

National Board Certification and Teacher Career Path: Does NBPTS Certification Influence How Long Teachers Remain in the Profession and Where They Teach?

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Abstract

Many states and public school districts offer strong incentives for teachers to seek certification from the National Board of Professional Teaching Standards (NBPTS) to fulfill requirements laid out in the No Child Left Behind Act for “highly qualified teachers” in the nation’s schools. This movement for increasing professionalization among teachers represents a sizable investment of public money as well as a significant expense for NBPTS applicants. In our analysis, we seek to identify how obtaining this certification impacts public school teachers’ career paths—specifically, how long certified teachers stay in teaching and where they accept teaching assignments. Using a competing risks model of teacher mobility and a regression discontinuity design on public school teacher data from North Carolina, we find evidence suggesting National Board Certified Teachers (NBCTs) are increasingly mobile between schools and districts when compared against both unsuccessful applicants and non-applicants to NBPTS. Further evidence is presented indicating that NBCTs might utilize the certificate to select into lower-poverty and lower-minority teaching assignments than would have been accepted otherwise. Surprisingly, we also find evidence that NBCTs have an increased likelihood of leaving the North Carolina public school system, in spite of substantial state- and district-level incentives intended to retain these teachers.

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The research presented here is based primarily on confidential data from the North Carolina Education Research Center at Duke University, directed by Elizabeth Glennie and supported by the Spencer Foundation. The authors wish to acknowledge the North Carolina Department of Public Instruction for its role in collecting this information. The author gratefully acknowledges the National Board for Professional Teaching Standards for providing financial support for this project. The authors also wish to thank Susanna Loeb for providing helpful comments on an earlier draft of this paper, and Carol Wallace for editorial assistance. The views expressed in this paper do not necessarily reflect those of the University of Washington, the Urban Institute, or the study’s funder. Responsibility for any and all errors rests solely with the authors.

I. Why Might NBPTS Certification Affect a Teacher's Career Path?

It is no exaggeration to say that the movement to professionalize teaching embodied by the National Board for Professional Teacher Standards (NBPTS) is one of the most significant teacher policy initiatives of the last three decades. The number of teachers who have successfully obtained this credential currently exceeds 47,500¹. Supporters of NBPTS believe the National Board has played (and will continue to play) a dramatic role in professionalizing teaching, changing the culture in schools in positive ways, and ultimately aiding students' learning. One important way in which NBPTS might impact schools is through its effects on teachers' career paths.

Ample evidence suggests that teacher quality can have a profound impact on student achievement (Hanushek, 1992; Rivkin et al., 2005; Rockoff, 2004). Furthermore, when judged by any number of qualifications, teachers tend to be inequitably distributed across schools and students, and teachers who leave the profession are the very ones we might wish to keep, at least as judged by their performance on licensure or other tests and the selectivity of the colleges from which they graduated.² To the degree that the NBPTS credential affects teacher career paths – how long teachers remain in the teaching profession and in which districts and schools they teach – it could have an important impact on the achievement and distribution of achievement in the districts employing Nationally Board Certified Teachers (NBCTs).

There are a number of ways that the existence of NBPTS could benefit schools. For example, the rewards or recognition that come with being a NBCT may influence high-quality teachers – some evidence (Cavalluzzo, 2004; Goldhaber, forthcoming; Vandervoort et al., 2004), but not all (Sanders, 2005), suggests that NBCTs are more effective in their classrooms than non-

¹ As of 2005 (www.nbpts.org).

certified teachers – to stay in the teaching profession longer than they otherwise would. This would appear to be the primary immediately tangible benefit of becoming NBPTS certified, as the existing studies showing positive NBCT effects on students do not show that the *process* of becoming NBPTS certified itself adds to a teacher’s human capital. This means the easily quantifiable value of NBPTS as an institution, and of the investment by teachers and schools in the certification process, depends largely on whether becoming certified changes a teacher’s career path.

While outside the scope of this paper, one might also imagine that NBPTS certification could have additional benefits. For instance, were it the case that NBCTs are effective role models, their elevation in the profession might serve as a catalyst for broader positive changes in schools through role modeling or serving in a school leadership position. And, the rewards associated with being an NBCT may also be a signal to those considering a career as a teacher that they can, through NBPTS, be rewarded for demonstrating key teaching skills thus encouraging them to become teachers.

Of course if there are absolutely no human capital or career path effects associated with NBPTS certification, then the NBPTS credential might simply be an expensive way to recognize already effective teachers (as of 2006, the NBPTS assessment fee is \$2,500). And, regardless of their *actual* impact, there is certainly the *perception* that NBCTs represent a valuable educational resource and this is likely to impact the distribution of teachers across schools and students.³ The distribution of NBCTs is of interest not only from a teacher quality standpoint, but also from a financial equity standpoint: a majority of states as well as the federal government explicitly

² See, for instance, Lankford et al. (2002) on the distribution of teachers across schools and students, and Murnane and Olson (1990) or Podgursky (2004) on the characteristics of teachers who leave the profession.

³ This perception presumably explains the significant investment in NBPTS, estimated in Goldhaber and Anthony (forthcoming) to total more than \$637 million as of 2005, with continued expansion in the years since.

promote NBPTS certification by financing or subsidizing the cost of the NBPTS assessment and providing additional compensation for NBCTs—consequently, the distribution of NBPTS teachers across districts and schools indirectly affects the distribution of *state* resources. For example, North Carolina, the state we focus on in this study, pays the full cost of the NBPTS assessment and provides NBCTs with a 12 percent increase (over the state salary schedule) in compensation so long as they remain as classroom teachers.

In short, there are significant reasons to focus on whether the recognition and financial rewards often associated with NBPTS certification do, in fact, influence teacher career paths. We begin this process in Section II, by developing a simple model describing how the NBPTS credential might influence a teacher’s career path and providing background on the existing teacher career-transition research. In Section III, we discuss the data and empirical methods used to test our model, and in Section IV we present our findings. In the final section we focus on the policy implications of the results and offer some concluding thoughts.

II. A Simple Model of Teacher Career Transitions

A simple model of utility maximization suggests that a teacher is more likely to remain *teaching* in the teaching profession if the expected lifetime benefits of doing so exceed those of moving to another profession. The same theory applies to the decision to remain in a particular school or district. For simplicity, imagine a case where job transition is costless and individual *i* chooses among various jobs, *j*, in order to maximize the present value of expected utility:

$$\max_j pv[u^i(T_j, X_i)], \quad \text{given } j \in \{j\}_i \quad (1)$$

Let T_j be the characteristics of job j and X_i be individual characteristics.⁴ Further, assume that T_j is a function of both compensation, C_j , and other non-pecuniary job factors, N_j :

$$T_j = f(C_j, N_j) \quad (2)$$

Individual i will opt to pursue a teaching career if the utility associated with the best teaching job exceeds that of the best non-teaching job:

$$\max_{j \in \text{School}} pv[u^i(T_j, X_i)] > \max_{j \notin \text{school}} pv[u^i(T_j, X_i)] \quad (3)$$

The financial incentives often associated with NBPTS certification provide a tangible benefit that makes teaching more lucrative relative to other jobs through C_j .⁵ Empirical evidence suggests the relative financial rewards and job opportunities in and outside of teaching influence teacher quit rates and the length of time teachers stay in the profession.⁶ However, even in the absence of financial incentives, we might expect NBPTS certification to make teaching more attractive, through N_j , by elevating a teacher's status within the profession; job status has in fact been found to be particularly important in careers like teaching where there are not widely differing salaries (Frank, 1985).⁷ This model, then, clearly implies that, all else equal, the existence of NBPTS-certification should enhance the likelihood of individuals entering the teaching profession and should encourage NBCTs to remain in the profession longer.

⁴ This simple model ignores the demand side of the market. For a more comprehensive analysis of how teacher and school-district preferences interact to produce a distribution of teachers across schools, see Boyd et al. (2005) or Ballou (1996).

⁵ As of the 2006-07 school year, 34 states and the District of Columbia provided some type of financial compensation for NBCTs (data collected from http://www.nbpts.org/resources/state_local_information, accessed November 1, 2006).

