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# Who Chooses To Teach (and Why)?

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**Abstract** — Decisions of college students determine who is prepared to teach. Analysis of a college cohort from the early 1980s indicates that graduates completing teacher training have roughly the same distribution of cognitive skills as all entrants into college. Yet, since college graduates are a select group, potential teachers fall low both in the overall graduate distribution and in the distribution by gender and race. Teacher training completion is significantly lowered by state requirements for courses and teacher tests, even though their effect on teacher performance is unclear. Surprisingly, participation in teacher training is not significantly affected by relative teacher earnings (*JEL* I2).

AN IMPORTANT LINE of educational policy discussion focuses on changing the composition of the teaching force, yet remarkably little is known about who enters teaching and why. The dearth of knowledge is also particularly puzzling, given the diverse interest in the subject for the past two decades. Recently, people have been concerned about the overall supply of qualified teachers, about the supply in various specialities such as math and science education, and about the quality of teachers attracted into the elementary and secondary schools. As a result of these concerns, many people seem willing to change radically the rules governing teaching jobs and the compensation of them on the belief (or hope) that a different group can be induced to enter teaching and that school performance will ultimately improve.

There are perennial projections of supply shortage. These projections reflect recent declines in the production of new teachers (NCES, 1992), the clear upturn in the student population occurring now, and the anticipated high retirement rates of teachers over the next decade. Many have questioned whether aggregate shortages will materialize, in part because of the large "reserve army" of potential teachers who could return to teaching. This questioning has led to a different set of issues — whether or not there will be a shortage of high-quality teachers and whether or not there will be sufficient numbers of teachers for specialized areas such as math and science. Without getting into questions about whether or not some sort of shortage may materialize, many key uncertainties remain about who is being prepared for teaching and what people respond to in making such decisions.

The paucity of existing analysis allows numerous statements simply to be repeated and used in the development of policies, whether or not they are accurate or relevant. For example, much of the information we have about characteristics and quality of teachers does not come from information about teachers *per se*, but instead comes from employing such information as SAT performance and other characteristics of high school seniors who indicate they plan on becoming a teacher.[1] The group of teacher aspirants is not, however, the group that eventually enters the teaching profession. Considerable shuffling takes place with many who originally expressed interest leaving the study of teaching, only to be replaced by a new group that had not previously thought of teaching.

This paper provides a simple analysis of the choice of preparing for a teaching career in college. It begins with a description of flows into and out of

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teacher training during various points of the college career. This analysis of flows highlights two features: choices by gender and racial background and the achievement levels of prospective teachers. The subsequent analysis turns to models of career choice that involve the direct estimation of how earnings opportunities and teacher certification requirements influence choices.

## 1. BACKGROUND AND DATA

Analysis of the supply of teachers is quite complicated because individuals enter into teaching jobs from various places (Murnane *et al.*, 1991; Boe and Guilford, 1992). At any point in time, newly hired teachers include a mixture of new college graduates, of returning teachers who had been out of teaching for some time, and of past college graduates who have either retrained or are currently entering teaching for the first time.

The focus of this paper is the decision to prepare for elementary and secondary teaching. We presume that this is the key step in setting potential teacher supply, because late entrants and re-entrants still went through a prior phase of teacher preparation. We also consider whether early jobs involve teaching or not, but the limited time span of the panel inhibits very broad generalizations from this.

Most information about decisions that determine the occupational choices of teachers involve either analyzing aspirations data — collected long before preparation for teaching or job choices are completed — or data on the current stock of teachers. These data, which provide insights into some issues, do not permit attention to the key decision points in the process and to how fundamental factors such as certification requirements and the like influence teacher preparation and supply.

We view the process of entry into the teaching profession as a series of sequential decisions. The process begins with the development of career goals and the initial aspirations of students in high school. We trace how the group that starts out with aspirations for teaching wends its way through the educational system and, specifically, which of these students ends up fully prepared to teach. The process also involves the infusion of new people who turn to teaching even though they did not have early aspirations to do so. We consider how these people compare with those who "always" wanted to teach.

This analysis employs the longitudinal data from the High School and Beyond (HSB) survey to follow students from high school through college. The first wave of the HSB data was collected from a group of high school seniors in 1980, and students were subsequently followed through 1986.[2]

The HSB data have a number of strengths for this work. First, its longitudinal design permits direct investigation of the choices students are making at each stage. Thus, it is possible to follow individual students from high school through college, observing at each stage whether or not a student is preparing for a teaching career. Second, its large national sample provides information on how varying certification requirements and rewards for teachers affect students' choices. Third, since all students were given standardized achievement tests, there is a rough measure of "quality" that can be introduced.

The HSB data are not, however, without their weaknesses. The HSB survey tracks a single cohort through school and thus introduces some uncertainty about what generalizations can be made to other times and cohorts. Additionally, the data provide just initial choices and actions. The seniors in 1980 would at best graduate from college in 1984, but common patterns of delayed completion of college imply that many of the sampled students would not graduate by then. The early observations in the HSB survey make it particularly difficult to observe a full set of employment decisions of potential teachers before the end of the panel. Because of movement into and out of teaching over extended periods of time for many in the teaching profession (Murnane *et al.*, 1991), this severely limits larger generalizations past those that derive from training decisions.

A focus of this analysis is the quality of individuals choosing teaching. This investigation cannot, however, observe actual teaching performance of any individuals, so the measurement of quality must rely on surrogates of future performance. The primary measure of quality of potential teachers employs the composite test score from the HSB battery of achievement tests taken in 1980. This composite score reflects reading, vocabulary, and mathematics proficiencies.

The primary motivation is studying the supply of high quality teachers, but we do not have an opportunity to observe directly the quality of classroom instruction by any of the sampled indi-

viduals. Indeed, nobody has ever been able to do that in a systematic way. It is plausible, however, to believe that "smarter" teachrs with higher achievement of their own could perform better in the classroom. This logic motivates one of the few studies of teacher supply that considers quality differences (Manski, 1987).[3] Tracing people by their observed achievement is further motivated by studies which suggest that teachers who score higher on basic achievement tests tend also to be better teachers. Separate studies of educational production functions tend to find some positive relationship between teacher and student measured achievement, although it is far from universal.[4] Moreover, achievement is fixed at high school, so that differential gains in achievement (whether directly related to college program or not) are not incorporated into the observed outcomes. Unfortunately, these data, in common with other available data, do not have any direct achievement measures after completion of postsecondary education.

