3.86
	δE3	-2.658	0.674	-3.95
	δE4	-2.575	0.681	-3.78
	δE5	-2.434	0.715	-3.41
	δE6	-2.188	0.754	-2.90
	Test Score	-0.0011	0.0036	-0.31
	Poverty	-0.006	0.238	-0.03
	Percent Black Students	0.086	0.200	0.43
	Nonwhite	-0.225	0.113	-2.00
	Urban	-0.559	0.121	-4.64
	Close to Atlanta	0.148	0.140	1.06
	Close to City with >75K	0.234	0.113	2.07
	County Unemployment Rate	0.082	0.023	3.61
Leave Working in GA				
	Log Teaching Wage	0.042	0.196	0.21
	δL1	-2.351	0.471	-4.99
	δL2	-2.357	0.480	-4.91
	δL3	-2.227	0.489	-4.56
	δL4	-2.163	0.499	-4.33
	δL5	-2.353	0.513	-4.59
	δL6	-2.386	0.531	-4.50
	Test Score	0.0012	0.0020	0.61
	Poverty	-0.849	0.144	-5.89
	Percent Black Students	1.078	0.130	8.32
	Nonwhite	-0.624	0.069	-9.03
	Urban	0.335	0.078	4.27
	Close to Atlanta	-0.245	0.080	-3.06
	Close to City with >75K	-0.060	0.078	-0.77
	County Unemployment Rate	-0.034	0.017	-1.94

Table C.3

Competing Risks Results for High School Teachers

Risk	Variable	Coefficient	Std. Error	T-Stat
Non-Teaching Job				
	Log Teaching Wage	-1.202	0.538	-2.24
	δN1	-1.109	1.348	-0.82
	δN2	-1.317	1.373	-0.96
	δN3	-0.703	1.396	-0.50
	δN4	-1.536	1.445	-1.06
	δN5	-1.184	1.461	-0.81
	δN6	-2.578	1.702	-1.51
	Test Score	0.0037	0.0068	0.55
	Poverty	-1.176	0.496	-2.37
	Percent Black Students	1.264	0.414	3.05
	Nonwhite	-0.288	0.201	-1.43
	Urban	-0.059	0.254	-0.23
	Close to Atlanta	0.174	0.256	0.68
	Close to City with >75K	-0.140	0.250	-0.56
	County Unemployment Rate	-0.016	0.049	-0.33
Education Sector Job				
	Log Teaching Wage	-0.680	0.341	-2.00
	δE1	-1.133	0.860	-1.32
	δE2	-1.762	0.872	-2.02
	δE3	-1.765	0.891	-1.98
	δE4	-1.958	0.914	-2.14
	δE5	-1.632	0.952	-1.72
	δE6	-1.514	1.016	-1.49
	Test Score	-0.0051	0.0045	-1.13
	Poverty	0.177	0.331	0.54
	Percent Black Students	-0.056	0.295	-0.19
	Nonwhite	-0.097	0.156	-0.62
	Urban	-0.618	0.170	-3.64
	Close to Atlanta	0.517	0.201	2.57
	Close to City with >75K	0.411	0.158	2.60
	County Unemployment Rate	0.061	0.032	1.88
Leave Working in GA				
	Log Teaching Wage	-0.046	0.251	-0.18
	δL1	-2.690	0.613	-4.39
	δL2	-2.719	0.624	-4.35
	δL3	-2.611	0.636	-4.10
	δL4	-2.629	0.647	-4.06
	δL5	-2.944	0.667	-4.42
	δL6	-2.916	0.698	-4.18
	Test Score	0.0061	0.0027	2.25
	Poverty	-0.513	0.205	-2.50
	Percent Black Students	0.711	0.197	3.60
	Nonwhite	-0.480	0.096	-5.01
	Urban	0.496	0.107	4.62
	Close to Atlanta	-0.199	0.111	-1.80
	Close to City with >75K	0.100	0.106	0.94
	County Unemployment Rate	-0.001	0.023	-0.05

Figure D.1 Kaplan-Meier Survivor Function for Male Teachers (Elementary and High School)