⁶ See Baugh and Stone, 1982; Brewer, 1996; Dolton and Van der Klaauw, 1999; Greenberg and McCall, 1974; Murnane, 1981; Murnane and Olson, 1989; and Stinebrickner, 2000. There is also some empirical evidence (Brewer, 1996) that suggests NBPTS certification could affect the quit rates of non-NBPTS-certified teachers by providing potential avenues for teacher career advancement.

⁷ These types of jobs are less likely to reward workers through income, thus other aspects of the job, like status, become more important to workers.

While it should encourage them to remain in the teaching profession longer, it may not keep them in their role as *classroom* teachers longer. On the one hand, teachers in North Carolina who move out of their role of classroom teacher lose the added NBPTS-associated compensation, and this would discourage them, for instance, from moving to a non-classroom position (e.g. in the central office). But, the NBPTS credential may signal to school district leadership that an NBCT would, for instance, make a good instructional leader and therefore open up additional attractive (possibly higher paying) career possibilities.

It is a stated goal of NBPTS to “[c]ontribute to the equitable distribution of resources by making the placement of accomplished teachers a more overt process,”⁸ but our simple model suggests that it may do otherwise. Teachers have been shown, all else equal, to prefer working in schools with smaller minority student populations and larger higher-achieving student populations (Hanushek et al., 2002; Scafidi et al., 2003).⁹ And, controlling for degree and experience levels, teacher *salaries* do not vary much *within* school districts (and sometimes within states) while the *non-pecuniary* aspects of teaching jobs vary considerably (Loeb and Page, 2000; Hanushek et al., 2001). Thus, to the extent that being NBPTS-certified enhances a teacher’s job market bargaining power we would expect that, at least within districts, since the wages are the same regardless of the work environment of a given school within that district, teachers will optimize their non-pecuniary compensation by choosing to work in more-advantaged schools [that is, $T_j = f(C_j, N_j) > T_k = f(C_k, N_k)$ for schools j and k if they are both in the same school district because $C_j = C_k$].¹⁰

⁸ See www.nbpts.org.

⁹ Teachers also appear to prefer to teach in schools that are in close proximity to where they attended high school (Boyd et al., 2005).

¹⁰ Note that this same argument applies to classroom assignments within schools.

A school district's reaction to the NBCTs is less clear. As we describe below, districts may try to lure teachers with compensation above and beyond the state's 12 percent salary supplement. Additionally, districts may have preferences regarding the within-district distribution of NBCTs. For example, district leaders might try to get their "best" teachers into disadvantaged schools that are most in need of help, but they likely also face pressure from parents who may wish to have their children taught by NBCTs. The ways in which teacher and district preferences lead to the sorting of teachers are therefore unclear. For this reason, combined with the fact that changes in school demographics are largely outside of a school's control, we do not offer a hypothesis for the effect the NBPTS credential has on the time that NBCTs remain in a particular school.

The bottom line is that, while it is a policy goal of NBPTS to create a more-equitable distribution of resources – in this case, high-quality teachers – one can easily imagine ways that NBPTS certification could, depending on state and district policies, exacerbate existing teacher-quality inequities.

III. Data and Empirical Methods

The data for this study is drawn primarily from administrative records of teachers and students maintained by the North Carolina Department of Public Instruction of North Carolina (NCDPI). These data include detailed teacher characteristics (such as degree level, salary, current assignment, certification status) for over 70,000 teachers per year, as well as student information (such as race, gender, limited-English-proficiency status, free-and-reduced lunch status, test exemptions and performance) for about one million students per year. A subset of the student and teacher records can be linked together and matched with data from the Educational

Testing Service (ETS) that includes information on which teachers applied to, and were certified by, NBPTS during the period of 1997-2000. All of these data are matched to the U.S.

Department of Education's *Common Core of Data* to obtain school- and district-level characteristics, and to a survey of local school district officials detailing the *local* incentives, both financial and non-monetary, offered to NBCTs.

North Carolina is an ideal state for this study: the state funds the application fee for all first-time NBPTS applicants (and will also fund applicants applying for a retake if they weren't funded previously) and provides a 12 percent salary supplement to teachers who obtain NBPTS certification. Not surprisingly, given these incentives (which are among the most generous in the United States) North Carolina has the most National Board Certified Teachers of any state in the country. More importantly, the North Carolina data permits the tracking of teachers over time, so it is possible to follow them as they progress in their careers and determine how NBCTs compare to non-NBCTs in terms of length, district, and school of employment.

The NCDPI records include all teachers and students in the state over a 10-year period (covering school years 1994-1995 through 2003-04). The teacher data include demographic information, degree and experience levels, licensure status, the college from which the teacher graduated, and the teacher's performance on one or more licensure exams. We restrict our sample to full-time teachers and those who have taught for at least three years and less than thirty years. We opt for these restrictions since teachers with less than three years experience are not eligible to be NBPTS certified and because we wish to limit the number of teacher moves (out of the dataset) that are due to retirements. This yields a sample of 575,619 teacher observations (individual teachers appear in the sample multiple times) and 109,416 unique teachers.

A teacher is classified as an NBCT from an indication on the teacher’s payroll records as receiving the state’s 12% salary supplement. Our sample contains a total of 15,579 NBCT observations and 5,937 unique NBCTs. **Table 1** reports sample statistics for select variables by NBPTS status for all teachers observed during 2003-04, the last school year included in the analysis.¹¹

Table 1. Descriptive Statistics for Teachers in 2003-2004 Academic Year by Certification Status

	National Board Certified Teachers	Non-certified Teachers
	Individual Characteristics	
Female	0.893 (0.309)	0.792 (0.406)
Black	0.058 (0.235)	0.152 (0.359)
Graduate-degree holder	0.507 (0.500)	0.293 (0.455)
Average licensure test score*	0.354 (0.770)	-0.003 (0.878)
	School Characteristics	
Secondary school	0.281 (0.450)	0.248 (0.432)
Median Housing Value	105,065 (30,718)	99,371 (28,125)
Suburban locale	0.220 (0.414)	0.189 (0.392)
Proportion of minority students in school	0.354 (0.225)	0.412 (0.259)
Proportion receiving free or reduced lunch in school	0.313 (0.178)	0.371 (0.201)
Expenditures per student	4,174 (408)	4,137 (361)
Total Observations	5,146	56,615
*Licensure scores on teachers for various licensure tests were normalized against the test distribution, centered at 0 with a standard deviation of 1, resulting in a single z-score for each teacher. Where the same teacher is observed to take multiple tests, the z-scores were averaged together.		