This analysis begins with a descriptive overview of the path to teaching careers. It then turns to an investigation of whether or not the differences in requirements and rewards across states influence these observed patterns.

## 2. OVERALL TRANSITION PATTERNS

This section identifies the movement of students into and out of training programs for elementary and secondary teaching. Special attention is given to students who aspire to elementary and secondary teaching during their senior year in high school; their academic progress and evolving career aspirations are followed through college. This group has continually stronger attachment to the possibility of teaching than high school students or college entrants as a whole.

Special attention is given to the top of the achievement distribution. The comparison employed traces students who scored in the top quarter of the test distribution of those who ever attended a regular, academic post-secondary program during the first two years after high school graduation time. We prefer to use this fixed measure of the achievement distribution, but it is important to note that the empirical achievement distribution is anything but fixed. At each step of the educational process, there is a sorting and narrowing of performance differences. Table 1 describes the changes in the achievement distribution for the entire college population, regardless of career choices. The table vividly depicts the sorting process. While the overall sample and the achievement distribution are defined in terms of students who ever attended college — such that 50% would be in the top half and 25% in the top quartile, those continuing in school at each subsequent point are an ever more select group. We follow the high school class of 1980 over three two-year intervals. Two-thirds of those who have graduated from college by spring 1986 come from the top half of the distribution of initial attenders, and fully 42% come from the top quartile. Moreover, the selection process is even sharper for males, where over 46% of the graduates come from the top quartile of the initial distribution. These summary statistics of the achievement distribution provide a benchmark for consideration of the distribution of students opting for teaching careers.

This analysis is a snapshot; it looks at the progression of one cohort through their post-

**Table 1**. Achievement distribution of college attenders by ability[a] and gender ($n$ = 4509)

| College status (survey year) | Total | | Males | | Females | |
|---|---|---|---|---|---|---|
| | % top half | % top quartile | % top half | % top quartile | % top half | % top quartile |
| Attending college "sophomore year" (1982) | 52.8 | 30.4 | 57.0 | 34.1 | 49.1 | 27.1 |
| Attending college "senior year" (1984) | 62.3 | 37.5 | 65.0 | 40.8 | 59.6 | 34.1 |
| Graduate college (1986) | 66.6 | 42.3 | 68.2 | 46.4 | 65.1 | 38.4 |

[a] Ability distribution is based on reading, vocabulary, and mathematics test scores in 1980 of the sample of high school seniors who ever attended an academic postsecondary program by the time of the first HSB follow-up (1982).

secondary studies. As such, it cannot distinguish between time-specific factors and the normal transition and aging process. The subsequent investigation of variations in transition probabilities across different states, however, provides some indication of more fundamental driving forces.

We begin with the sample of students in their senior year of high school in 1980 and trace their path through college and through teaching preparation. Table 2 is divided into two parallel views of teachers engaged in preparation for teaching and, ultimately, in a teaching occupation by spring 1986. The left half of the table ("original aspirants") takes a fixed group of students — those high school students who aspired to a teaching job in elementary and secondary schools in their senior year of high school — and follows their actual choices. The right half of the table ("late aspirants") provides a similar set of snapshots for all those engaged in teacher preparation programs who were *not* original teaching aspirants before entering college. The sum of the two halves provides the total stock of students preparing for (engaging in) teaching at each point in time.

As Table 2 indicates, only a small proportion of high school students who aspire to teaching ever complete a bachelor's degree with a specialty in teaching and education. If we follow the group of original aspirants, we find that only 22% graduate by 1986 having completed a teacher preparation program.[5] Moreover, of the total students who graduate from teacher training, only slightly over two-fifths (41.4%) thought they would be teachers when they were in high school.[6] This is very important, because it suggests that simply looking at statistics of aspirants does not characterize very well who actually prepares for teaching. More sampled people than those completing teacher preparation are actually teaching in elementary and secondary schools in 1986,[7] and the representation of original aspirants in actual teachers is even lower.

There is a significant influx of people at each stage, but, not surprisingly, the biggest transition comes between the senior year of high school and sophomore year of college. As soon as two years later ("the sophomore year"), significantly less than half of those enrolled in actual teacher preparation programs at the college level aspired to teaching originally. This seems straightforward: Most people do not get their college academic program settled until they have attended college for some time.

Individuals who originally aspire to be teachers are below average for all college entrants in terms of high school achievement. Only 40% of aspirants are found in the top half of the achievement distribution defined by all students who ever attended college by 1982 (two years after graduation from high school). More important, there are noticeably fewer in the very top of the distribution — although there is significant representation of the best. About 17% of the aspirants are found in the top quartile of the achievement distribution.

From the original pool of people aspiring to teach, a disproportionate number of those eventually exiting come from the bottom portion of the distribution.[8] Thus, those who are left are more heavily weighted in the right half of the distribution. By graduation, half of students who maintain

**Table 2**. Teacher preparation transitions by ability[a] and aspirations: entire sample

| Status (year) | Original aspirants | | | Late aspirants | | |
|---|---|---|---|---|---|---|
| | % top half | % top quartile | n | % top half | % top quartile | n |
| Aspire to teach senior year HS (1980) | 40.2 | 17.4 | 352 | 0.0 | 0.0 | 0 |
| In teacher training (1982) | 45.5 | 21.6 | 130 | 36.2 | 11.2 | 232 |
| In teacher training (1984) | 45.1 | 16.8 | 93 | 55.5 | 24.3 | 203 |
| Graduate college, teacher prepared (1986) | 50.0 | 21.5 | 56 | 47.3 | 20.9 | 98 |
| Actively teaching (1986) | 51.5 | 33.1 | 64 | 63.3 | 25.9 | 159 |

[a] Ability distribution is based on reading, vocabulary, and mathematics test scores in 1980 of the sample of high school seniors who ever attended an academic postsecondary program by the time of the first HSB follow-up (1982).

teaching goals and graduate from a teacher preparation program come from the top half of the achievement distribution of all entering college students, and over 20% are from the top quartile of entering students. Moreover, of those actually teaching in elementary and secondary schools in the final survey (1986), a full third of the teachers come from the top quartile of the initial distribution. Thus, while some relatively weak people study education, graduation and actual employment apparently represent larger hurdles for the weak students, and the remaining group does not appear to be the "dregs" as some have suggested.