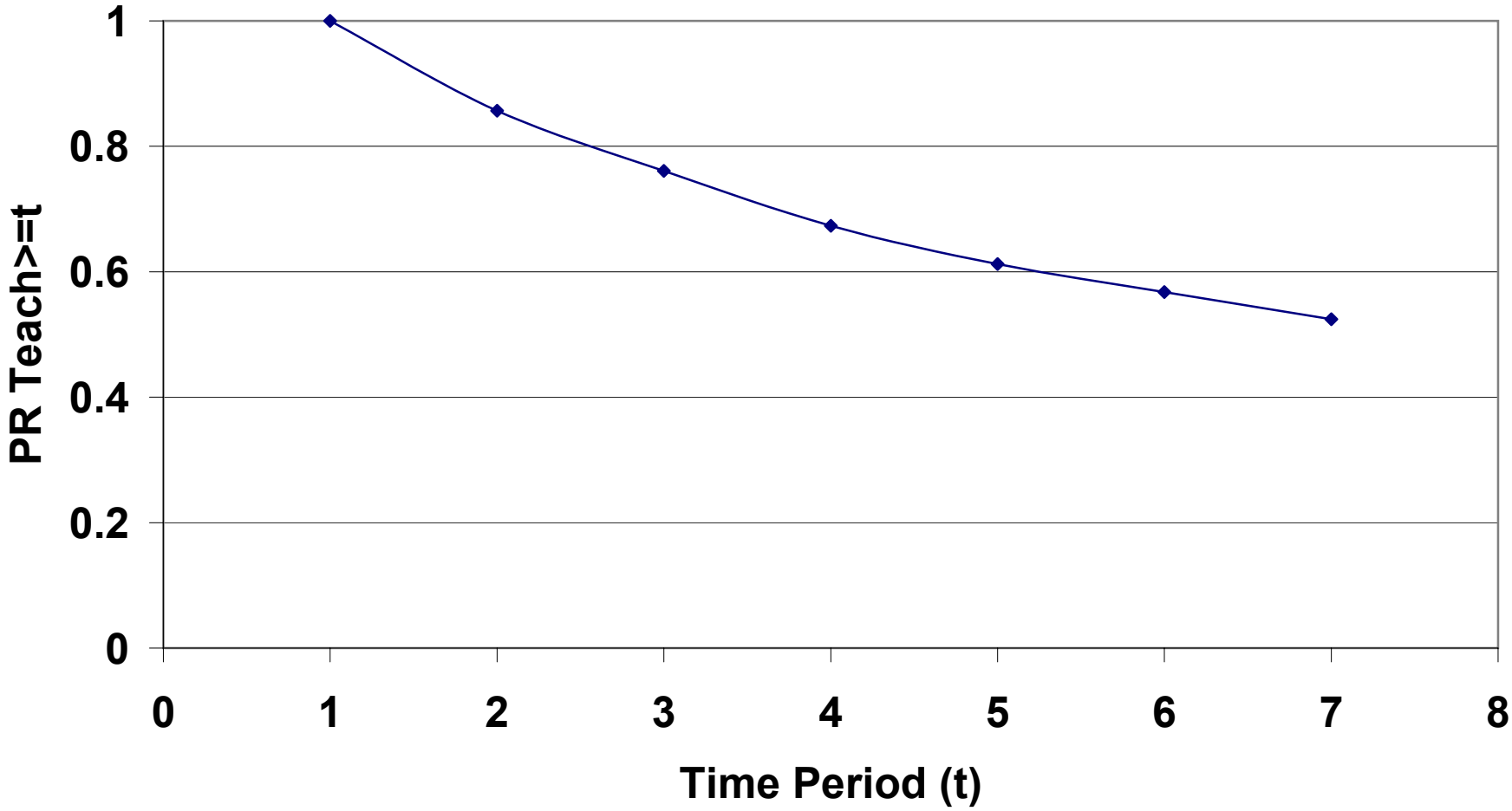

Table D.1

Education Sector Wages and Non-Teaching Wages of Male Former Full-Time Teachers (Elementary and High School)

		Non-Education Sector Wages				
		0	(0-10,000]	(10,000-Minwage(T))	[Minwage(T), infinity)	Marginal Probability
Education Sector Wages	0	0.3387	0.0995	0.0961	0.0824	0.6167
	(0-10,000]	0.0435	0.0412	0.0183	0.0114	0.1144
	(10,000-Minwage(T))	0.0881	0.0389	0.0057	0.0000	0.1327
	[Minwage(T), infinity)	0.1178	0.0172	0.0000	0.0011	0.1361
	Marginal Probability	0.5881	0.1968	0.1201	0.0950	1.0000

Table D.2

Summary Statistics for Male Teachers (Elementary and High School)

	Male Teachers	
Variable	**Mean**	**Std. Dev.**
Log Teaching Wages	10.39	0.169
Nonwhite*	0.205	0.404
Poverty***	0.396	0.244
Percent Black Students	0.199	0.399
Urban	0.671	0.470
Close to Atlanta	0.506	0.500
Close to City with >75K	0.200	0.400
County Unemployment Rate	4.57	2.01
N	2,652	

*** Mean and SD reported for first year of teaching spell only.**

**** For teachers in elementary schools test score equals the average 3rd grade percentile rank on the Iowa Test of Basic Skills Exam (ITBS Math + ITBS Reading)/2. For high school teachers, the test score is the average overall score on the Georgia High School Graduation Test. For a given school, both test scores could range from 1 to 100.**

***** Poverty equals the proportion of children eligible for free or reduced price lunch.**

****** Close to Atlanta equals "1" if school district is within 50 miles of Atlanta. Close to a city with 75,000 residents equals "1" if the school district is within 50 miles of a city that contains at least 75,000 residents, not including Atlanta.**