DO ALTERNATIVE OPPORTUNITIES MATTER? THE ROLE OF FEMALE LABOR MARKETS IN THE DECLINE OF TEACHER SUPPLY AND TEACHER QUALITY, 1940-1990*

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ABSTRACT

This paper explores the impact of the expansion in professional opportunities that American women faced on teacher supply and teacher quality. Using standardized test scores, undergraduate institution selectivity, and positive assortative mating characteristics as measures of quality, evidence of a marked decline in the quality of young women going into teaching is documented. In contrast, the quality of young women becoming professionals increased. The more teachers are paid relative to professionals, the more likely educated women and blacks are to choose to teach. When wage opportunities in teaching become relatively less attractive, the quality of teachers and prospective teachers declines. These effects of relative earnings are economically significant.

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I. Introduction

Over the last century and particularly since World War II, labor market opportunities for educated women in the United States expanded substantially. While real wages conditional on education and experience have grown for all women, wage increases are notably higher among college-educated women [Goldin 1997; Pencavel 1998; Smith and Ward 1984, 1989]. Within professional occupations, women's wages also rose relative to those of men [Black and Juhn 2000]. These wage gains produced not only increased labor force participation among women, but also led to a rising share of women in traditionally male professional occupations [Black and Juhn 2000].

What implications did this expansion in professional opportunities have on the teaching profession, traditionally the primary occupation for educated women? As women have responded to the rise in these opportunities and joined the professions, declining proportions of such women choose to go into teaching. These changes are particularly striking among new labor market entrants; that is, those between ages 21 to 30. Among such young college graduate women in 1940, 30 percent of whites and 45 percent among blacks were teachers[1] (also see Figure II). By 1990 less than 10 percent of young college graduate black and white women were schoolteachers. This trend contrasts sharply with the only slightly declining trend among white men. In comparison, fewer than 10 percent of young college graduate women were in the professions in 1940.[2] By 1990 this had grown to 40 percent.

Various measures of quality also indicate a change in the skill mix across teaching and the professions. Calculations using the National Longitudinal Surveys show that, across the early 1940's and the mid 1960's birth cohorts, high quality individuals increasingly choose not to teach. In particular, among those that scored in the highest quintile on standardized exams, the fraction that became professionals increased by 22 percentage points, while the fraction that became teachers declined by 21 percentage points (see Figure III broken down by race and gender). In addition, the fraction of college freshmen from highly selective institutions that were prospective teachers declined from 1971 to 1995, as prospective teachers were increasingly being drawn from institutions of low to medium selectivity (see Figures IV & V). Again these trends are strikingly different from those among white men.

One purpose of this paper is to document these important changes in the composition of women employed in teaching. Another goal is to investigate the associations between these occupational choice patterns, the decline in teacher quality, and the variation in relative wages. As alternative opportunities for young women expanded over time, the earnings differential between teachers and professionals grew; in 1940 the average young female professional earned less than the average female teacher and by 1990 she earned more. Using geographic and time-series variation, I test to see if these declines in relative teacher wages and relative wage growth can help to explain these changes in employment in teaching. I use three sets of data sources: the Integrated Public Use Microdata Series of 1940-1990 (IPUMS), the National Longitudinal Surveys of Young Men, Young Women, and Youth-79, and the Cooperative Institutional Research Program (CIRP) Freshman Surveys from 1971-1995. I am particularly interested in estimating the effect of changes in teacher wages *relative* to alternative professions on teacher supply and quality, in order to determine whether raising relative teacher wages might attract more teachers, and especially more high quality teachers.

Labor economists have long argued that increases in female real wages account for a substantial proportion of the growth in the overall female labor force [Goldin 1990; Mincer 1962; Smith and Ward 1989]. Nevertheless few economists have studied the effect of the changes in alternative female wage opportunities on employment in teaching, traditionally a female-dominated sector.[3] Understanding the impact of changes in the female labor market on employment in teaching is important not only for establishing what happened to women and how labor markets work, but also for its potential relevance in accounting for changes in school quality. Because teachers constitute a major input in education production in terms of their factor share, the erosion of teacher quality over time that is documented below could have had a big effect on school quality.[4] In addition, there is a perception that teachers today are less qualified than they once were because of the greater professional opportunities available to women. Given that school boards and legislators cannot simply mandate improvements in the quality of new teachers, it is important to study how potential teachers respond to the various incentives that might be offered them. Policymakers and researchers also debate whether paying teachers more would induce

more highly skilled women to enter the profession. For example, studies by Ballou and Podgursky [1997] find that raising teacher wages have little to no effect on teacher quality, while Figlio [1997] finds that they do.

Indeed I find that the more teachers are paid relative to professionals, the more likely educated young women are to choose to teach. Moreover, as wage opportunities in teaching become relatively less attractive, the ability of teachers and prospective teachers declines. These estimated wage effects are positive across the conditional test score distribution, particularly among teachers at the upper end. The effects I estimate are quite substantial. Ceteris paribus, I find that a 10 percent increase in entry teacher earnings raises the probability that young college-educated women choose teaching by 3 to 15 percent for blacks and 2 to 13 percent for whites. Women are also more sensitive to wage changes than are men. These results are robust to controls for labor market specific and time specific effects, as well as to the use of state-level variation in the school-age population and in lagged industrial structure as instrumental variables.[5]

These results are consistent with the interpretation that the availability of opportunities affects employment in teaching. Despite the overall growth in real wages paid to teachers, these real wage increases have not kept up with the growth in alternative professional occupations.[6] As other opportunities improved for women and blacks, fewer chose to teach, and those who did teach tended to be less skilled. Results also suggest that demand-side shocks drove these changes, in particular, industrial shocks that favored more able individuals and women, similar to findings by Blau & Kahn [1997].[7]

The organization of this paper is as follows. Section II describes the changes over time in the employment in teaching, as well as across regions and demographic groups. Section III briefly presents the literature, and Section IV discusses a model of occupational choice. I outline the empirical issues in Section V. Estimated results are reported in Sections VI and VII. Section VIII follows with a discussion of alternative interpretations to the results and other caveats. Finally, Section IX summarizes and concludes.

II. Trends in the Teacher Market, 1940-1990: A Descriptive Analysis

In order to illustrate why relative wages may be a significant contributor in accounting for changes in the employment of women in teaching, I begin by looking at trends in teacher participation rates, teacher quality, and then relate them with national wage trends. Unless otherwise noted, I base the descriptive analysis on individuals aged 21 to 60 with at least two years of college from the 1940-1990 1-percent census samples (IPUMS) further described in the Data Appendix. All statistics are weighted to reflect the U.S. population.