A similar pattern holds for the late aspirants. The injections into the system begin with low ability students in the sophomore year, indeed even lower than the initial original aspirants, but by graduation the people who switched into teaching during their college years look quite similar in distribution to those remaining students who always were pointed toward a teaching career.

The final shape of the distribution when one considers the award of a degree deserves special consideration. Many who are seeking teaching degrees have not received a BA degree by spring of the sixth year after high school graduation. Of the original aspirants, only two-thirds of those studying education in 1984 have graduated by 1986; similarly, about half of the late entrants studying education in 1984 have completed their degree requirements by spring 1986. Those failing to receive a degree, not surprisingly, tend to come from the lower half of the overall distribution. Thus, in terms of the shape of the distribution of graduates with teaching degrees, it is stronger than the original aspirants and, indeed, very close to a representative draw from the overall distribution of college attenders. (On the other hand, it may be that the HSB follow-up is too early to capture the full distribution of graduates. Indeed, the low achievers may eventually complete training — implying that the distribution of those prepared to teach is lower than that of the graduates found in spring 1986). Against this, the data in Table 1 for all college graduates (by 1986 in the HSB data set) indicate that two-thirds fall in the top half of the achievement distribution of college entrants, and 42% come from the top quartile. The graduates with teaching credentials come close to replicating the initial distribution of college students but fall noticeably short of matching the distribution of all college graduates.

The picture of teacher preparation varies sharply by gender. Table 3 displays the breakdown of transitions for males (part A) and females (part B). A number of generalizations are apparent. First, and quite obviously, males represent only a small part of the sample — about 20% of potential and actual teachers. Second, males that are committed to teaching in high school (the original aspirants) are higher in the achievement distribution at every observation point, although the new injections into teaching tend to be lower in achievement both than male original aspirants and than women who enter teaching preparation later. On net, at graduation time there are proportionately fewer males in the top half of the distribution but more in the top quarter. Third, women are much more likely than men to stay in teaching once they express an initial interest, even though the absolute continuation rates are low even for women. The picture that emerges from these observations is that teaching remains a "standard" occupation for women in ways that it is not for men, and men who graduate and enter teaching are somewhat more likely to come from the very top of the achievement distribution. Even this may be changing, however, as more and more occupations open to women. By 1990, for example, less than 11% of women college graduates age 20–29 were engaged in teaching, as compared to over 40% two decades before; the fall for males was much less, from 9% to 5.7% (see Hanushek and Rivkin [1994]).

The movements in and out of teacher training by gender tend to follow quite different patterns. For males, injections into training are generally lower in ability than original aspirants. For females, the opposite is true. The new female entrants into teacher training programs tend to be of higher ability than those who originally planned on a teaching career and who stay with it through graduation. Thus, looking only at people who aspire to teach in high school leads to downward biases in quality when based on females and upward biases when looking at males.

The patterns also differ sharply by race. The HSB data set permits separate analyses of the training of whites, Hispanics, and blacks. To put these data into perspective, however, we begin with the racial picture of overall college completion. Table 4 presents data reflecting the changing achievement distribution by racial group. Hispanics and blacks have much less representation in the top half and

**Table 3a**. Teacher preparation transitions by ability[a] and aspirations: males

| Status (year) | Original aspirants | | | Late aspirants | | |
|---|---|---|---|---|---|---|
| | % top half | % top quartile | n | % top half | % top quartile | n |
| Aspire to teach senior year HS (1980) | 53.3 | 22.3 | 64 | 0.0 | 0.0 | 0 |
| In teacher training (1982) | 61.7 | 33.7 | 12 | 41.9 | 11.1 | 59 |
| In teacher training (1984) | 69.8 | 34.0 | 13 | 46.5 | 19.9 | 62 |
| Graduate college, teacher prepared (1986) | 60.2 | 40.0 | 8 | 37.7 | 16.9 | 20 |
| Actively teaching (1986) | 60.2 | 45.5 | 8 | 63.2 | 26.8 | 35 |

[a] Ability distribution is based on reading, vocabulary, and mathematics test scores in 1980 of the sample of high school seniors who ever attended an academic postsecondary program by the time of the first HSB follow-up (1982).

**Table 3b**. Teacher preparation transitions by ability[a] and aspirations: females

| Status (year) | Original aspirants | | | Late aspirants | | |
|---|---|---|---|---|---|---|
| | % top half | % top quartile | n | % top half | % top quartile | n |
| Aspire to teach senior year HS (1980) | 37.7 | 16.4 | 288 | 0.0 | 0.0 | 0 |
| In teacher training (1982) | 44.0 | 20.5 | 118 | 34.8 | 11.2 | 173 |
| In teacher training (1984) | 41.7 | 14.4 | 80 | 59.7 | 26.4 | 141 |
| Graduate college, teacher prepared (1986) | 48.3 | 18.5 | 48 | 50.1 | 22.0 | 78 |
| Actively teaching (1986) | 50.2 | 31.3 | 56 | 63.3 | 25.7 | 124 |

[a] Ability distribution is based on reading, vocabulary, and mathematics test scores in 1980 of the sample of high school seniors who ever attended an academic postsecondary program by the time of the first HSB follow-up (1982).

**Table 4**. Achievement distribution of college attenders by race and ethnicity

| College status (survey year) | Hispanic | | Black | | White | |
|---|---|---|---|---|---|---|
| | % top half | % top quartile | % top half | % top quartile | % top half | % top quartile |
| Attending college "sophomore year" (1982) | 19.3 | 10.8 | 19.7 | 6.5 | 59.9 | 35.2 |
| Attending college "senior year" (1984) | 30.8 | 15.9 | 23.8 | 7.3 | 68.2 | 41.9 |
| Graduate college (1986) | 38.7 | 24.8 | 19.2 | 6.7 | 71.0 | 45.7 |

[a] Ability distribution is based on reading, vocabulary, and mathematics test scores in 1980 of the sample of high school seniors who ever attended an academic postsecondary program by the time of the first HSB follow-up (1982).

top quartile of the achievement distribution than do whites, but the interesting story is in the selection process over time. Hispanic students go through a selection process similar to whites such that by graduation there is over twice the percentage of students in the right tail of the distribution as there was initially (19.3 to 38.7% in the top half and 10.8 to 24.8% in the top quartile).[9] On the other hand,

the achievement distribution of blacks is virtually unchanged between entry and graduation from college — there is no selection!