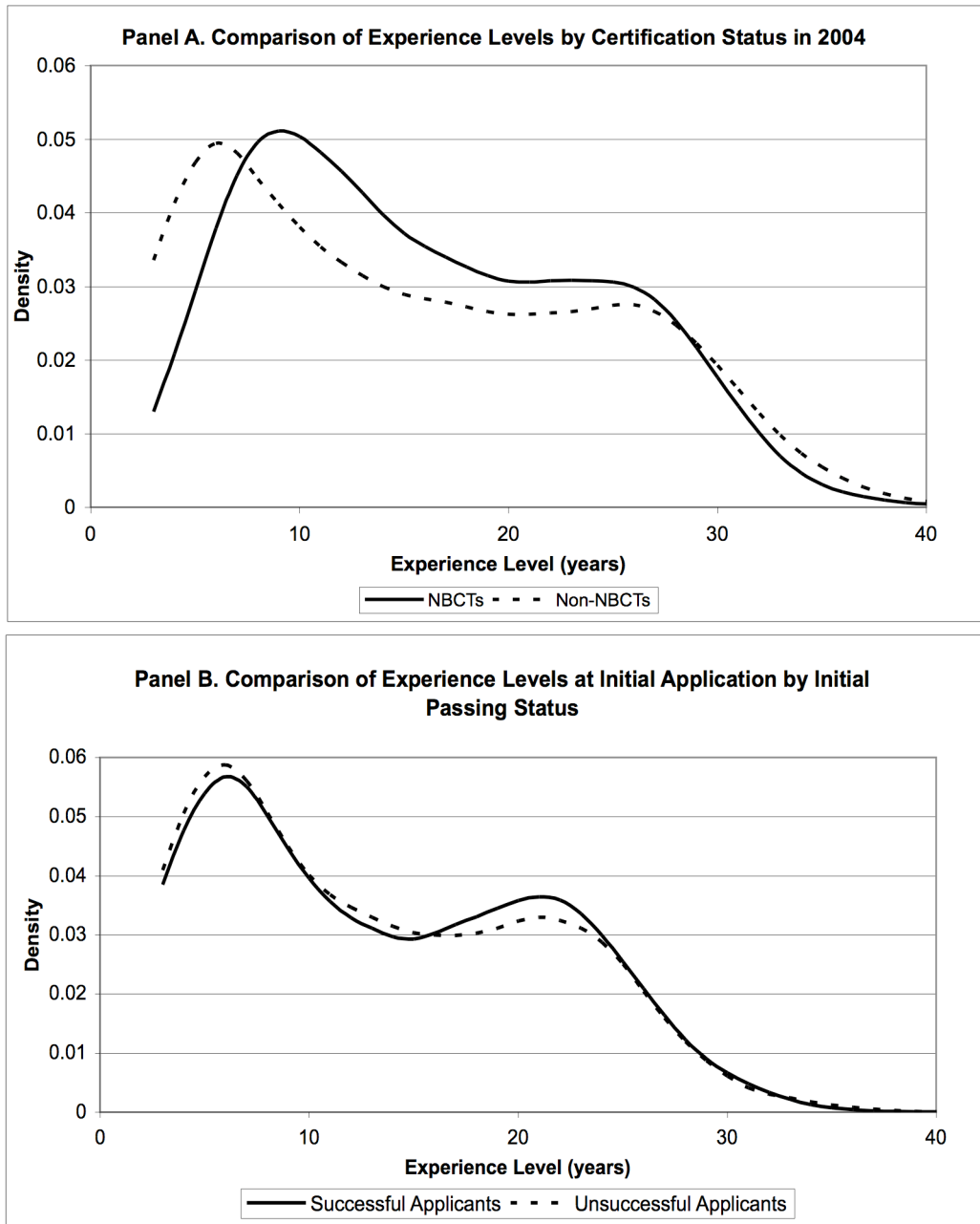
¹¹ Sample statistics for other years or that were calculated based on teacher observations (as opposed to unique teachers) across years look quite similar to those reported in Table 1.

Consistent with prior research (Goldhaber et al., 2004), we find that NBCTs are more likely to be female, hold a graduate degree, and have above-average performance on a state licensure test than non-NBCTs, and they are significantly less likely to be African-American than non-NBCTs. It is also notable that they tend to be teaching a lower percentage both of minority students and of students eligible for free or reduced-priced lunch.

Figure 1 depicts the experience distribution (kernel density estimates) of teachers by NBPTS certification status. Panel A compares the experience distribution between NBCTs and non-NBCTs as observed in the last year of data available, 2004.¹² As shown, the distributions are roughly equivalent, with the distribution of certified teachers shifted towards more experience in the early stages of the teacher's career. Additionally, application for NBPTS certification drops off somewhat steeply beyond approximately 25 years of experience, and this characteristic reveals itself with a lower density of NBCTs relative to non-NBCTs in the latter stages of teacher careers. Lastly, the data only include teachers with at least 3 years of experience, as this is the minimum level of experience necessary to apply for NBPTS certification. Panel B shows a comparison between initial passing status and an applicant's experience level at the time of initial application. Though these distributions are virtually equivalent, there is some indication of higher failure rates among less-experienced teachers, and conversely, higher passing rates among more experienced teachers, particularly at the two modes of the distribution. As indicated above, application for the NBPTS exam after 25 years of experience is uncommon, as seen by a steadily decreasing density in both successful and unsuccessful applicants.

¹² Note that we omit teachers from our sample who have less than 3 years of experience since they would be ineligible to apply for NBPTS certification.

Figure 1. Experience Distribution by NBPTS Certification Status



For a subset of teachers in our dataset –those who appear in the data between the years 1997-2000– we have detailed information on application to NBPTS provided by ETS, including whether a teacher applies to be NBPTS certified, and the scores that each applicant received on the 10 sub-assessments that are the components of the certification process. This allows us to

compare successful and unsuccessful applicants to NBPTS and investigate applicant career paths along the continuum of performance on the NBPTS assessments. Within this subset of teachers, we identify 2,971 unique NBPTS applicants, of whom 1,753 successfully passed the exam within the four-year time span of the data.

In **Table 2** we present summary information (by NBPTS application status) on the percentage of teachers making one of five specified year-to-year transitions: 1) choosing to remain at the same school, 2) taking another teaching position at a different school within the same district, 3) taking a teaching position in another district within the state, 4) leaving employment in North Carolina public schools (this includes those who left public school teaching in North Carolina and those who left the state),¹³ and 5) moving from a teaching position into an administrative position.¹⁴

Table 2. Summary Data on Observed Teacher Transitions 1997-2000 by Certification Status

Experience Level	Certification Status	Stayed in Same School	Moved Schools w/in District	Moved Districts	Left NC Public Schools	Switched to Administration	Total
3-11 Years	Non-applicant	75.39%	8.07%	3.98%	12.47%	0.09%	79,653
	Applicant	85.00%	10.01%	3.06%	1.93%	0%	4,506
	Successful Applicant	78.57%	8.93%	3.35%	8.93%	0.22%	448
12-19 Years	Non-applicant	83.62%	6.78%	2.18%	7.30%	0.12%	62,030
	Applicant	88.67%	7.61%	2.09%	1.63%	0%	2,825
	Successful Applicant	85.47%	7.85%	2.03%	4.65%	0%	344
Over 20 Years	Non-applicant	84.35%	5.52%	1.17%	8.86%	0.11%	61,676
	Applicant	89.44%	7.51%	0.73%	2.33%	0%	1,931
	Successful Applicant	87.54%	6.06%	2.69%	3.70%	0%	297
All Levels	Non-applicant	80.62%	6.90%	2.58%	9.80%	0.10%	203,359
	Applicant	87.04%	8.76%	2.28%	1.92%	0%	9,262
	Successful Applicant	83.20%	7.81%	2.75%	6.15%	0.09%	1,089

¹³ It is likely that the great majority of those who leave employment in public schools in North Carolina also leave the teaching profession. According to the 2000-2001 *Teacher Follow-up Survey*, of all the teachers who left their state's public education system, only 12 percent went to teach at a different school outside the state system (Goldhaber et al., 2006).

¹⁴ In classifying administrative positions, we use payroll records that denote employees as a full-time equivalent in any non-teaching capacity (i.e., librarian, counselor, vice principal, etc.). Instances where an employee was previously observed to be a licensed teacher, but later was employed in non-teaching positions were determined to have made a transition into administration.

The data are categorized by experience level and into three groups: those who never apply for certification during our sample period, those who apply for certification at some point during our sample period, and those who apply for certification and successfully attain NBPTS certification during our sample period.

We classify teachers as applicants if they apply *at any point* during the sample period, based on the theory that teachers who ultimately apply to NBPTS may be different than non-applicant teachers even before they actually opted to apply; however, the findings reported in **Table 2** (and below) are qualitatively similar when we classify teachers as applicants only in the year in which they actually apply to NBPTS. Teachers are classified as NBCTs in the year in which they are publicly recognized as being NBPTS certified, as the credential can only have a direct impact on a teacher's career path when it has been officially bestowed upon her. The percentages reported are teacher-year observations and reflect one observation per teacher per year (e.g., a teacher who taught for three years will contribute three observations).

Several noteworthy patterns emerge from a casual examination of **Table 2**. First, NBPTS applicants (regardless of their experience level and whether they are successful in obtaining NBPTS certification) appear to be more likely than non-applicants to stay in their own schools, and far less likely to leave the NC public school system (the differences between groups are statistically significant). For example, about 85 percent of early-career NBPTS applicant teachers remain in the same school year-to-year versus only 75 percent of non-applicants.