A. The Decline in the Employment of Women in Teaching

With the rise of women professionals fewer college-educated women are found in teaching. As seen in Table I, the proportion of black and white women with at least 2 years of college in teaching declines markedly over time. At the beginning of the period a much higher fraction of women than of men are teachers. There has been no obvious defeminization of the teaching workforce, however. Using administrative data from public schools, the percentage of all teachers that are female has remained fairly stable--at 69 percent in 1960/61 to 72 percent in 1990/91.[8]

The declines in the proportions of women that teach are also not uniform across race, cohorts, regions, and over time. The proportion for white women declines from 21 to 15 percent between 1940 and 1950 before rising to 25 percent over the 1950s and 1960s. This increase reflects the intensive hiring of teachers during those decades as school systems moved towards smaller class sizes and the baby boom cohorts had to be accommodated. The exit of the boomer cohorts undoubtedly contributes to the dramatic decline between 1970 and 1990. In 1970, about 25 percent of young white women are teachers as well as 32 percent of young black women. By 1990, only 8 to 9 percent among these women are teachers. The decline in the proportion of women teaching also occurred within as well as across cohorts, particularly for cohorts born after 1940. As cohorts got older, fewer among them are teaching.[9] Because the decline over time across recent entrants to the labor force, those aged 21 to 30 by the census enumeration is particularly pronounced, the fact that the stock of teachers encompasses multiple cohorts means that the change over time may be slow to show in the stock of potential workers.

Table II focuses on flows of new entrants and reports the fraction of 21 to 30 year olds within education groups who are teachers by region and race. Four findings are particularly noteworthy. The decline between 1970 and 1990 occurs everywhere and across all groups, but is especially pronounced for women in general and among blacks in the South. College-educated blacks (women and men) are more likely to be in teaching than their white counterparts, especially before 1970. Regional differences in those who teach are also highlighted in Table II—women in the South and Midwest are more likely to be teaching. A fourth interesting finding from Table II is that black men's patterns are more similar to those of white and black women than to those of white men. These trends appear to be consistent with a story that the availability of opportunities affects employment in teaching. In areas or time periods with fewer alternative opportunities, a larger percentage of the college-educated population chooses to teach. [10]

B. The Rise of Women Professionals

If the proportion of college-educated women who become teachers has declined over time, what occupations did college-educated women choose instead? The decline of the employment of women in teaching is striking not only when compared to the slight decline for white men, but particularly in the context of rising female employment in traditionally male professions. The share of women entering professions such as engineering, medicine and the law grew rapidly after 1960. As seen in Table III, the proportion of young college-graduate women in these occupations increased by 33 percentage points among whites between 1960 and 1990, and by 29 percentage points among black women, compared to the slight increase of 9 percentage points among white males. There is also geographic variation in the rise of women professionals. States in the Northeast observed more rapid changes and higher fractions of women in the professions than did other regions of the country. This may be related to regional differences in the structure of the economies, in the attitudes toward women entering these occupations, as well as in the access of women to institutions where the appropriate human capital could be acquired.[11]

C. Decline in Teacher Quality

Given that fewer college-educated women are choosing to go into teaching, how talented are the ones who pursue that career path? Have the skills or ability of teachers changed over time? If so, what

occupations are high quality women choosing? This section presents some evidence of the decline in teacher quality and the increasing propensity of high quality women to choose other professions.

Since standard quality measures are not found in the IPUMS, I turn to the National Longitudinal Surveys of Young Men (NLS-YM), Young Women (NLS-YW), and Youth-79 (NLSY) to investigate changes over time in teacher quality.[12] I compare the performance of teachers and professionals across birth cohorts on standardized examinations such as the Armed Forces Qualifying Test (AFQT) and IQ tests.[13] Figure III plots the fraction of test takers that score above the 80th percentile that are professionals and teachers by birth cohort. The figures are calculated separately for white males versus all females. Overall, the fractions that are professionals increases over this time frame while the fraction that are teachers declines. But the decrease in the share of high quality teachers and increase in the share of high quality professionals are much larger for females than for white males. Among the early 1940s cohort (cohorts who were in their late 20's in 1970), 30 percent of those who scored above the 80th percentile are teachers; among the cohorts who were in their late 20's in 1990, only 8 to 9 percent are teachers. Meanwhile, 49 percent of the early 1940s cohort who scored above the 80th percentile are professionals, and the proportion increased to 70 percent of the cohort who were in their late 20's in 1990.

Furthermore, teachers are increasingly being drawn from the lower end of the distribution. Table IV shows that the fraction of teachers who scored below the 20th percentile increased from 8 percent of female teachers born in the 1940's to 19 percent of female teachers born in the early 1960's. The fraction of female teachers who scored above the 80th percentile fell as well, from 41 percent of cohorts born in the early 1940's to 19 percent of cohorts born in the early 1960's.

The decline in the quality of teachers is further illustrated among prospective teachers in the CIRP Freshman Surveys of 1971, 1975, 1980, 1985, 1990 and 1995. A potential teacher in these surveys is indicated in two ways: whether a freshman declares teaching as her career plan or whether she intends to major in education. The two indicators are very highly correlated.[14] Turning to Figure IV, the fraction of all prospective education majors who were enrolled at highly selective institutions declines from 21 to 10 percent over the 1970s, remaining at about 10 percent through 1995. The fraction of those who declare

teaching as their career plan also declines over the same period. This decline across race and gender groups is illustrated in Figure V. The decline is greatest for white females, followed by black females and only a very slight decline for black males. Note that the fraction of white females who declare teaching as their career plan converges to that of white males by 1995. Meanwhile prospective teachers and education majors are increasingly being drawn from low to middle selective institutions (refer again to Figure IV). The fraction of education majors from low-selective institutions steadily increases from 34 percent in 1971 to 57 percent by 1985, declining slightly to 50 percent in 1995. High-quality freshmen are increasingly going into the professions and into business careers. In 1971 among white female freshmen from highly selective institutions, 28 percent were potential teachers, 11 percent were planning to be doctors/engineers/ lawyers/college professors, and 2 percent were planning to have business careers. By 1980 only 6.5 percent were potential teachers, while 25 percent intended to be doctors/engineers/etc, and 15 percent planned to pursue careers in business. The fraction planning to teach increases slightly to 9 percent by 1995, but still 27 percent plan to be doctors/engineers/etc and 9 percent plan to have business careers.