Table 5 presents the teacher training patterns for blacks (Part A), Hispanics (Part B), and Whites (Part C). While the samples for minority groups are small, high quality (top half or top quartile) blacks exit from teaching throughout the process and are not replaced with high quality injections. Furthermore, a much smaller proportion of eligible blacks will stay with teaching careers than is found for whites. Again, while the samples get quite small, Hispanics are more likely than blacks to enter and to stay in teacher training programs. And, those who do enter teaching tend to be noticeably higher in the achievement distribution. These differences across racial and ethnic groups are consistent with the overall patterns of progress through college that were shown in Table 4.

Finally, in each of the descriptions of student flows, there was an apparent anomaly in that more individuals were actively teaching in 1986 than had graduated with teacher preparation. While this will be discussed further below, this appears to reflect largely the impact of nontraditional or alternative certification requirements. Further, a number of those who graduate with teacher preparation are not included in the category of active teachers, since obtaining a teaching degree is neither necessary nor sufficient for obtaining a teaching job.

## 3. FACTORS INFLUENCING TEACHER PREPARATION AND ENTRY

The previous descriptions of the flows into and out of teacher preparation programs and their completions give a coarse overview of entry into teaching. Nevertheless, they obscure what could be important differences based upon the detailed circumstances facing individual students. While these data do not permit looking at idiosyncratic demand considerations, they do permit looking at variations across states. Consequently, this provides an opportunity to look at some of the most debated issues of educational policy.

Individual states operate quite distinct policies with respect to certification requirements, work conditions and rules, and compensation. Indeed, many reform proposals begin with the notion of working through state-level policies. For example, one set of potential policies would improve the compensation and conditions of employment for teachers and would work to expand the pool of potential teachers. An alternative set of policies involves tightening the requirements for teaching, through such things as extended training requirements, testing programs, and the like. Other analyses suggest that stringent certification requirements based on course work and other preparation are ineffective in ensuring high student performance (Hanushek with others [1994]). Here, however, we focus on how these requirements affect the supply of potential teachers.

The analytical approach adopted here is to combine the High School and Beyond data with state level information about the structure of teaching requirements and pay for teachers.[10] We then employ these data to explain variation in the probability of preparing for teaching careers by variation in state requirements and economic conditions as well as in the background factors considered previously.

We concentrate on the probability that an individual will graduate with an education degree, given that they graduated from college by 1986. As noted above, obtaining a teaching degree is not the only route into teaching, but it is by far the most common. Of the elementary school teachers observed in 1986, only 3.4% had bachelor's degrees outside of education — although one quarter had yet to obtain a degree even though they were actively teaching. On the other hand, at the secondary level, 27.6% had degrees outside of education (and 19% had yet to graduate). Because the observations here are very early in any possible careers, it is not possible to identify with any precision who may or may not untimately enter teaching. Therefore, it is not possible to trace through the college preparation of those who do and do not eventually enter this field.

Our modeling work concentrates on three primary factors that have been featured in recent discussions of teacher supply policies: the amount of teacher-specific course work that is required for certification; the use of teacher tests for certification; and, the relative earnings of teachers. These matters, which are some of the most important policies controlled at the state level, have been highlighted for change, even though the recommended changes have not always pointed in the same direction.

As policy recommendations about course work

**Table 5a**. Teacher preparation transitions by ability[a] and aspirations: blacks

| Status (year) | Original aspirants | | | Late aspirants | | |
|---|---|---|---|---|---|---|
| | % top half | % top quartile | n | % top half | % top quartile | n |
| Aspire to teach senior year HS (1980) | 17.3 | 7.5 | 66 | 0.0 | 0.0 | 0 |
| In teacher training (1982) | 24.1 | 0.0 | 13 | 0.44 | 0.0 | 43 |
| In teacher training (1984) | 0.0 | 0.0 | 7 | 10.6 | 0.3 | 37 |
| Graduate college, teacher prepared (1986) | 0.0 | 0.0 | 5 | 0.0 | 0.0 | 13 |
| Actively teaching (1986) | 0.0 | 0.0 | 5 | 3.5 | 0.3 | 25 |

[a] Ability distribution is based on reading, vocabulary, and mathematics test scores in 1980 of the sample of high school seniors who ever attended an academic postsecondary program by the time of the first HSB follow-up (1982).

**Table 5b**. Teacher preparation transitions by ability[a] and aspirations: Hispanics

| Status (year) | Original aspirants | | | Late aspirants | | |
|---|---|---|---|---|---|---|
| | % top half | % top quartile | n | % top half | % top quartile | n |
| Aspire to teach senior year HS (1980) | 6.5 | 4.6 | 83 | 0.0 | 0.0 | 0 |
| In teacher training (1982) | 10.2 | 9.8 | 30 | 12.4 | 1.0 | 57 |
| In teacher training (1984) | 13.5 | 12.3 | 17 | 16.3 | 4.6 | 40 |
| Graduate college, teacher prepared (1986) | 2.1 | 2.1 | 7 | 15.2 | 0.0 | 22 |
| Actively teaching (1986) | 33.4 | 30.5 | 9 | 21.5 | 9.3 | 35 |

[a] Ability distribution is based on reading, vocabulary, and mathematics test scores in 1980 of the sample of high school seniors who ever attended an academic postsecondary program by the time of the first HSB follow-up (1982).

**Table 5c**. Teacher preparation transitions by ability[a] and aspirations: whites

| Status (year) | Original aspirants | | | Late aspirants | | |
|---|---|---|---|---|---|---|
| | % top half | % top quartile | n | % top half | % top quartile | n |
| Aspire to teach senior year HS (1980) | 46.2 | 20.0 | 190 | 0.0 | 0.0 | 0 |
| In teacher training (1982) | 50.4 | 24.7 | 85 | 42.2 | 13.3 | 122 |
| In teacher training (1984) | 48.0 | 17.6 | 68 | 62.7 | 28.2 | 123 |
| Graduate college, teacher prepared (1986) | 53.2 | 22.7 | 43 | 52.0 | 24.0 | 62 |
| Actively teaching (1986) | 54.3 | 34.6 | 48 | 71.9 | 30.7 | 89 |

[a] Ability distribution is based on reading, vocabulary, and mathematics test scores in 1980 of the sample of high school seniors who ever attended an academic postsecondary program by the time of the first HSB follow-up (1982).

requirements have moved in many conflicting directions, uncertainty has increased. States periodically review their requirements and frequently call for new and additional course work for teacher preparation. Other arguments suggest, however, that undergraduate course work requirements should be lowered significantly. Such requirements, the argument goes, crowd out other undergraduate courses, cutting into the development of subject matter knowledge and creating potentially adverse supply effects through cutting off other career possibilities in order to prepare for teaching.