Second, applicant teachers are slightly less likely than non-applicants to move from one district to another for early- and mid-career teachers, but there are not always consistent differences across experience groups between successful applicants and non-applicants. Third, across all experience groups, applicants who achieve NBPTS certification are slightly more

likely than non-applicants to stay in the same school and considerably less likely to leave the state—but it is of interest that successful applicants appear to be *less* likely to remain in the same school and more likely to leave the state than unsuccessful applicants, though the results are not consistently significant across all experience groups.

Finally, we note that only a small proportion (0.1%) of teachers in general are observed to move to an administrative position in either the school or district, and in our sample, none of the NBPTS applicants were observed making this type of career move—though a small handful of applicants did make such a move after becoming certified. This is somewhat surprising, as surveys of NBCTs suggest that career progression is one factor in the decision to seek NBPTS certification (Kelley and Kimball, 2001).

Though it's certainly possible that once certified, a teacher may opt to teach for a few years before moving into an administrative post, longer-term observations (beyond the 1999-2000 school year) of the teachers in our North Carolina sample do not suggest that NBCTs are more likely than other teachers to move into administrative posts, and even suggest they may be less likely to make such a move.¹⁵ A noteworthy aspect of such a transition is that a certified teacher would forgo the 12% teacher salary supplement by moving into an administrative position, as this supplement is only for those who actively teach *and* hold the NBPTS certification. The loss of this incentive may offer some explanation for the low proportion of NBCTs who make this move. Given the small number of NBCTs who move into administration, we are reluctant to draw any inferences from the data, hence these specifications and outcomes are omitted in the results presented below.

¹⁵ In the survival model discussed below, we track teachers through the end of 2003. Some NBCTs (and NBPTS applicants) do transition to administration, but at a demonstrably lower rate than non-applicant teachers in general.

A. Competing Risks Hazard Model

As **Table 1** illustrates, there are important individual and teaching-context differences between applicants and non-applicants, as well as between successful and unsuccessful applicants. Thus, to assess the causal effects of obtaining the NBPTS credential, we begin by estimating a discrete-time competing-risks model (following Boyd et al., 2005 and Imazeki, 2002)¹⁶ to study the role NBPTS certification may play in influencing the length of time teachers remain in a particular school versus moving to an alternate school in the same district, moving to an alternate school in a different district, or leaving the profession in North Carolina (again, this may be leaving public schools in North Carolina or leaving the state):

$$h_j(t | X, T, \text{NBC Status}) = k_j(t) \exp(\beta_1 X_t + \beta_2 T_t + \beta_3 \text{NBC Status}) \quad (3)$$

for $j \in \{\text{school exit, district exit, and state exit}\}$

In this model we estimate the hazard of making each of these respective exits (h_j) using a vector of individual characteristics (X_t) as well as school and district factors associated with the teaching position (T_t), including incentives for NBPTS certification. We include this vector of characteristics, many of which are time varying, to control for the impact of exiting due to other reasons. In the analysis, we primarily focus on the influence of NBPTS certification status and NBPTS-associated financial rewards on career decisions by using measures of both applying for and successfully passing the exam.

Lastly, we recognize that receiving NBPTS certification likely impacts teachers differently depending on the stage of their career due to the nature of the certification, which provides professional and financial benefits to the holder over its 10-year lifetime. Accordingly,

¹⁶ Strictly speaking, since our models have several exit types as well as the possibility of repeated exits, a repeated-event, competing-risk model would be the most appropriate estimation method. Due to computational infeasibility, however, we simulate this method by isolating each exit type, running repeated event models, iterating for each exit type, and adjusting the variance with robust standard errors.

we employ this competing-risks model with three distinct experience classes to account for different stages of teachers' careers. We look at (i) a cohort of early-career teachers who have completed three to eleven years of teaching, (ii) a cohort of mid-career teachers who have completed twelve to twenty years of teaching, and (iii) a cohort of late-career teachers who have completed twenty to twenty-nine years of teaching.¹⁷ The upper limit in each of these cohorts is not explicit, but rather implied by the time span of our data.

As described above, we exclude teachers with less than three years of experience (to match the eligibility requirements to apply for the NBPTS exam) and constrain teachers to have less than thirty years of experience (to mitigate the effect of exits from retirement). Because we observe teacher moves by comparing changes from one year to the next and have teacher data as a yearly snapshot, the last year that we can assert teacher moves is 2003, giving an effective eight-year span of career transition observations for teachers entering the cohort in 1995.

B. Comparison of Successful and Unsuccessful NBPTS Applicants

As mentioned above, we have detailed test information on everyone from North Carolina who *applied* to become NBPTS certified for a subset of our data (spanning the 1996-97 school year to 1999-2000). Thus, we also estimate a variant of equation (3) above where we include an indicator variable for whether an individual applied for the exam. Focusing on this subset of teachers is important, as there are likely to be unobservable differences between NBPTS applicants and non-applicants in attachment to the teaching profession. Even comparing successful applicants against unsuccessful applicants, however, may not be a perfect comparison, as passing may be due to differences in (unobserved) effort or motivation during the assessment process. If these unobserved differences among applicants also determine an applicant's outlook

¹⁷ It is, of course, arbitrary how one classifies a teacher's career stage, but the results are not sensitive to small changes in the experience classifications (e.g., estimating the models for an early career experience category that is 4

on future career movement, such a comparison may still be subject to bias—similar to comparisons between certified and non-certified teachers as above. Because all applicants do demonstrate a similar motivation to put forth at least a minimal effort, however, we feel the comparison between successful and unsuccessful applicants is at least as good as the original comparison, and likely better. Thus, we view the comparison between successful and unsuccessful *applicants* as a more informative gauge on the effects of NBPTS certification on a teacher’s career path.¹⁸ The findings of these competing-risks models are laid out in Section IV below.

While the comparison between successful and unsuccessful NBPTS applicants is likely to mitigate biases arising from unobserved variables that are correlated both with teachers’ career paths and their NBPTS status, we attempt to further address this issue by employing regression discontinuity methods, a quasi-experimental estimation design. Employing such a design to the problem eliminates this potential bias due to unobservable differences among applicants and provides a method to test the causal effects of obtaining certification on teachers’ career paths. Hahn, Todd, and Van der Klaauw (2001) formally develop the conditions under which regression discontinuity can be employed and discuss its implications for causal testing. More recently, Porter (2003) and Lee and Card (2006) further discuss estimator choice and estimation in the presence of specification error. Guryan (2001) and Jacob and Lefgren (2004), among others, employ analogous designs to quantify various treatment effects in empirical education contexts. Likewise, we employ regression discontinuity methods to applicants to the NBPTS exam to determine the causal treatment effect due to obtaining NBPTS certification.

to 10 years of experience).

¹⁸ On the premise that applicants may have unobservable differences from non-applicants, we identify all teachers who eventually apply in our dataset as applicants from the time they enter the study, even though they may not

In the framework of the NBPTS exam, applicants are evaluated on ten different sub-assessments on a scale from 0.75 to 4.25. A weighted linear combination of these ten sub-assessments and a constant term then provide the final scaled score for the NBPTS exam, for which scores of 275 and over pass. Accounting for rounding, we have a sharp cutoff point between those who pass and those who fail at 274.5 points, which forms the basis for comparison in this design.

The motivation behind the regression-discontinuity model explicitly recognizes that teachers' preparedness and performance on the exam are not random events, but are largely determined by the applicants themselves. Further, certain teacher attributes such as race, gender, demographics of their school, and licensure score are all associated with higher scores on the NBPTS exam—thus, the expected distribution of their scores is reasonably predictable (Goldhaber and Anthony, forthcoming).

An applicant's precise final score, however, may be considered random in that the score on each sub-assessment that determines the overall score will have some random error associated with it—particularly because some of the sub-assessments are based on subjective assessments of the quality of, for instance, a candidate's teaching practices.¹⁹ Around the cutoff point then, we will observe both successes for applicants who were predicted to fail and failures for applicants otherwise predicted to pass. In essence, because of an applicant's inability to choose his or her final score with certainty, assignment to passing status is a random event around the cutoff point.

actually apply for several years. However, we indicate obtaining certification from the time it is actually given to the teacher, since holding the NBPTS credential cannot directly impact a teacher's career path prior to its receipt.