Because traditional quality measures are not found in the IPUMS, I also investigate an alternative measure of teacher quality that can be found in this data. Under the assumption of positive assortative mating, I use the husband's position in the male wage distribution and the husband's education as a proxy for married female teacher's quality.[15] Although these measures are not the "standard" measures of teacher quality, these are highly correlated with accepted quality measures. I focus on married young women 1960 and onward due to the prevalence of marriage bars prior to this period.[16] Table V tabulates the occupational distribution of young married women whose husbands earn above the 75th percentile on the male wage distribution or whose husbands attained more than a college education. The fraction of married female teachers whose husbands are top-earners falls over time, while the fraction of professionals whose husbands are top-earners increases over time. Similarly, the fraction of married female teachers whose husbands attained more than college falls over time, while the fraction of such professionals increases over time.

D. Relative Teacher Earnings

The above discussion examined trends in the employment of the educated population in teaching relative to other professions and changes in relative teacher quality. One of the striking trends was that the relative decline in employment and quality was most pronounced for women and blacks. An explanation for this differential decline is that alternative labor market opportunities for women and blacks converged closer to those of white males. This hypothesis is, however, difficult to test directly because I cannot identify job opportunities or job offers with the data. I can instead use wages as an indicator of opportunities, and employ this evidence to evaluate the hypothesis. Using the IPUMS, I next calculate teacher earnings relative to workers of similar skill by race and gender group. The earnings refer to wage income from the calendar year preceding the census from *all* occupations, i.e. not just the primary occupation.[17] As Hanushek and Rivkin [1996] point out, overall earnings may better reflect the benefits of being a teacher as opposed to having a different primary occupation since teachers enjoy other non-pecuniary benefits such as longer vacations than other workers.

Mean teacher earnings relative to that of workers of similar background are plotted in Figure VI.[18] This figure shows the major decline in relative teacher earnings for women and blacks that occurred as their alternative wage opportunities improved, particularly after 1960. The decline in relative teacher earnings for women and blacks is especially noteworthy when compared to the only slight decline for white males. This indicates evidence that the expansion in opportunities for women and blacks is a major source of explanation for changes in teacher supply and teacher quality. Both teacher and non-teacher real earnings do exhibit downward trends during the 1970s, followed by increases in the 1980s (not shown). But the increases in teacher wage levels did not overcome the rise in the opportunity cost of teaching. This also suggests that using teacher wage levels as opposed to relative wages may lead to inaccurate estimates of teacher wage effects on teacher supply and teacher quality.

III. Related Literature

In light of this evidence of declining relative teacher wages, particularly for females and blacks, the natural question to ask is to what extent these declines in wages and declines in teaching participation and quality are related. Although there is an abundance of literature analyzing the relationship between women's wages and employment, very few economists have looked at how the teacher market can be affected by the changing value of women's time.[19] A notable exception is Flyer and Rosen [1994; hereafter FR] who hypothesize that growing market opportunities for women between 1960 and 1990 affected *both* the demand and supply of teachers. They argue that by increasing female labor force attachment, expanded opportunities also induced an increase in the demand for teachers: school services are purchased to substitute for household-produced child services. This feedback is particularly in evidence in the 1960s and 1970s, as the baby boomers entered the school system. With the baby bust, absolute and relative teacher wages declined. Although comprehensive, FR's analysis makes the implicit assumption that teacher quality has remained constant over time. Since the expansion in alternative wage opportunities for women changes the relative returns to quality, we expect the quality across occupations to also be affected by changes in relative wages.

On the other hand, work by other researchers has also noted the decline in teacher quality. Murnane et.al. [1991] in "Who Will Teach? Policies that Matter" document the proportion of college graduates with high standardized test scores who choose to become teachers declined between the mid-1960s and the early 1980s using the same National Longitudinal Surveys I use above.[20] I expand on their analysis of changes in teacher quality by explicitly relating the decline to changes in relative wages.

In more recent work, Lakdawalla [2001] also finds that between 1940 and 1990, the relative schooling of teachers declined by about three years and the human capital value of teachers declined by thirty percent, relative to both the college-educated population and to college professors. He argues, however, that this was a direct result of biased technical change outside of the education sector, which raised the demand for specialized skill outside of teaching, and thus makes skilled teachers more expensive but no more productive (since teaching only requires general skill). This, in turn, leads to relative declines in human capital among teachers and in their wages. While the focus on technical change

may be theoretically appealing, the empirical evidence is less than compelling. Such a phenomenon would result in all groups responding similarly, while I find that, in contrast to all other race and gender groups, white male teacher relative earnings, participation rates in teaching, and relative quality either stayed the same or declined relatively slowly over the period (or sub-periods) under study.

Although the trends certainly suggest that the decline in teacher quality may be related to the decline in relative teacher pay, previous studies of this relationship in the economics of education literature yield mixed results. For example, Ballou and Podgursky [1997] find that relative wages have no effect on the SAT test scores of prospective education majors, while Figlio [1997] finds that, within select metropolitan labor markets, teacher salaries are positively related with teacher's undergraduate college selectivity.[21] Most existing studies use cross-sectional variation to identify the effect of teacher wages or fail to adequately control for alternative wage opportunities. In a study linking student outcomes and teacher wages, Loeb and Page [2000] find that controlling for alternative opportunities matters a lot; teacher wage effects are insignificant when alternatives are not controlled for. When teacher wages are measured relative to those for all college graduates, they find that raising teachers' wages significantly reduces student dropout rates. As discussed further below, in this study I use both time series and geographic variation and control for alternative professional wage opportunities. I also incorporate the earnings profile at various points of the lifecycle across the two sectors.

IV. What theory tells us

To illustrate why relative wages matter, I use Roy's model [1951] as a framework for thinking about the occupational choice decision of a potential teacher. Let *0* denote the non-teaching sector and *1* the teaching sector. The following earnings distributions characterize the earnings facing an individual who is considering teaching:[22]

$$(1) \qquad \ln w_0 = \mu_0 + \varepsilon_0, \quad \text{where } \varepsilon_0 \sim N(0, \sigma_0^2)$$

$$(2) \qquad \ln w_1 = \mu_1 + \varepsilon_1, \quad \text{where } \varepsilon_1 \sim N(0, \sigma_1^2)$$

and ρ gives the correlation between ε_0 and ε_1. One can think of ε_0 and ε_1 as the value of an individual's draw of talent or ability in each sector. This may vary across sectors because an individual's skills are a better match for the tasks in one sector over another. Assuming that individuals are income maximizing, the decision to be a teacher is determined by the sign of the index function:

$$(3) \qquad \begin{aligned} I &= \ln w_1 - \ln w_0 \\ &= (\mu_1 - \mu_0) + (\varepsilon_1 - \varepsilon_0) \end{aligned}$$

The probability of choosing teaching, *P*, is given by:

$$(4) \qquad \begin{aligned} \mathrm{P} &\equiv \Pr(I > 0) \\ &= \Pr[\nu > -(\mu_1 - \mu_0)] \\ &= 1 - \Phi(z) \end{aligned}$$

where $\nu \equiv \varepsilon_1 - \varepsilon_0$, $\mathrm{z} \equiv \dfrac{-(\mu_1 - \mu_0)}{\sigma_\nu}$ and Φ is the standard normal cumulative distribution function. The proportion of the population in teaching is then a negative function of μ_0, income earned in the non-teaching sector, and a positive function of μ_1, earnings as a teacher.