Those advocating loosening the requirements for undergraduate preparation split, however, on where to take these recommendations. Some feel that relaxing or eliminating the undergraduate requirements should go hand in hand with a new requirement of master's level training in education (cf. Carnegie Forum [1986], Holmes Group [1986]). Others believe that alternative strategies such as New Jersey's Provisional Teacher Program offer much more hope (Murname *et al.* [1991]). Again, while this work cannot assess the outcomes of teacher training requirements in terms of student learning,[11] it can look at the effects of different requirements on the supply of trained teachers.

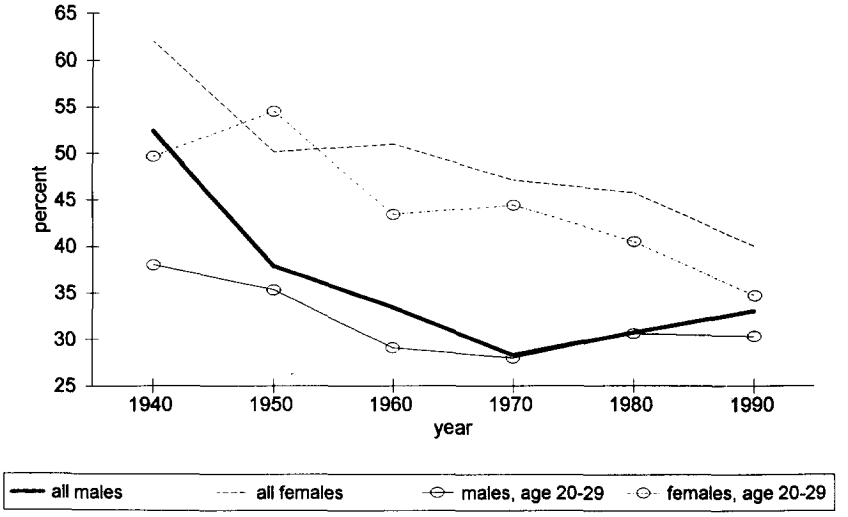
The testing of teachers is another controversial area. Since 1980, a majority of states have enacted legislation requiring teachers to take and pass a test before initial certification. The most common test is the National Teacher Examination (NTE), but a number of states have developed alternatives. A variety of questions has been raised about this. Are teacher test performance and teaching performance highly correlated? Are the tests disciminatory? Do the tests erect an artificial barrier to entry into teaching? While we cannot look at the larger issues, we can look at whether the use of such tests influences student decisions on teacher preparation.

Finally, the most frequently suggested policy for improving the quality of the teaching force is to increase the compensation of teachers (see, for example, Carnegie Forum [1986]). The relative salaries of teachers, displayed in Figure 1 and Table 6, fell noticeably since World War II. The pattern is, however, a bit different than conventional wisdom typically suggests. Most of the fall came before 1960 for men, and salaries have since recovered somewhat compared to alternative occupations for college graduates. For women, and particularly for young women, the relative declines are much more recent and hold when compared to both college graduates and all nonteaching females (see Hanushek and Rivkin, 1994). As figure 1 indicates, the expansion of alternative opportunities for women outside of teaching has driven the relative position of teaching jobs down to that of men.[12] The policy argument remains, nonetheless, straightforward: Higher salaries will attract a larger and more qualified pool of applicants. It is possible to look at this hypothesis by observing variations in the relative earnings of teachers compared to other occupations.

Our statistical analysis considers how these various factors affect the probability of completing a teacher training program. The variable definitions and descriptive statistics are found in Table 7 and probit estimates of student decisions for teacher training appear in Table 8. Overall, by 1986 12.5% of the college graduates were prepared for teaching careers. The probit estimates in Table 8 indicate the marginal effects of each factor. The separate columns vary in the characterization of state factors that influence teacher preparation. The first column considers just the effects of the number of required professional credits in undergraduate training and the use of either the NTE test or a state test for certification; the second column adds the relative earnings of teachers in each state; and the third and fourth allow for interactions between student race and test requirements. In general, the estimates are very stable across specifications, so we will simply report the results from column 2 unless otherwise indicated.

The top portion of Table 8 provides a multivariate extension of the previous descriptive analyses of student choices. Quite clearly, those preparing for teaching are heavily concentrated among white females. At the sample means, the white male preparation rate is 10 percentage points lower. Similarly, Asians (18.2 percentage points) and blacks (9.2 percentage points) are more likely to train in fields other than teaching.

Holding constant race and gender, people scoring higher on the base year test score are less likely to enter teaching. A move from the mean to one standard deviation above the mean on the base year test score implies a 5.5 percentage point decline in the probability of training for teaching. Again, this negative influence of ability is consistent with the observation that graduates are an ever more select group of the population. Even though graduates




**Percent College Educated Workers Below Average Teacher Earnings: by sex , age**

**Table 6**. Earnings comparisons of teachers and non teachers: by sex and education, 1940–1990

| | % nonteacher college graduates earning less than average teacher | | % all nonteachers earning less than average teacher | |
|---|---|---|---|---|
| Year | females | males | females | males |
| 1940 | 60.7 | 52.4 | 89.5 | 84.3 |
| 1950 | 50.1 | 37.8 | 82.6 | 72.3 |
| 1960 | 51.0 | 33.4 | 86.2 | 68.8 |
| 1970 | 47.1 | 28.3 | 87.0 | 65.4 |
| 1980 | 45.7 | 30.7 | 77.6 | 50.2 |
| 1990 | 40.0 | 33.0 | 71.5 | 55.7 |

Note: All comparisons are weighted by age distribution of nonteachers.
Source: Hanushek and Rivkin, 1994.

with teaching degrees are higher ability than those who ever dabble with teacher training in college or ever aspire to teach, they are below the average graduate.