¹⁹ See www.nbpts.org for more information on the sub-assessments that go into the determination of a candidate's overall NBPTS score.

By exploiting this random assignment around the cutoff, we can utilize the quasi-experimental design of regression discontinuity to determine an average treatment effect, which in this context is the effect on teachers' careers due to passing the exam, estimated with the following model:

$$y = \beta_1 S + \beta_2 D \cdot I_{(Pass)} + \beta_3 I_{(Pass)} \quad (4)$$

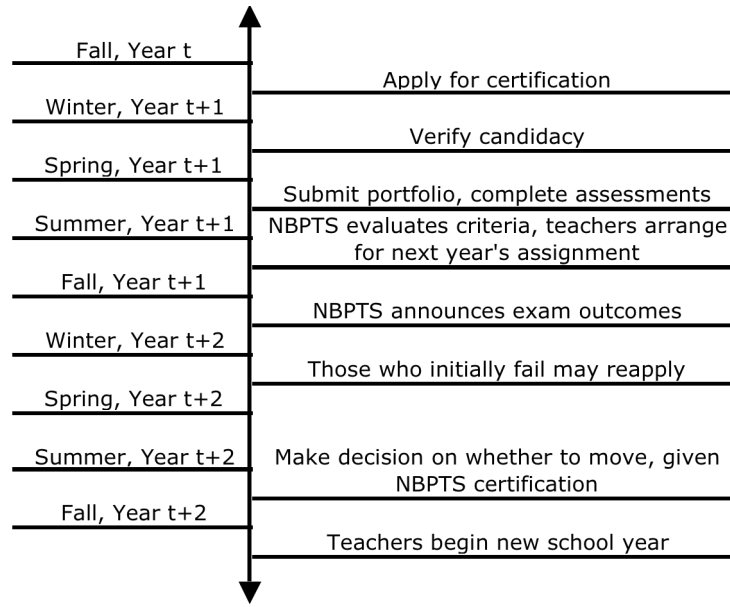
where the dependent variable is a post-test realization of some variable of interest (y), regressed on some specified polynomial order of the standardized test score (S), an interacted polynomial expansion for those who pass ($D \cdot I_{(Pass)}$), and an indicator for passing the exam ($I_{(Pass)}$). As long as the data meet certain continuity conditions, the average treatment effect (β_3) is now identified as a direct result of passing the exam; thus, passing the exam is determined to be causal in this circumstance.

We wish to note that in our analysis we only consider the first attempt of each applicant and exclude any exam retakes, as retakes potentially violate the continuity condition necessary for proper identification in the regression discontinuity design. In our data, 1,434 of the 2,971 unique applicants passed on the initial attempt, giving a pass rate of slightly less than 50%. Of those teachers who initially failed, we observe 593 who reapply for the exam (almost always the very next year), of which 319 eventually pass on a later attempt, which is a slightly higher pass rate compared to the initial attempt. We exclude any retakes to avoid potentially biasing the estimates due to these different test score distributions.

In our analysis, we are first interested in whether teachers are more or less likely to make an exit from their school as a result of passing the NBPTS exam; and second, in the types of teaching assignments newly certified teachers accept vis-à-vis their unsuccessful counterparts. Accordingly, the control group in this design is the group of initially unsuccessful applicants, and

those receiving treatment are those who are successfully awarded certification on their first attempt. A noteworthy point here is that, since initial failure determines whether a teacher is assigned to the control group, a teacher who initially fails but passes again on a retake will still be included in the control group and will not be considered as receiving the treatment, even though he or she eventually attains certification.

Before presenting the results, we wish to discuss the timing of the events relevant to this model. When a typical applicant applies to the NBPTS exam, he or she will undergo a three-step process of submitting an initial application, verifying candidacy, and ultimately submitting a portfolio and completing the assessments. This process must be initiated by the end of a given calendar year and be completed by June of the following year—roughly mirroring the traditional school year. NBPTS then evaluates the criteria and returns a decision to the applicants no later than the end of that calendar year, making the whole process from application to outcome approximately one full year (for more information on the application process, please see www.nbpts.org). Given the length of the process and the typical practice of entering a teaching contract to teach for a full school year, most teachers cannot make any new exit decisions with this information until the second summer after their application. Further, once the exit is made, we cannot evaluate the nature of the change until the following school year is completed, when measuring the change by such factors as the level of spending per student or the percentage of minority students associated with the teacher's new assignment. We illustrate this with a timeline below:



The variables of interest to us in this analysis are (1) the probability of making an exit at increasing intervals after receiving NBPTS certification and (2) the school characteristics of teaching assignments in the years after certification, conditional on remaining in the North Carolina public school system.

We consider exit decisions made the summer immediately after certification as well as exits that occur several years after becoming certified, as a focus on a single year after receiving certification may be overly restrictive of the time frame in which NBPTS certification has an impact on teachers' mobility. Examining exit decisions made the second summer after certification or even later allows us more flexibility in capturing career path decisions; however, enlarging the time frame will necessarily include those who initially failed the NBPTS exam, but reapplied and passed the next year and made exit decisions immediately as a result.

As noted above, only the initial test outcome is considered for this design, and those who fail their *initial* attempt comprise the control group for this design. But, any teacher who *eventually* passes the NBPTS exam—regardless of whether their initial attempt was successful or not—is receiving a treatment. Since some of those who originally failed are part of the control

group and may pass on a later retake, this will tend to decrease the magnitude of any observed difference between the control and treatment groups. Thus, the shorter-term variables are likely purer measures of the treatment effect due to passing the exam, though they likely represent a lower-bound estimate of the total NBPTS impact because they restrict movement to a shorter period of time. The longer-term variables can capture more of the *total* impact of NBPTS certification on teacher transitions over time, but error is introduced into our control group, thereby decreasing the magnitude of the effect. Thus, *all of the regression discontinuity results are likely to be lower-bound estimates of the impact of NBPTS certification on teachers' career paths.*

IV. Results

A. Competing-Risks Hazard Model Findings²⁰

We present the results of the competing-risks models for the variables of interest in **Table 3**. The findings are reported for teachers of varying experience levels and are broken out by teacher race. Panel A shows the results for white teachers and Panel B shows the results for African-American teachers. We estimated the results separately for white and African-American teachers, since prior evidence shows there are significant differences in the likelihood of certification by teacher race (Goldhaber et al., 2004) and this may indicate differential selection into NBPTS status by race. The effect of NBPTS status on a move from one school to another within a district is reported in columns 1 and 2; the effect of a move from one school to another

²⁰ A small percentage of teachers, approximately 1.5% percent, exit and then re-enter the dataset during our sample period. In the results presented below, we do not consider a teacher to move if they re-enter the dataset in the same school within a year. Our findings, however, are almost identical when we either classify these teachers as new entrants into the sample upon re-entry or exclude them from the sample altogether.

between districts is reported in columns 3 and 4; and the effect of a move out of the North Carolina public school system is reported in columns 5 and 6.