Next let us consider what happens to average teacher quality as changes in sector *0* occur. In particular, consider the effects of an exogenous increase in μ_0, mean earnings in the non-teaching sector. A change in earnings is exogenous in the sense that it is unrelated to shifts in the skill level of the population. Consider for instance a positive price shock in the non-teaching product market, raising the marginal product and wages of workers in sector *0*.[23] This model tells us that teacher quality may not necessarily decline when alternative female wage opportunities increase. What happens to average teacher quality depends on the distribution of ability in each sector and the nature of self-selection. For example, suppose skills are unique to each sector so that individuals pursue their comparative advantage in that those who are relatively better at teaching chose teaching, while those with relatively higher productivity in alternative occupations are in non-teaching.[24] In this case, average teacher quality could actually *increase* with a rise in mean earnings in the non-teaching sector. The story is this: as μ_0 increases and shifts the non-teaching distribution upward, those who would have chosen non-teaching before the

change would see their earnings increase so they would still choose non-teaching. Other workers who would have chosen teaching before the change now see their relative productivity and earnings across sectors change. In particular, the group that gains most from switching to non-teaching is those from the lower end of the teaching skill distribution, because their skills are now relatively more productive in non-teaching. This leaves more of the highly skilled in teaching, whose teaching skills are still relatively more productive, thereby raising average teacher quality.

Average teacher quality will decline with an increase in μ_0 when skills are sufficiently positively correlated across sectors and the distribution of ability in the non-teaching sector is more dispersed relative to the teaching sector, resulting in a non-teaching earnings distribution that is more unequal than in teaching.[25] This gives rise to negative self-selection—low ability individuals face higher earnings in teaching while high ability individuals earn more in non-teaching. An exogenous increase in μ_0 means better opportunities in the non-teaching sector for some marginal individual so that she chooses not to teach. But this marginal individual is actually more talented than the average teacher prior to the shock. In this case an increase in μ_0 decreases average teacher quality.

Thus, changes in average relative wages not only affect the decision to enter teaching but also the average quality of teachers. The trends discussed above further showed that higher quality individuals are the ones increasingly choosing not to teach as their opportunities expanded. A shock that expands labor market opportunities can also be considered as an exogenous increase in σ_0; as the number and types of jobs for women and blacks in the non-teaching sector increase, variation in the value of skill and productivity in the non-teaching sector are likely to increase as well.[26] Changes in inequality across the non-teaching earnings distribution can also be thought of as an exogenous change in σ_0 as long as the change in inequality is again unrelated to changes in skill levels.[27] An increase in σ_0 improves the position of the more able on the non-teaching earnings distribution relative to teaching, drawing more of the talented into non-teaching. Meanwhile, more teachers are being drawn from the lower tail of the skill distribution, decreasing average teacher quality. Because relative earnings in alternative occupations

(particularly the professions) increased more for women and blacks, I expect teacher quality to also decline more for women and blacks with an expansion in alternative opportunities.

V. Empirical Issues

A. General empirical specification

The second goal of this paper is to estimate the effect of the rise in alternative opportunities on teacher supply and quality using wages as an indicator of opportunities. To the extent, then, that wages are an imperfect measure of women's opportunities, I am likely to underestimate the effect of alternative opportunities on teacher supply and quality. To investigate the effect of changes in teacher earnings (W^1) relative to alternative professions (W^0) on employment in teaching, following is the basic specification estimated separately for each race and gender group j :

$$(1.1) \qquad Y_{ijkt} = f_j(X_{ijkt}'\theta + \sum_a \alpha_a W^1_{jkt} + \sum_a \beta_a W^0_{jkt} + \sum_a \delta_a G^1_{jkt} + \sum_a \gamma_a G^0_{jkt})$$

where Y represents teacher supply or teacher quality.[28] X_{ijkt} is a vector of characteristics of person i residing in area k at time t.[29] Wage effects are estimated for various age cohorts, a=21-30,31-40,41-50,51-60. I also include controls to capture the lifetime profile of earnings in teaching and in alternatives, G^1_{jk} and G^0_{jk}.[30] Hence, at time t, $\alpha_{(a=21\text{-}30)}$ is an estimate of the effect of raising *entry* earnings in teaching relative to the professions and $\alpha_{(a\neq 21\text{-}30)}$ provides quasi-estimates of *"retention"* effects.[31] Meanwhile δ_a and γ_a estimate teacher wage effects over the rest of the lifecycle for the various age groups.

I next focus on wage effects on new labor market entrants: what is the effect of changes in earnings on *beginning* teacher supply and teacher quality. I focus on the flows of recent labor market entrants for two reasons. First, more recent cohorts experienced the most change in their opportunities. Focusing on entry cohorts highlight changes over time particularly because change may be slow to show up in the stock of workers. Teaching is also an occupation with high attrition rates particularly in the first five years and about one in four who leave return [Murnane et. al. 1991].[32] To avoid confounding the issue with exits from and re-entries into teaching, I present separate teacher supply results that focus only

on college-educated individuals aged 21 to 30.[33] I then estimate this version of equation (1.1) on entry cohorts:

(1.1)' $$Y_{ijkt} = f_j(X_{ijkt}'\theta + \alpha W^1_{jkt} + \beta W^0_{jkt} + \delta G^1_{jkt} + \gamma G^0_{jkt})$$

B. The Identification Problem

Observed W may be endogenous.

An important empirical issue is that observed market earnings may be endogenous because at each area and point in time, the W's are a result not only of factors that affect the demand for teacher and professional services, but also the supply and quality of teachers and professionals. Because location is a choice variable, individuals sort themselves across these labor markets such that areas that pay more to recruit teachers are observed to draw more (and more high-quality) teachers. The effect of interest is not about whether a rise in teacher salaries in one area draws individuals from other areas, but whether or not a rise would draw individuals who would otherwise have chosen more attractive careers.