The bottom portion of the table is concerned with the direct state policy instruments discussed previously. The requirements for professional credits (PROFCRDT) vary quite widely across states with the average being 19 credits and a standard deviation of over 11 credits. An increased requirement lowers the probability of completing a teacher's preparation curriculum, with an added 10 credits reducing teaching preparation by 1.2 percentage points. These estimated effects are significantly different from zero at the 10% level.

The use of certification tests also reduces teacher training. Other things being equal, teacher preparation will be 4 percentage points lower in a state requiring either the National Teachers Examination (NTE) or another state-wide test. This measure is clearly quite crude, because it does not indicate the differential difficulty in passing these.[13] Nonetheless, these requirements have strong effects on teacher preparation, reducing teacher training on average by a third. Murnane *et al.* [1991] suggest that the use of certification tests may have differential effects on minorities, particularly blacks. To analyze this, the last two columns of Table 8 include an interaction between whether or not the student is black and the state's use of a certification test. While

**Table 7**. Variable definitions, means, and standard deviations for teacher preparation models (n = 1325)

| Variable | Mean (SD) | Definition |
|---|---|---|
| Male | 0.438 (0.496) | = 1 if male; = 0 if female |
| Hispanic | 0.155 (0.362) | = 1 if Hispanic of Spanish; = 0 otherwise |
| Indian | 0.005 (0.073) | = 1 if American Indian or Alaskan Native; = 0 otherwise |
| Asian | 0.048 (0.214) | = 1 if Asian or Pacific Islander; = 0 otherwise |
| Black | 0.152 (0.359) | = 1 if African–American; = 0 otherwise |
| Base test score | 55.96 (7.44) | Student combined mathematics, reading, and vocabulary test score, base year (1980) |
| TEST | 0.435 (0.496) | = 1 if state requires testing for initial certicication; = 0 otherwise (Source: Goertz, Ekstrom and Coley [1984]) |
| PROFCRD | 18.91 (11.47) | Number of professional education credits required by state for certification (Source: Woellner, 1982) |
| RELEARN | 1.011 (0.095) | Mean starting teacher salary from 1980 HSB survey relative to mean 1980 Census annual earnings of all females age 25–34 with 4 years college by state |

**Table 8**. Probit estimates of the probability of earning a Bachelor's degree in education conditional upon receiving a Bachelor's degree (standard errors in parentheses) [n = 1325; mean probability = 0.125]

| Variable | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| Male | −0.645# | −0.646# | −0.646# | −0.647# |
| | (0.11) | (0.11) | (0.11) | (0.11) |
| Hispanic | −0.242† | −0.222 | −0.260* | −0.238 |
| | (0.15) | (0.15) | (0.15) | (0.15) |
| Indian | −0.105 | −0.111 | −0.133 | −0.143 |
| | (0.58) | (0.58) | (0.58) | (0.58) |
| Asian | −1.176# | −1.169# | −1.19# | −1.18# |
| | (0.44) | (0.44) | (0.44) | (0.44) |
| Black | −0.596# | −0.587# | −0.404* | −0.376† |
| | (0.16) | (0.16) | (0.20) | (0.21) |
| Base test score | −0.048# | −0.048# | −0.049# | −0.049# |
| | (0.01) | (0.01) | (0.01) | (0.01) |
| TEST | −0.258* | −0.245* | −0.195† | −0.173 |
| | (0.11) | (0.11) | (0.11) | (0.12) |
| PROFCRDT | −0.008† | −0.008† | −0.008† | −0.008† |
| | (0.004) | (0.004) | (0.004) | (0.004) |
| RELEARN | | 0.377 | | 0.487 |
| | | (0.52) | | (0.52) |
| Black × TEST | | | −0.435 | −0.472 |
| | | | (0.30) | (0.30) |
| Intercept | 2.040# | 1.625* | 2.062# | 1.528* |
| | (0.44) | (0.72) | (0.44) | (0.72) |

Statistical significance: †p <0.10; *p < 0.05; #p < 0.01.

these estimates indicate a negative interaction — i.e., that black students react more strongly than others to the use of these tests, the estimated effects are statistically insignificant. (The statistical insignificance may simply reflect the relatively small samples and limited variation).

Finally, the models also consider the effect of relative teacher earnings. This measure compares

HSB data on entry salaries for teachers with average earnings of female college graduates age 25–34 in each state. While the point estimates indicate that higher relative earnings elicit a positive supply response, the magnitude is extraordinarily small, and the effects are not significantly different from zero. These negligible earnings effects could be explained by measurement difficulties. The earnings measures differ only by state and refer to 1980. Thus, if individuals have different expectations based either on more local information or on their forecasts of the future, these estimates could be biased downward. Nevertheless, they suggest that overall salary actions will not have a large short run effect on training and supply.

These results about relative earnings do differ from some previous analyses that concentrate on people already in teaching jobs. Baugh and Stone (1982) find that active teachers respond to below market earnings by changing occupations.[14] Murnane *et al.* (1991) similarly find that relative earnings affect retention by teaching speciality. Zarkin (1985) concentrates more on long run expectations formed from projections of future demand and finds that teachers react to long run earnings possibilities. Each of these analyses, however, begins with people who have already gone through teacher training and have already entered the teaching profession. While some consistency of wage effects between training decisions and occupational change decisions would be expected, these analyses of behavior of teachers show noticeably different behavior than that of college students contemplating entering teaching. None look at the effects of differential certification requirements and economic conditions across states.

Because of the special concern about high ability students and their choices, the preceding analysis was duplicated for students in the top quartile of those attending college. Of the 499 students in the top quartile who graduated from college by 1986, 6.2% completed teacher training (as compared to 12.5% for the entire population of graduates). Interestingly, however, the estimated probit models of choice for the top quartile are not significantly different from those for the rest of the population.

In the course of the investigation, several other characteristics of state programs were examined. The TEST variable was disaggregated into the NTE and other state-specified tests; variables indicating the use of forgivable loans for students in education programs and for the requirement of eventually obtaining a master's degree for full certification were introduced; and, the measure of course requirements was expanded to include those outside the education field. None of these proved significant in the analyses. This result, however, may simply reflect the crudeness of the measures and the limited variation in requirements across the states.

The choice models were also disaggregated to reflect earlier choices made by these students. Table 9 presents estimates of three separate submodels: the probability of initially entering a teacher training program in 1982; the probability of remaining in a teacher training program through 1984; and the probability of entering a teacher training program for the first time in 1984.