Table 3. Estimates of Hazard Ratio Impacts from NBPTS Certification

Panel A. White Teacher Sample							
Experience Level	Variable	Moved Schools within District		Moved Schools between Districts		Left NC Public Schools	
		1	2	3	4	5	6
Early-career teachers	Obtaining Certification	1.273** (0.105)	1.075 (0.145)	1.412** (0.164)	1.532* (0.292)	1.063 (0.371)	4.731** (2.576)
	Applicant	-- (0.102)	1.099 (0.102)	-- (0.130)	1.034 (0.130)	-- (0.109)	0.285** (0.109)
Mid-career teachers	Obtaining Certification	1.184 (0.145)	1.057 (0.218)	1.475* (0.275)	1.281 (0.482)	0.545 (0.392)	0.916 (0.745)
	Applicant	-- (0.206)	1.309 (0.206)	-- (0.256)	0.982 (0.256)	-- (0.458)	1.152 (0.458)
Late-career teachers	Obtaining Certification	1.502** (0.193)	1.117 (0.226)	1.392 (0.345)	2.036 (0.939)	1.133 (0.682)	12.512* (14.469)
	Applicant	-- (0.162)	1.158 (0.162)	-- (0.268)	0.790 (0.268)	-- (0.151)	0.151 (0.151)
Panel B. Black Teacher Sample‡							
Experience Level	Variable	Moved Schools within District		Moved Districts		Left NC Public Schools	
		1	2	3	4	5	6
Early-career teachers	Obtaining Certification	1.596* (0.308)	1.609 (0.494)	1.314 (0.591)	1.752 (1.176)	-- (--)	-- (--)
	Applicant	-- (0.206)	1.137 (0.206)	-- (0.261)	0.916 (0.261)	-- (--)	-- (--)
Mid-career teachers	Obtaining Certification	1.718 (0.613)	0.863 (0.492)	-- (--)	-- (--)	2.878 (2.969)	11.519* (13.990)
	Applicant	-- (0.417)	1.850** (0.417)	-- (--)	-- (--)	-- (--)	0.906 (0.652)
Late-career teachers	Obtaining Certification	1.248 (0.342)	-- (--)	1.953 (1.384)	2.154 (1.410)	3.303 (3.803)	3.014 (3.718)
	Applicant	-- (1.014)	-- (1.014)	-- (1.014)	2.623* (1.014)	-- (1.275)	2.174 (1.275)

*, **: Significant at 5% and 1% levels, respectively.

Note: The following variables were used in each of the models in addition to the variables reported above: gender, level of higher education, salary, expenditures per student, salary supplements in the district, assignment type (secondary or elementary), locale type, proportion of minority students, proportion of students receiving free & reduced lunch, licensure test scores, and differentials of teacher licensure scores against other teacher colleagues. Columns 1, 3, 5 report estimates for NBCT and non-NBCT status only, and do not include application status. Columns 2, 4, 6 report estimates that distinguish between non-applicant, NBPTS applicant, and certified applicant status.

‡For several of the models on black teachers making specific exits, too few teachers were observed making the specified move; thus failing to identify the parameters of interest. In these cases of limited cell size, the estimates are omitted.

The numbers reported in the table are hazard ratios, implying that a value greater than one means the variable increases the likelihood (or conversely, a value less than one means the variable decreases the likelihood) of making a specified exit, all else equal; a hazard ratio of one

implies the variable has no effect on the baseline hazard. While not reported in the table, each of these models also includes covariates for teacher gender, education status, salary, percentage of minority students in the district, percentage of free and reduced-price lunch recipients, average expenditures-per-student in the district, and average licensure-exam score for teachers. To control for greater opportunities available to teachers for transfer (i.e., more schools within driving distance), we also included indicator variables on school locale—urban, suburban, etc.

Prior to discussing the findings for the NBPTS variables, it is worth highlighting several findings for the other covariates in the model. Our results are largely consistent with those found elsewhere in the education literature on the determinants of teacher career moves. Specifically, we obtained results suggesting that teachers in teaching assignments with higher numbers of low-income and minority students are at significantly greater risk of exiting a specific school for any option (Rivkin et al., 2005). Increased district salaries or instructional expenditures decreased the risk of a teacher exiting a school, and, not surprisingly, teachers with less experience are found to be more volatile in their teaching assignments, in the sense that they are more likely to leave their school for another option. We also find consistent evidence supporting previous findings (Podgursky et al., 2004) of higher-ability teachers (as measured by teacher licensure scores) having an increased risk of exiting the profession when teaching among lower-performing colleagues. Several other covariates were significant in some models, but were not consistent across exit types and experience levels.²¹

Finally, recall that, in addition to the 12 percent salary supplement offered by the state to NBCTs, a small minority of school districts offers an additional financial incentive (either a one-

²¹ Results of all covariates for all move types and all experience levels are available on request. Alternate model specifications were attempted, allowing for different hazard functions between teachers by gender and schooling type; however, the hypothesis that these survival functions were proportional was not rejected, so we present the aggregated model here.

time bonus or a permanent salary supplement) to teachers who become NBPTS certified.²² We experimented with including information in our models on the magnitude of the bonus or salary supplement that individual districts offered to teachers who become certified. Surprisingly, we find little consistent evidence that these within-state incentives have an impact on the hazard that a teacher leaves a particular school (we treat all exits the same regardless of type, since specification tests failed to reject the null hypothesis that the determinants of these moves are in fact different).

The finding that additional compensation for NBCT status does not significantly decrease the hazard of leaving a school or district may be due to an unobserved correlation between current financial incentives and unobserved (undesirable) aspects to a particular teaching assignment. The incentives are generally small and may not fully compensate teacher for non-pecuniary job characteristics. In fact, the largest incentives offered (a \$2,000 salary supplement or \$2,000 bonus) are far smaller than the differentials that some researchers estimate are necessary to entice teachers to teach in disadvantaged school settings (Hanushek et al., 2004).

Turning to a focus on the NBPTS variables, there is good evidence from columns 1, 3, and 5 (which include only an indicator for NBCT status) of **Table 3** that NBPTS certification is correlated with increased mobility of teachers within the profession. At the early-career stage, both white and African-American NBCTs are more likely than their non-certified peers to change schools within a district or change schools between districts. The magnitude of the difference is sometimes quite large; the point estimate, for instance, suggests that African-American NBCTs have a hazard that is 60 percent higher than African-American non-NBCTs. The finding that NBCTs are more likely to move within the profession is consistent across

²² Relatively few districts (from 14 to 17 percent in the period from 2001 to 2003) offer these financial incentives, with approximately 80 percent of these offering bonuses only. The mean bonus and raise among schools providing

experience groups and race categories (though the coefficient estimates are not always statistically significant). Contrary to expectations, we find little difference between NBCTs and non-NBCTs in the likelihood of leaving North Carolina public schools.²³

In columns 2, 4, and 6 of **Table 3**, we report findings from model specifications where an indicator has been added for whether teachers applied to NBPTS. This is an important comparison, since teachers who become NBPTS certified are likely to be different from non-certified teachers in important and perhaps unobservable ways. We hope, then, that the comparison between successful and unsuccessful applicants will provide a cleaner estimate of the causal implications of obtaining the NBPTS credential.²⁴ In these models the NBPTS-applicant coefficient is the differential between applicants and non-applicants to NBPTS, the NBCT coefficient is the differential between successful and unsuccessful applicants to NBPTS, and the multiple of the two coefficients is the differential between NBCTs and non-applicants.

The finding that the estimated coefficient of the NBPTS-applicant variable is generally not statistically significant suggests little evidence of differences between applicants and non-applicants within profession moves (between schools, within districts, or between districts) among white teachers; however, the fact that the estimated coefficients are considerably larger though measured with imprecision is worth noting. Among the African-American teachers in our study, we did find some evidence of mid-career applicants being more likely to switch schools, as well as late-career applicants who demonstrate a higher likelihood of leaving for another district; however, the cell sizes among the African-American teacher population, particularly among African-American NBCTs, suggest the power of these estimates may not be particularly

them in 2003 are \$722 and \$937, respectively.

²³ It was not possible to estimate the hazard for African-American teachers across all experience groups and all exit types due to small cell sizes.

high. Success in obtaining certification (reflected by the estimated coefficient on the NBCT variable) seems to indicate that having the NBPTS credential does lead to an increased likelihood of switching schools or districts, and the total effect (the multiple of the NBPTS applicant and NBCT coefficients) largely reflects the findings in the specifications discussed above: NBCTs in the North Carolina population are generally more likely to switch schools than non-NBCTs.