For studying the effect of W, I want to rely solely on variation coming from the demand side. In other words, holding the teacher supply curve within each market *k* constant, I would like to identify the elasticity of supply from changes in the Ws generated by changes in demand. I therefore employ a variety of fixed effects, instrumental variables, and difference strategies to identify the elasticity of supply, and discuss these efforts below. Of course it is also possible that more high quality individuals are drawn to these areas for reasons unrelated to the teacher market, such as a husband's occupation. Women are generally less mobile than men.[34]

Other sources of omitted variable bias.

In a world where agents are perfectly mobile, the wages offered in teaching relative to the wages in alternative occupations should be equalized for workers with the same human capital. Local labor market economic and demographic conditions may give rise to some temporal and cross-sectional variation. However, other differences across labor market areas in non-pecuniary returns in teaching versus alternatives may also produce compensating differentials, leading to omitted variables bias. Most

previous studies typically estimate equation (1.1) using cross-section data so that the coefficient on W is identified from variation in teacher supply or quality and salaries across schools (or school districts or labor market areas) *at a point in time*. Since I have no measures of non-pecuniary attributes in teaching versus alternatives across these areas, I employ fixed effects and difference strategies to control for other likely omitted variables.

VI. Results for Teacher Supply

A. Data

The data I use for studying teacher supply come from the Integrated Public Use Microdata Series (IPUMS) 1940-1990. The huge sample size from the census is its primary advantage and is particularly useful for obtaining statistics for the local labor markets. Unless otherwise indicated, I focus the analysis on the college-educated population and limit the sample to all individuals aged 21 to 60 not currently attending school and who attained or completed at least fourteen years of schooling. The category "teachers" includes all private and public teachers below the post-secondary level. The category "professionals" includes accountants, engineers, college professors, doctors, other health technicians, managers, officials, and proprietors. This category is broad enough to encompass college-educated and high-ability individuals' occupational choices and narrow enough to be of comparable skill to teachers.

A natural definition of a local labor market for teachers might be the school district. Because most teacher salaries and schedules are set at the school district level, any variation in wages within a district are purely due to differences in the education-experience composition of the teaching force, or extracurricular duties such as coaching sports teams. In this study, however, an examination of teacher wage effects across school districts may not be the appropriate strategy when considering the wages of teachers *relative* to what could be earned in alternative occupations. School districts across the nation vary in size and concentration, such that the school district of one's residence will not necessarily constitute a labor market for an individual making an occupational decision. Moreover, the unavailability

of school district identifiers in the IPUMS and potentially very small sample sizes do not allow for calculations at this level.

Instead I define two labor market areas within each state: one labor market for all of the state's metropolitan areas and another one for all its non-metropolitan areas.[35] This is equivalent to assuming urban and rural residents have different tastes or form wage expectations differently. Hence college graduates residing in Los Angeles or San Francisco are considered to be facing the same labor market conditions, or alternatively, that individuals in Los Angeles also consider opportunities in San Francisco and other metropolitan areas in California when making their occupational choice decision.[36] As a sensitivity check I also carried out the same analyses with labor markets defined at the state level. The results are very similar in both the magnitude and direction of effects. In calculating the standard errors, I adjust for the non-independence of observations within each area by using the formula as outlined in Moulton [1986].

B. Y=Pr(occupation choice): Multinomial Logit Results

Table VI reports multinomial logit estimates of equation (1.1) over all individuals aged 21 to 60 with at least two years of college in the IPUMS. The occupation categories individuals choose between are teaching, the professions, non-professional occupations, and being out of the labor force (NILF) or unemployed as the baseline category.[37] Area-specific fixed effects are employed in these regressions, so the identification comes from the variation over time. The reported coefficients are marginal effects evaluated at the means, and since the regressions are without constants, we may interpret the magnitude of these estimates for comparison across specifications and groups. Across specifications, coefficients on future earnings δ_a and γ_a for all age groups *a* are only mildly significant or are insignificant, indicating contemporaneous wage effects dominate lifecycle wage effects.[38]

Two findings from Table VI speak to the hypothesis that the availability of opportunities affects teacher supply. First, own-wage and cross-wage effects for females and blacks are in the expected direction, while they are insignificant or significant in the wrong direction for white males. Raising teacher earnings significantly raise the probability college-educated women choose teaching *and*

significantly decrease the probability they choose the professions or other occupations. On the other hand, increases in professional earnings not only attract more women to the professions, it also significantly decreases the probability white women choose teaching and black women choose other occupations. In addition, increases in non-professional earnings significantly decrease the probability women choose teaching and raises the probability women choose non-professional occupations. Own-wage effects for black males are also positive and significant while cross-wage effects are either zero or significantly negative.

A second finding from Table VI is that young females and blacks are particularly sensitive to changes in wage opportunities. For example, older white female cohorts have significantly lower teacher wage elasticities and less negative cross-wage elasticities than those in the 21-30 age group. Additional teacher wage effects for older cohorts are significantly negative for white females in their probability to choose teaching (col. 4) and positive and significant in their probability to choose the professions (col. 5) or other occupations (col. 6). These lower own-wage and less negative cross-wage elasticities indicate that it takes greater relative teacher wage increases to attract older white female cohorts. A 10 percent increase in teacher earnings raises the probability a new labor market entrant chooses teaching by 9 percent, in contrast to only 4 percent among 31-40 year olds and 3 percent among 41-50 year olds. This likely reflects specific human capital and the cost of switching across these occupations.

C. Cross-section Analysis as Sensitivity Test

I proceed to estimate equation (1.1) over individuals aged 21 to 30, new entrants to the labor market, the group most sensitive to changes in wage opportunities. By controlling for the state and metropolitan status of residence, the above multinomial logit regressions in effect controls for permanent differences in labor market conditions by comparing wage effects generated by changes in wages over time *within* each labor market area. However, a time-series analysis to determine the role of the expansion in alternative wage opportunities may be confounded by other relevant supply-side factors that changed over time. For example, changes in teacher supply may also be due to changes in "societal discrimination"; in earlier decades women were socialized to enter traditionally female pursuits, while

today's society regards women in traditionally male fields as more acceptable. Not only are attitudes toward women's work changing, women's tastes for career versus family have also been shifting [Goldin 1997]. To address these issues, I explore a cross-section analysis as a sensitivity check. As long as tastes for careers and other unobservable factors that determine sorting across areas are specific to that time period or cohort, the cross-section wage coefficients should provide consistent estimates of wage effects. Finally I condition on both state and time fixed effects, utilizing variation across non-metropolitan and metropolitan labor market areas within states at a particular point in time.