These models give similar results to the graduation models with a few notable exceptions. The relative earnings of teachers in the state has a statistically significant impact on the initial choice of teacher preparation in 1982 (column 1), although the magnitude of the effect is small. A change of relative teacher earnings of 10% (the cross-sectional standard deviation) would imply a 0.7 percentage point increase in 1982 teacher preparation. When traced through until completion of training, the implied effect on eventual supply is thus quite small. Both certification requirements (TEST and PROFCRDT) depress the probability of teacher training, but they are statistically insignificant in these estimates.

Continuation in teacher training (column 2) is also affected significantly by relative earnings. A 10% increase in relative earnings would imply a 5 percentage point increase in continuation rates (with a mean continuation rate of 65%). The continuation models also indicate that the use of certification tests depresses the rate by 9.7 percentage points. Finally, within the relatively small sample used to estimate the continuation model (311 students in teacher training in 1982), higher ability students in terms of base test scores tend to continue their teaching programs more frequently than do lower ability students. This anomalous result may simply reflect the fact that lower ability students are more likely to drop out of school.

The state certification requirements and economic conditions have one irregularity in the model of late entrants into teaching (column 3). Students who were not enrolled in teaching preparation programs in 1982 are more likely to enter by 1984 if the state

**Table 9**. Probit estimates of transition probabilities (standard errors in parentheses)

| Variable | Teacher training 1982[a] | Teacher training 1982 and 1984[b] | Teacher training 1984 only[c] |
|---|---|---|---|
| Male | −0.638# | −0.461* | −0.258* |
| | (0.07) | (0.19) | (0.10) |
| Hispanic | −0.173* | 0.129 | −0.228 |
| | (0.08) | (0.20) | (0.15) |
| Indian | −0.238 | 0.116 | −0.190 |
| | (0.26) | (0.59) | (0.49) |
| Asian | −0.564# | −0.782 | −0.890* |
| | (0.18) | (0.54) | (0.38) |
| Black | −0.584# | 0.107 | −0.343* |
| | (0.09) | (0.25) | (0.15) |
| Best test score | −0.029# | 0.024* | −0.027# |
| | (0.004) | (0.01) | (0.01) |
| TEST | −0.009 | −0.265† | 0.212* |
| | (0.06) | (0.16) | (0.11) |
| PROFCRDT | −0.001 | −0.004 | −0.006 |
| | (0.003) | (0.01) | (0.005) |
| RELEARN | 0.557† | 1.373† | 0.288 |
| | (0.29) | (0.72) | (0.52) |
| Intercept | −0.026 | −1.952* | −0.281 |
| | (0.39) | (0.97) | (0.71) |
| Sample | 4050 | 311 | 2142 |
| Mean probability | 0.084 | 0.653 | 0.041 |

Notes: [a]Probability of being in teacher training program in 1982 given that the student entered some academic postsecondary program.

[b]Probability of being in a teacher training program in 1984 given that the student was enrolled in a teacher training program in 1982.

[c]Probability of being in a teacher training program in 1984 given that the student was not enrolled in a teacher training program in 1982.

Statistical significance: † = $p < 0.10$; * = $p < 0.05$; # = $p < 0.01$.

uses testing for certification (TEST). There is no obvious explanation for this, since, among other things, those with higher base tests still tend to enter teacher preparation less frequently.

The final investigation considers the probability of teaching in an elementary or secondary school sometime by 1986.[15] These models, comparing those in the teaching profession with all college graduates, are presented in Table 10. The results are very similar to those explaining the completion of teaching training (Table 8), which is not surprising since teacher training is chosen by some 69% of those who enter teaching. The very partial nature of these findings must, however, be emphasized. The HSB data permit only a preliminary look at career choices and patterns because of the survey timing. The students sampled frequently have not finished college within four years of high school graduation, and those who have finished frequently have not settled into a career. Moreover, 1985 and 1986 were years of weak demand for new teachers. Thus, these estimates should not be interpreted as indicating the full pattern of teacher supply.

There are two important differences in these results compared to the earlier ones. First, actual teaching, which involves both the supply and demand sides of the market, is less biased toward low ability students. Specifically, even though student performance on the cognitive tests is still negatively related with entry into teaching, the quantitative effect is less for entry as opposed to teacher preparation. Second, the number of professional credits no longer exerts a statistically significant effect on teacher supply — presumably related to the fact that these requirements have less effect on the 20% of the sample who do not enter teaching through teacher training programs.

The existence of teacher certification tests still has a depressing effect on teacher supply. Indeed, testing has an even stronger depressing effect on actual entry into teaching in the schools as compared to completion of teacher training.

**Table 10.** Probit estimates of the probability of teaching in an elementary or secondary school by spring 1986 conditional upon receiving a Bachelor's degree (standard errors in parentheses) [n = 1299; mean probability = 0.124]

| Variable | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| Male | −0.476# | −0.476# | −0.475# | −0.475# |
| | (0.098) | (0.098) | (0.098) | (0.098) |
| Hispanic | −0.147 | −0.143 | −0.157 | −0.151 |
| | (0.141) | (0.143) | (0.141) | (0.143) |
| Indian | −0.027 | −0.028 | −0.042 | −0.044 |
| | (0.585) | (0.585) | (0.585) | (0.585) |
| Asian | −0.075 | −0.072# | −0.086 | −0.082 |
| | (0.224) | (0.225) | (0.224) | (0.225) |
| Black | −0.203 | −0.202 | −0.107 | −0.100 |
| | (0.146) | (0.146) | (0.188) | (0.190) |
| Test score | −0.018# | −0.018* | −0.018# | −0.018# |
| | (0.007) | (0.007) | (0.007) | (0.007) |
| ANYTEST | −0.250# | −0.247* | −0.216* | −0.209† |
| | (0.098) | (0.100) | (0.107) | (0.110) |
| PROFCRDT | −0.001 | −0.001 | −0.001 | −0.001 |
| | (0.004) | (0.004) | (0.004) | (0.004) |
| RELEARN | | 0.071 | | 0.127 |
| | | (0.503) | | (0.507) |
| Black × TEST | | | −0.209 | −0.219 |
| | | | (0.266) | (0.269) |
| Intercept | 0.169 | 0.090 | 0.181 | 0.040 |
| | (0.409) | (0.692) | (0.410) | (0.694) |

Statistical significance: †p <0.10; *p < 0.05; #p < 0.01.