The most surprising findings are among those reported in column 6 of **Table 3**, regarding the hazard of leaving North Carolina public schools. Not surprisingly, NBPTS applicants are found to be less likely to leave the system (the difference is statistically significant for early career teachers). This is consistent with expectations, as teachers who apply to the National Board are likely to be the ones with a strong attachment to the teaching profession and the expectation that they will be in the system long enough to recoup the time investment associated with going through the certification process. Contrary to expectations, however, is the statistically significant finding (for early- and late-career white teachers, and mid-career African-American teachers) that successful NBPTS applicants (NBCTs) are far more likely than unsuccessful applicants to leave the system. The magnitude of this finding is striking: for example, the point estimate suggests that late-career white NBCTs are, at any given time, over 12 times more likely than unsuccessful NBPTS applicants to leave the system. The estimates here are identified by observed exits of teachers with the specified attributes, and in the case of small cell sizes can lead to imprecise estimates.

To attempt to add precision to these estimates, we also experimented with models containing all three cohorts simultaneously (with indicators for experience category), and the estimates were roughly consistent with those presented above; and, in the case of leaving the NC

²⁴ Note that these models are not directly comparable to those in columns 1, 3, and 5 because we only have information on application status for a subset of years.

public school system we found white applicants 59 percent more likely to stay in the system than white non-applicants, but white NBCTs (successful applicants) were estimated to be nearly 3.4 times more likely than unsuccessful white applicants (both significant at the 1 percent level) to leave. Taken together, these findings suggest that average white NBCTs are 38 percent more likely to exit the public school system in North Carolina than average non-applicant white teachers.

We also experimented with estimates based on stratifying at the school and district levels, which allows the baseline hazard function to vary between schools or districts while restricting the coefficients on all other variables to be equal across the state. These types of models are dynamic analogues to fixed-effects models. While we did find some distinctions between estimates in these methods and those presented here, they were largely consistent in those cells that had many observations.

Below, we employ a regression-discontinuity approach to explore the robustness of these findings and whether the credential has an impact on the kind of schools that NBCTs teach at (as measured by the characteristics of the schools and their student bodies).

B. Regression-Discontinuity Results

For the regression-discontinuity models we use the sample of teachers for whom we have information on their NBPTS assessment scores. In these models, the continuous distribution of NBPTS assessment scores serves as a control variable, and any discontinuity observed when controlling for a teacher's assessment score is determined to be a causal effect of obtaining the NBPTS credential. As before, we estimate the models separately for white and African-American teachers, so as not to misattribute the pre-existing racial differences in the likelihood of becoming certified to the causal effect of obtaining the NBPTS credential.

In **Table 4** we report our findings for models identifying a teacher’s probability of exiting a given school within a specified time period (1, 2, 3, or 4 years) after obtaining NBPTS certification. In these analyses we categorize move types interdependently (as opposed to the survival model findings reported in **Table 3**, where we categorized the exit types to be mutually exclusive). For instance, in modeling the probability of leaving a school, a teacher exiting the state (who also simultaneously leaves the school) is treated the same as a teacher moving to another school within the district. The reason for this alternate categorization is that the competing risks models above explicitly model each specific move type in concert with other exit types and thus incorporates more information into the estimates. Since the regression discontinuity methods only look at each specific exit in isolation, we are compelled to look at the moves in this less-informative approach and not make the distinctions among types possible in the competing risks analysis.

These models are based on a polynomial expansion of the applicant’s final score on the NBPTS exam using a logit model and employing robust standard errors clustered on the discrete values of the final score.²⁵

²⁵ A potential weakness to the regression discontinuity design employed here is that coefficient estimates may be sensitive to the model specification used. To check the robustness of our findings, we estimate the discontinuity of all models presented in this section on a first- through fourth-order polynomial expansion on the test score. The results presented in these tables are those determined to be the best fit, using tests of goodness of fit. Our findings on all these model specifications suggest that the significant coefficients are generally robust to the model.

Table 4. Regression Discontinuity Estimates for Marginal Probability of Exiting for Certified Teachers

Panel A. White Applicant Sample				
	Years After Obtaining Certification			
Exit Type	1 year	2 Years	3 Years	4 Years
Leaving School	0.078	0.070	0.097**	0.115**
	(0.180)	(0.162)	(0.134)	(0.132)
Leaving District	0.147*	0.126**	0.105*	0.093**
	(0.280)	(0.195)	(0.165)	(0.140)
Leaving NC Public Schools	0.104	0.147**	0.127**	0.103**
	(0.334)	(0.179)	(0.158)	(0.130)
Panel B. Black Applicant Sample				
	Years After Obtaining Certification			
Exit Type	1 year	2 Years	3 Years	4 Years
Leaving School	-0.331	-0.100	-0.060	0.136
	(0.957)	(0.653)	(0.480)	(0.643)
Leaving District	-1.595	-0.381	-0.072	0.097
	(6.836)	(1.810)	(0.575)	(0.809)
Leaving NC Public Schools	-0.115	-0.845	-0.904	-0.038
	(1.097)	(2.530)	(2.521)	(0.706)

The results presented here are the estimated marginal probabilities from passing the NBPTS exam (standard errors reported are for the coefficient estimates). This marginal effect is derived by multiplying the estimated coefficient with the density of the distribution at the cutoff, which for white teachers falls very close to the mean (-0.1 sd) and for African-American teachers falls approximately one standard deviation above the mean African-American teacher score. The estimated discontinuities at the cutoff represent an estimate of the effect of obtaining the NBPTS credential on the increase (or decrease) in the likelihood of exiting a particular school. Panel A reports the findings on the probability of leaving for white NBCTs as compared to those who failed the exam initially, and panel B reports the results for African-American NBCTs as compared to those who initially failed the exam.²⁶

Given the results of the survival model in the previous sub-section, it is not surprising that we find evidence, largely statistically significant, for white NBCTs to exit the school or state

at a higher rate than non-NBCTs (estimates range between 7-12 percent more likely to make such an exit), further supporting the finding that NBCTs have an increased hazard of within-state transitions as a result of becoming certified. Surprisingly, however, the point estimates on leaving the state also show a consistently increased risk of leaving at all intervals after obtaining certification, and while the first year is not significant, all estimates beyond that are significant, and the magnitude of the point estimates is also substantial—ranging from 10-15 percent. For example, our findings suggest that within four years after becoming certified, NBCTs have a 10 percent greater likelihood of leaving the state than unsuccessful applicants. These findings are contrary to our expectations about the impact of such a credential on a teacher’s career path, but generally consistent with the estimated differentials in the competing risks models above. These estimates also vary in magnitude from the findings presented in the survival analysis section above; however, the findings here are estimates on the causal treatment effect of receiving NBPTS certification (separate from all other factors).

The findings for African-American teachers (reported in Panel B) are quite different from those of white teachers and, to some extent, from the survival models results presented above. None of the estimates are significantly different from zero, and the signs of the estimated coefficients in general are not nearly as consistent as those of the white applicant sample.

However, it is worth noting that the point estimates for African-American NBPTS applicants consistently suggest that African-American NBCTs have a decreased likelihood of exiting the North Carolina public schools, whereas the point estimates for white applicants suggest that white NBCTs have an increased probability of this type of exit. That said, we wish to express our caution about interpreting the effects from the sample of African-American

²⁶ As mentioned in Section III, to meet the continuity conditions necessary for identification in the regression discontinuity design, only the initial test outcome is considered here. Retakes are not considered in the analysis.

applicants as the density of the distribution at the cutoff is considerably lower than in the white sample, in addition to containing fewer observations than the white applicant pool. Thus, while the results from these estimates are informative on the direction of effect, since the effect is only observed in a very small portion of the population, the magnitudes of the estimates are likely imprecise.

Next we turn our attention to the nature of the school moves made by those who become certified compared to those who are unsuccessful applicants. In **Table 5** we report on models that estimate the effects of becoming NBPTS certified on school characteristics. Here our variables of interest are measures of the percentage of minority students, the percentage of subsidized lunch receipts, district expenditures per student, and median housing values in the district, evaluated at increasing intervals after passing the NBPTS exam.²⁷ Descriptive statistics for these school characteristics as well as the distribution among NBPTS-certified teachers can be found in Goldhaber et al. (forthcoming). In this study, we further the analysis by seeking to determine the causal effect of obtaining NBPTS certification on the distribution of teachers among schools. The coefficient estimates reported in the table are the marginal effects of becoming NBPTS certified on the attributes of future teaching assignments.