Results are reported in Table VII. Each panel and column delineated by borders represents separate regressions with different specifications of the market wages.[39] Columns 1 to 5 are estimated over the population of individuals aged 21 to 30 with at least two years of college, and the sample is further restricted to the employed sub-population in columns 6 to 10. In columns 1 and 6 without any controls for alternative earnings opportunities, I find insignificant to significantly negative effects of teacher wages on the probability of entering teaching. Controlling for alternative market opportunities in the professions in columns 2 and 7, however, both separately and as relative teacher earnings, I find that teacher earnings significantly and positively affect the propensity to enter teaching. Market entry professional earnings also have a separate and significant effect on this propensity; all else equal, higher market professional earnings reduce the probability that a college-educated individual enters teaching. This is true whether the estimation utilizes variation over time (columns 3 and 8), across labor market areas at a particular point in time (columns 4 and 9), or within state at a point in time across metropolitan and non-metropolitan labor market areas (columns 5 and 10). This is also true across the various race and gender groups.[40] In areas or points in time where teachers are paid relatively less than professionals, more college-educated individuals choose not to teach.

Thus, changes over time as well as cross-section differences in relative teacher wages affect the probability college-educated women and blacks choose to teach. Controlling for alternative opportunities is important; without these, teacher wage effects are negative and significant to insignificant. Turning also to Column 1 of Table IX that report marginal effects from a linear probability model, there are significant

differences in wage elasticities across groups. Similar to the multinomial logit for young people, women and blacks are more sensitive to relative teacher wage changes than white men.

D. Instrumental Variables Estimates

To further address some of the endogeneity issues raised earlier, I proceed to form 2SLS estimates of relative wage effects. This framework also suggests that changes affecting relative teacher demand operate on teacher supply through its effect on (W^1_{jkt} - W^0_{jkt}). I use the state-level industrial structure and demographics as instruments for relative teacher earnings. As noted above in the discussion of long-term trends, new teacher demand increased as the baby boom cohorts entered the school system and subsequently declined as the boomer cohorts left. I exploit this cohort variation in the school-age population leading to changes in relative teacher demand. Estimates are reported in Table VIII. Changes in total school-age population appear to be significantly related with white female relative teacher wages.[41] When there are more school-age children, white female relative teacher wages are significantly higher.

I also use lagged industrial composition as an indicator of demand conditions in alternative sectors. I calculate a rough measure of industrial structure: the proportion of the employed population in the services, manufacturing, and federal government sectors. In states like Pennsylvania and Michigan that are heavily concentrated in manufacturing, the demand for educated women in non-teaching sectors is relatively low. As manufacturing declined and the services and federal government sectors expanded, demand for college-educated women and blacks in alternative sectors grew, leading to a decline in female relative teacher wages. These regressions also point to the covariance in earnings in the public sector—the higher the concentration in the federal government sector, the greater teachers are paid relative to professionals.

The estimated relative wage effects when using the instruments are further magnified (Table IX), lending more empirical support to the above results. This strategy in effect identifies responses off of wage changes generated by changes in relative teacher demand across areas and over time, that is, it attempts to identify the supply curve. The greater magnitudes of the 2SLS estimates suggest that the

previous fixed effects regressions identified equilibrium points arising from both supply and demand shifts.[42]

E. Difference Analyses

The 2SLS estimates tell us that industrial shocks were important. As a finer attempt at getting at the story, I also perform a difference-in-difference in these regressions, by taking the differential in relative teacher earnings of females and blacks relative to white males'. Discrimination is very difficult to measure. This strategy in effect decomposes wage responses into those due to race and gender specific factors and those related to the overall wage structure. Race and gender specific factors could include discrimination. The assumption then is that since white males experienced no discrimination, white male relative wages reflect product market shocks to relative teacher demand.[43] One way to evaluate the relative importance of race and gender specific versus neutral sources of demand shifts is to net out the effect of overall wage structure. In this framework, the identification of relative changes in participation rates within each area for each group comes from responses to changes in own groups' relative wage beyond that faced by white males.

Columns 2 to 4 in Table IX show that the 2SLS estimates of this net relative wage effect are much less than the previous 2SLS estimates of relative wage effects. This tells us that race and gender specific wage responses net of neutral demand are not as large as neutral responses. This strategy is admittedly a first-pass attempt. Nonetheless the 2SLS and diff-in-diff estimates suggest that the driving force leading to these changes are neutral demand-side shocks, changes affecting the overall economy such as industrial shocks, more so than race and gender specific shocks.

VII. Results for Teacher Quality[44]

In a review of 376 education production function estimates, Hanushek [2002] finds that more than 70 percent report class-size, expenditure per pupil, and measures of teacher quality such as teacher education and experience have negative to insignificant effects on student performance. Of these input-

based measures, teacher test scores have the highest proportion of estimated effects that are positive and statistically significant. I then use the standardized test scores reported in the National Longitudinal Surveys of Young Men (NLS-YM), Young Women (NLS-YW), and Youth (NLSY-79) to explore changes in the quality of those who teach. For the NLSYM and NLSYW cohorts, I use their IQ scores as constructed by the survey, that is a weighted average of various standardized tests recorded in the high school transcripts; percentile IQ scores from this average are then generated. For the NLSY respondents, I use their revised percentile scores on the Armed Forces Qualifying Test (AFQT). Demographic and employment data are included for the survey years these respondents were aged 21 to 30 to determine their occupation and location. Finally market earnings of professionals and teachers in the IPUMS 1970-90 are calculated within the following cells—birth cohort, race, gender, region and SMSA status of residence—and are merged onto observations in the NLS's with the same characteristics.[45]

Table X reports quantile regression estimates of the effect of raising relative teacher wages on the percentile scores of teachers across the conditional test score distribution. Quantile regressions are particularly useful for investigating if relative teacher wages affect the quality of teachers not just at the mean but also across the quality distribution. In specifications without fixed effects, the median and highest 25 percent quality teachers are significantly affected by relative wages (cols. 1-3). Controlling for region, relative wages significantly raise teacher scores across the distribution (cols. 4-6). Relative wages only have a significant effect on the upper tail in regressions with cohort fixed effects (cols. 7-9), which is probably due to the lack of regional variation in wages. Relative teacher wage effects are positive and significant across the distribution in regressions even with both region and cohort fixed effects (cols. 10-12). On the whole, when wage opportunities in teaching are relatively better, the ability of new entrants to teaching is higher. This result is particularly robust across specifications among teachers at the 75th percentile. That high-quality teachers are more sensitive to relative teacher wages is consistent with the story that the availability of opportunities affects not just the quantity but also the quality of teachers. With an expansion in opportunities, high-quality women, who presumably have better alternatives than those of lower quality, are increasingly choosing not to teach.