These latter models of course become more complicated because they combine both student choices and school system choices. The demand for teachers is directly related to changes in student populations, teacher retirements, subject area demands, and quality judgments of school officials. The models here do not separate demand and supply sides of the market and are thus best interpreted as reduced form relationships.[16] Nonetheless, they provide consistent patterns to those found for student choices of training programs.

## 4. INTERPRETATION AND CONCLUSIONS

This study stops considerably short of uncovering what we would like to know about teacher supply. It finds a number of factors that affect teacher preparation and thus teacher supply. It cannot, however, easily carry this through to statements about ultimate impacts on student learning.

The descriptive analysis and the subsequent models of student choice underscore what has been conventional wisdom. White females are much more likely to complete teacher preparation than males or members of racial and ethnic minority groups. Moreover, lower ability students as measured by cognitive achievement tests are more likely than higher ability students to enter teaching.

The most significant findings, however, relate to state requirements. The barriers that states set up for certification indeed inhibit supply. The prospect of taking an examination for certification lowers the rate of teacher preparation, everything else equal. Likewise, increased course requirements for professional education depress supply. Nothing of course is said here about whether or not these are appropriate (although others have argued tht these requirements are not). These results merely indicate that such requirements are costly in terms of a smaller pool of trained teachers.

The results for the effects of teacher salaries do not indicate that this is a particularly powerful influence on student choices. Even though relative earnings of teachers compared to all college graduates vary considerably across the Nation, they do not have a large or statistically significant impact on student preparation for teaching.

The preliminary glimpse at actual entry into the teaching profession shows similar patterns across states. The use of teacher examinations for certifi-

cation purposes has the clearest impact on lessening supply. Nonetheless, the data on actual teaching come too early in potential careers to give a very complete picture of what supply ultimately will look like; thus these results should be considered preliminary.

Ultimately we need to merge information about actual teaching ability with information about factors affecting supply. Such a statement is obviously much more easily stated than accomplished. All of the analytical work on schools and educational performance suggests that the simple, commonly measured attributes of teachers such as degree level or amount of teaching experience is not closely related to the classroom performance of the teacher (Hanushek, 1986, 1989). Given this, direct estimation of supply functions for teachers is very difficult.

The quality measure of this study — cognitive test performance of students prior to college entry — has two problems. While teacher ability is somewhat related to student performance, it is far from perfect. Additionally, these are tests given prior to attending college, thus ignoring any differential value-added by college experiences.

All of these arguments suggest that the study of teacher supply must be more directly related to actual classroom performance. The research design that accomplishes this is quite complicated. Moreover, the only direct method may involve some degree of experimentation. But even that has difficulties if one wishes to trace through the full response of student decisions and the like.

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## NOTES

1. See, for example, the discussion in the Carnegie Forum (1986) report calling for significant increases in teacher salaries, justified in part by the comparision of SAT scores of college bound students. Similar analyses of prospective teachers employing the ACT test are found in Weaver [1983], although that study acknowledges possible supply changes during undergraduate schooling.
2. A separate part of the HSB dataset obtained information on students who were sophomores in 1980, but this panel is not used here.
3. Consideration of policy aspects of teacher tests is renewed by Strauss (1994) in an analysis of Pennsylvania teachers.
4. See the overall description of such studies and the summary of results in Hanushek (1986, 1989). The studies finding a positive and significant relationship between teacher test score and student performance number 8 out of 31 separate estimates; another 10 studies find positive but insignificant effects of teacher test scores. More recent work not surveyed also shows mixed results; cf. Ferguson (1991) and Hanushek (1992).
5. In all cases, the descriptive statistics are weighted according to the sample weights provided in the HSB data. This weighting is important because the HSB data were not derived from a representative national sample but instead oversampled certain types of schools and student types.
6. Note, however, that those aspiring to a teaching career in high school are still much more likely than the remaining population to prepare for teaching. Specifically, the portion of the HSB sample that we employ includes 4509 students who attended some academic postsecondary schooling by the first follow-up in spring 1982.
7. This larger number of people teaching presumably reflects both varying certification requirements and waivers of preparation requirements (either temporary waivers or those included in alternative certification arrangements).
8. Note, again, that the left half of Table 1 includes an almost fixed population — those originally aspiring to a teaching career. (A few people exit from school or from teacher training in 1982 and re-enter later). Therefore, ignoring re-entrants, as this group is traced over time, a rising mean (or portion in the top of the distribution) comes from people lower in the distribution exiting.
9. The cut-off points on achievement distribution are defined in terms of the entire population (not separated by gender or race).
10. To do this analysis, we combine High School and Beyond data with information on state certification requirements found in Woellner [1982] and Goertz, Ekstrom, and Coley [1984]. Because the HSB does not provide direct information on state of residence for students, we employ the Hanushek and Taylor [1990] algorithm to determine the state of residence. This algorithm uses identification of colleges attended by students in a school to infer the state location.

11. Hanushek [1989] provides evidence that currently offered graduate training for teachers is quite ineffective. There is little or no evidence to suggest that teachers with advanced training do better in the classroom than those with just a bachelor's degree.
12. In 1970, 40.6% of female college graduates age 20–29 were teachers. By 1990, the comparable figure was 10.9%.
13. Murnane *et al.* [1991] provide evidence that the stringency of the cut-off score employed has important effects on supply. Thus, the measurement of just the use of such a test is a very crude indication of the importance of this factor across states and over time.
14. Current Population Survey data are used to estimate a standard "Mincer" human capital model for all workers. Residuals are then used to explain whether or not teachers leave teaching occupations. A separate analysis of Oregon teachers confirms sensitivity of teachers to wage differentials but does not address certification requirements.
15. Similar models were also estimated to examine those teaching in Spring 1986 (as opposed to ever having taught). These models were very similar in statistical terms and quantitative estimates to those presented and thus are not reproduced here.
16. Attempts to model both supply and demand of teachers include Boardman, Darling-Hammond, and Mullin (1982), Strauss (1993), and Flyer and Rosen (1994). Both Boardman, Darling-Hammond and Mullin and Flyer and Rosen provided general analysis, but lack information about state-specific requirements and conditions for teaching. The analysis by Strauss, which concentrates on just a single state, cannot investigate state policies such as credit requirements or use of teacher tests because there is no variation within the sample. Our modeling efforts did include measures of the growth in K-8 and K-12 populations by state during 1980–87 to capture demand influences, but these were never significant.

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