²⁷ To mitigate the effects of inflation and the need of a base year, we measure the *difference* in expenditures per student and median housing values from the initial year to the year of observation and employ these as the dependent variables in our analysis.

Table 5. Regression Discontinuity Estimates for School Characteristics

Panel A. White Applicant Sample				
	Years After Obtaining Certification			
Exit Type	1 year	2 Years	3 Years	4 Years
Percentage of Free & Reduced Lunch Students	-0.014 (0.011)	-0.006 (0.012)	-0.003 (0.015)	-0.004 (0.022)
Percentage of Minority Students	-0.008 (0.012)	-0.025* (0.013)	-0.024 (0.014)	-0.023 (0.022)
Difference in Expenditures per Student (new - old)	-71.800** (18.073)	-61.374* (30.778)	47.710 (55.708)	-113.848 (69.800)
Difference in Median Housing Values (new - old)	28.8 (1,055.6)	1,585.7 (1,618.9)	4,081.2 (2,187.9)	4,412.6 (3,256.1)
Panel B. Black Applicant Sample				
	Years After Obtaining Certification			
Exit Type	1 year	2 Years	3 Years	4 Years
Percentage of Free & Reduced Lunch Students	-0.043 (0.044)	0.001 (0.061)	-0.041 (0.052)	-0.044 (0.096)
Percentage of Minority Students	-0.414** (0.075)	-0.341** (0.077)	-0.308** (0.078)	-0.087 (0.089)
Expenditures per Student	-1.500 (33.528)	46.887 (50.372)	-31.125 (79.975)	124.068 (73.488)
Median Housing Values	1,281.5 (2,855.9)	925.7 (3,128.0)	4,255.7 (4,651.2)	4,566.5 (2,920.6)

Among white NBCTs, the estimates are fairly weak with few significant findings. Notably, those estimates that are significant at the 95 percent level—decreases in expenditures per students one and two years after certification—fall into insignificance beginning in year three and even change sign. Though these other estimates are generally not significant, we can at least observe consistency in the sign of the percentage of free and reduced-price lunch recipients as well as the percentage of minority students. The findings here suggest that NBCTs may move to schools with lower poverty and fewer minority students as a direct result of passing the NBPTS exam. Additionally, as white applicants as a group do tend to start from more affluent and homogenous schools, the marginal impact of certification on such characteristics may be somewhat small (hence not statistically significant). An important part of these comparisons of new and old teaching assignments is that the estimates are conditional on a teacher remaining in

the state; hence, the power of our estimates decreases over time as our sample size shrinks due to teachers exiting the state.

The estimates on the African-American applicant sample, in contrast to the white sample above, do show very significant decreases in the percentages of minority students at the schools where NBCTs teach. Though the other measures were not consistent or significant, these measures of minority students do seem to provide a substantially large treatment effect to successful African-American applicants. In year 4, the estimate does fall considerably, and also becomes insignificant; however, this is likely due to the small cell size of observations for African-American applicants four years after certification. The magnitude of these estimates, particularly compared against the same estimates from the white applicant pool, can be attributed to different average starting levels between black and white applicants. In spite of these different starting points, however, the causal impact of receiving certification for this segment of the population is large.

V. Public Policy Implications and Conclusions

In most respects the analyses presented here tend to confirm what theory suggests: as a consequence of becoming NBPTS certified, NBCTs exhibit greater employment mobility than their uncertified peers and are more likely to leave a given school for another school in the same district or another district. Furthermore, consistent with research on teacher preferences when making a transition, NBCTs move to schools with lower percentages of minority students.

Given the widespread perception that the NBPTS credential is a sign of teacher quality, it is not surprising that teachers having this credential may be able to secure more favorable teaching assignments. But, our finding that obtaining the NBPTS credential leads to greater

mobility and subsequently permits NBCTs to alter the kinds of schools in which they teach raises equity concerns. Existing research suggests that the value of NBPTS certification is one of teacher quality as opposed to human capital—meaning that schools benefit from having NBCTs in their classrooms, but not directly from having their teachers engage in the certification process itself. In fact, there is some evidence that teachers are less effective while in the process of becoming certified (Goldhaber and Anthony, forthcoming; Harris and Sass, 2006). Thus, our findings suggest that schools that already tend to lose teachers – that is, those with higher proportions of minority students – may be harmed by the greater mobility that arises for teachers as a consequence of having a readily identifiable credential ostensibly signaling their quality.

One potential implication of this finding is that state or local policymakers may wish to provide differential financial incentives to give NBCTs greater encouragement to work in disadvantaged schools.²⁸ A recent case study report (Humphrey et al., 2005) on the distribution of NBCTs in six states shows that they are far more equitably distributed across schools in California, where they receive a \$20,000 reward for teaching in a *low-performing school*, than they are in the other five states where the financial incentive is available to any NBCT regardless of teaching assignment.²⁹ This case study suggests that targeted financial incentives are an important component toward a more equitable distribution of NBCTs, but incentives alone may not be enough as other working conditions factors (e.g., school resources, principal leadership, collegiality of teaching staff) are also important in determining where teachers opt to work.

²⁸ While there is a high correlation between the percentage of minority students in a school and various measures of disadvantage, such as the percentage of free and reduced-price lunch eligible students, our findings suggest that such targeting may not address all equity concerns since teachers appear, again consistent with recent research, to be more concerned about the racial/ethnic make-up of a school's student body than about its socioeconomic make-up (Stinebrickner et al., 2005).

²⁹ The distribution of NBCTs in Los Angeles Unified School District appears to explain much of the differential distribution in California as a whole.

We did not find evidence that the varying district-level financial incentives offered to NBCTs had much of an impact on their career paths. These incentives, however, were quite small compared to the 12 percent pay increment the state offers--far smaller than the aforementioned California incentives or what other research suggests is necessary to influence teacher attrition (Hanushek et al., 2004). New research shows that targeted pay incentives can be an effective way to encourage teachers to teach in higher-poverty settings – in a specific example, an \$1,800 incentive for math and science teachers who teach in schools with a higher-than-average percentage of students eligible for free or reduced-price lunch resulted in a statistically significant decrease in the attrition rate of teachers receiving the incentive (Clotfelter et al., 2004).

Given the small number of African-American NBCTs, we must be careful about over-interpreting the effects of this credential on African-American teachers. Still, our findings of differences between white and African-American teachers in the effects of becoming certified on their career paths are intriguing. Unlike Hanushek et al. (2004), we find evidence that African-American NBCTs are *more* sensitive to teaching in a high-minority school than are white NBCTs, and there are some differences in attrition patterns by teacher race. These findings, combined with prior work showing large unexplained racial differences in certification rates suggest that white and African-American NBCTs may differ from one another in ways that are not easily observable in the data (Goldhaber et al., 2004). Additionally or alternatively, part of the explanation for this may be that the kind of schools that African-American and white teachers tend to be teaching in may be quite different; thus the findings may not reflect different preferences but rather that they are, in general, making decisions based on very different starting contexts. These issues merit further investigation.

A significant and interesting departure from what we had hypothesized is that obtaining the NBPTS credential appears to increase the probability that a teacher will leave the North Carolina system. This finding, at least on the surface, is counterintuitive given both the investment of time and energy required to become NBPTS certified and the large salary supplement that NBCTs in North Carolina receive. One possible explanation for this seemingly anomalous finding is that NBCTs leaving the North Carolina system are not by and large leaving the teaching profession. Instead, teachers may be obtaining the NBPTS credential in order to enhance their employment options in other states. Unlike many states, North Carolina is a net importer of teachers so it would not be surprising if many of the teachers in North Carolina are in schools far away from where they were raised and attended high school. Given research showing that teachers tend to be employed “close to home” (Boyd et al., 2005), it would not be surprising if NBCTs are using the NBPTS credential, which meets the *No Child Left Behind* highly qualified definition under many state teacher certification requirements, as a vehicle to move to a teaching position in another state.

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