VIII. Discussion of Results and Caveats

In summary, I find that the higher the wages teachers are paid relative to those for professionals and non-professionals, the more likely educated women are to choose to teach. Women are more sensitive to wage changes than are men; young women are particularly more sensitive than older cohorts. Moreover, as wage opportunities in teaching become relatively less attractive, the ability of teachers and prospective teachers declines. These estimated wage effects are positive across the conditional test score distribution, particularly among teachers at the upper end. These results are consistent with the interpretation that the availability of opportunities affects employment in teaching. As alternative opportunities improved for women and blacks, fewer choose to teach, and fewer among those who teach are of high quality.

There remains the issue of whether I have isolated relative supply or relative demand. The basic identifying assumption across the above regressions is that long-run changes in relative teacher wages are generated by relative demand changes. Yet economic theory tells us that observed wages and employment may be due to either supply or demand factors, or a combination of both. The typical supply side explanation for why women tend to choose occupations such as teaching is that since women anticipate shorter and less continuous work lives than men, they choose occupations where their human capital depreciates less from labor market exits [Polachek 1981; FR 1994; Blau et. al. 1998]. As suggested by Becker [1985], women may also select teaching because its tasks are more compatible with home production. Discrimination can also lead to supply-side effects—because women are socialized to enter traditionally female pursuits or perceive barriers in certain occupations. To the extent that these supply-side factors led women to segregate into occupations such as teaching, an expansion in alternative opportunities should actually increase the supply of workers in alternative sectors, shifting the relative supply curve in teaching inward. Yet we observe the opposite effect in equilibrium: relative wages of teachers actually decline, suggesting changes in relative demand for the most part drive the relative wage decline.[46]

A relative supply and demand framework also tells us that since both relative teacher wages and employment in teaching declined more for women than for men, labor demand in alternative sectors must have shifted in favor of women. This argument is easier to make in the case of skill-biased demand as in the literature on wage inequality. This is a more difficult argument to make in the case of skilled women relative to men because of coincident changes affecting the female labor market. The first stage of the 2SLS regression certainly suggests that industrial changes may account for some of the shifts. Recall that these regressions showed relative teacher wage declined more in states with higher concentration in services and government sectors. This seems to be consistent with a story of overall growth in non-teaching sectors of the economy that favored women. The diff-in-diff strategy also suggest that these neutral sources of demand shifts, as opposed to race and gender specific factors such as the removal of discrimination barriers, account for more of the demand shifts. Other likely explanations for the relative teacher wage decline might also include increased unionization in the teaching sector and deunionization in alternatives, as well as women's admittance to professional programs and access to credit markets for loans to pursue skill acquisition. It is more likely that an interaction of overall economic, demographic, and institutional factors account for the shifts in relative teacher demand.

There is a final caveat to the above results on teacher quality. Because I analyze data on the flow of teachers or prospective teachers, I miss getting at retention wage effects on quality. To get at the effect on the quality of the average teacher facing a classroom, I would need to analyze wage effects not just on new or potential entrants but also on the current stock or pool of teachers. However, getting at the overall effect of a shift in the teacher salary schedule requires assumptions about occupation-specific human capital and other factors that affect the subsequent response by those already in teaching. Simulations by Ballou and Podgursky [1995] show that under certain assumptions, average teacher quality can actually decline with upward shifts in the teacher salary schedule. This happens because of perverse feedbacks in exit decisions, vacancy rates, or the willingness to invest in occupation-specific human capital. For example, older teachers choose to remain in teaching instead of retiring, diluting the quality of the teacher pool. Perhaps an across-the-board raise in teacher salaries given scarce government resources may not be

the best way to raise the quality of the teacher workforce. Since the above results suggest that teacher pay raises targeted to new teachers have positive effects, new teacher pay raises may have long-run effects on improvements in teacher quality. More importantly, in a separate paper I show that the above documented decline in teacher quality *has* affected school quality.[47]

IX. Conclusion

One goal of this paper is to document changes in the composition of women who choose to teach. I find that teacher performance on standardized exams declines between 1970 and 1990, relative to previous cohorts of teachers and to professionals in their own cohort. Female prospective teachers are also increasingly being drawn from less selective institutions.

I also seek to estimate the effect of changes in teacher earnings relative to professional earnings opportunities on teacher supply and teacher quality. The results show that the higher teachers are paid relative to professionals, the more likely educated women are to choose to teach. When wage opportunities in teaching become relatively less attractive, the quality of teachers and prospective teachers declines. Specification checks further imply that the results are robust to various identifying assumptions. These results are consistent with the interpretation that the availability of opportunities affects employment in teaching. As alternative opportunities improved for women and blacks, fewer choose to teach, and fewer among those who teach are of high quality.

DATA APPENDIX

I. IPUMS

The data for this study mainly come from the Integrated Public Use Microdata Series (IPUMS), consisting of 1-percent samples of the American population drawn from the decennial censuses of 1940, 1950, 1960, 1970, 1980, and 1990. The data was created at the University of Minnesota, and can be downloaded from http://www.ipums.umn.edu/.

A. Sample inclusion criteria for each census year: [1]

(1) aged 21 to 60
(2) black or white
(3) completed at least 14 years of schooling (or second year of college)
(4) not currently attending school

B. Further criteria in calculating labor market earnings for each area:

(5) employed in the prior calendar year
(6) not self-employed nor working without pay
(7) earn at least the effective minimum wage for 13 weeks[2]

C. Imputations and Edits:

I also imputed the wage income for workers top-coded at the census maximum as 1.5 times the top-code value, and deflated earnings by the Consumer Price Index averaged over U.S. cities with 1967 as the base year.[3] The earnings refer to wage income from the calendar year preceding the census from *all* occupations, i.e. not just the primary occupation. As Hanushek and Rivkin (1996) point out, overall earnings may better reflect the benefits of being a teacher as opposed to having a different primary occupation since teachers enjoy other non-pecuniary benefits such as longer vacations than other workers. The category "teachers" includes all pre-college teachers. Unfortunately pre-school teachers cannot be separated within this category prior to 1970. In 1970, 1980 and 1990, about 97 percent are elementary or secondary teachers of this category.

II. NATIONAL LONGITUDINAL SURVEYS

I also turn to three longitudinal surveys with standardized test scores whose cohorts overlap with a subset of the sample I am studying.[4] Specifically I use the National Longitudinal Surveys of Young Men (NLSYM; aged 14-24 in 1966), Young Women (NLSYW; aged 14-24 in 1968), and Youth-79 (NLSY; aged 14-22 in 1979). I first extract the test scores of all respondents. The IQ score is constructed by the survey and is a weighted average of various standardized tests recorded in the high school transcripts of NLS-YW and NLS-YM respondents; I then generate percentile IQ scores from this average. For the NLSY respondents, I use their reported revised percentile scores on the AFQT – Armed Forces Qualifying Test.

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[1] I use the upper cut-off of age 60 to skirt retirement issues. Including ages 60-65 lead to qualitatively similar results. I also tried excluding ages 21-25 to eliminate problems associated with joint schooling and work activities, and find the same patterns as when I include them. Since a number of teachers particularly in the earlier census years went to normal or teaching colleges (about 2 years of college and hence were teaching by age 21), I have included here ages 21-25 and those with less than 4 years of college for ease of comparison over time. Cohorts born before 1900 have wildly differing patterns, so they are not included here.

[2] The effective minimum wage used for the 1940 sample is $0.30; $0.75 in 1950; $1 in 1960; $1.30 in 1970; $2.90 in 1980; and $3.80 in 1990. (Source: Employment Standards Administration)

[3] For the most part the qualitative results are not sensitive to the exclusion and imputation outlined. Enforcing more labor force attachment by for instance excluding workers earning less than the minimum wage for 6 months only magnifies the results reported here. The trends reported in the next section are also similar to those reported by other researchers using administrative data or other surveys such as the CPS. All reported statistics are weighted to add up to the U.S. population using sampling weights found in the IPUMS.

[4] In particular cohorts who are 21-30 in 1970 to 1990.

A. Sample inclusion criteria for each NLS survey:
(1) black or white respondents;
(2) not in the military;
(3) with at least 2 years of college education;
(4) non-missing AFQT test score in NLSY; non-missing IQ score in NLSYW & NLSYM.

B. I extract employment data for survey years respondents were aged 21-30 and generate the following variables:
(1) SMSA status – mode SMSA value at ages 21-30
(2) Region of residence – mode region at ages 21-30
(3) Teacher – if ever a pre-kindergarten, elementary or secondary teacher at ages 21-30
(4) Professional – if ever a professional or technical worker at ages 21-30 but not a teacher nor nurse

C. Finally I calculate market earnings of professionals and teachers in the IPUMS 1970-90 within the following cells—birth cohort, race, gender, region and SMSA status of residence—and merge these means onto observations in the NLS's with the same characteristics.

III. CIRP Freshman Surveys

I also use data from Cooperative Institutional Research Program's (CIRP) Freshman Surveys of 1971, 1975, 1980, 1985, 1990, and 1995.[5] The UCLA Higher Education Research Institute administers the Freshman Surveys annually to all incoming freshmen at more than 1,700 colleges and universities. The data are stratified by type of college (e.g. public 4-year college) and selectivity. Institution selectivity is generated by HERI and is measured at one point in time, 1983. In addition to the institution-level characteristics, information collected includes student's prospective major and occupation, demographic characteristics, high school GPA, rank and SAT scores (some years only). Each freshman cohort included in this study is a nationally representative sample of first-time full-time college freshmen enrolled at four-year institutions. As with the analyses using the NLS's, earnings are first calculated from the IPUMS and merged onto the Freshman Surveys by year, race, gender, and state of institution. The earnings profile I use for the 1971, 1980, and 1990 freshman cohorts are the profiles in the 1970, 1980, and 1990 IPUMS, respectively. For the 1975 and 1985 freshman cohorts, I take the average profile across the two nearest decennial censuses (e.g. I average the 1970 and 1980 profiles to derive the profile for the 1975 cohort).

A potential issue with using college selectivity as a measure of teacher quality is that a number of highly selective institutions curtailed undergraduate education programs in the time period under study. I then use respondents' career plan as an indicator for potential teacher supply and find similar results as when I use college major in education as an indicator of teacher supply.

A more important limitation to this data is that not all prospective education majors and prospective teachers end up actually teaching. Neither do all teachers major in education in college. This issue has to deal with when students acquire information and form expectations about relative wages. One would expect the marginal value of this information to be greatest as a freshman, before sunk costs are created which make it costly to switch fields. On the other hand one might expect learning to occur as students progress through college, making college seniors or new graduates the more ideal cohort to study for this question. For the purposes of this study the extent to which this issue biases the results depends on whether the way wage expectations are formed are changing over time. In the multivariate analyses I control for unobserved heterogeneity specific to that cohort using time fixed-effects.

IV. INSTRUMENTS

Industrial composition: Calculated as employment in sector *a* in state *k* as a share of total employment in state *k*.

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[5] Although the surveys have been collected annually since 1967, data prior to 1971 were unavailable in electronic form. I was also granted access only to these particular cohorts due to the size of each survey.

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NOTES:

1. The category "teacher" is defined as all teachers below the post-secondary level.

2. This category include accountants, engineers, college professors, doctors, lawyers, etc. For simplicity, I use from hereon the term "professionals" to refer to professionals and managers excluding teachers and nurses.

3. Flyer and Rosen [1994] and Murnane et.al. [1991] are notable exceptions. Lakdawalla [2001] also report the decline in the relative quality of teachers and present a different hypothesis. These studies are discussed further below.

4. There exists a debate on whether the decline in school quality is just a perception or whether schools have actually gotten worse. For example, declines in the average student performance on the SAT were observed in the late 1960s and early 1970s [see survey by Koretz 1986]. Some claim that this decline is purely due to a composition effect in the changing mix of SAT takers.

5. Specifically I use the 10-year lagged industrial structure.

6. For an excellent survey of the growth in teacher real wages over the 20th century, see Hanushek and Rivkin [1996]. For a review of increases in teacher salaries since the 1980s, see Ballou and Podgursky [1996].

7. I show this both in a conventional 2SLS framework using demand conditions as instruments for wages, and in an unconventional difference-in-difference strategy that separates race & gender specific from race & gender neutral factors. As the industrial structure shifted in intensity from manufacturing to service, non-teaching sectors of the economy that favored women grew, increasing demand for skilled and women workers.

8. Figures from Status of the American Public School Teacher, NEA. The decline in the fraction of college-educated women in teaching may be partly explained by the increase in the number of women going to college, but these declines are not purely a result of this increase. In particular, the college attendance rates are not uniform across these groups. In fact, between 1960 and 1990, the largest increases in the college proportion are among white males while the proportion of white males in teaching declined only very slightly. The rate of increase in the proportion with college is also higher among white females than black females, but the decline in teaching participation rates is steeper among black females.

9. As previously noted by Murnane et. al. [1991], teaching is an occupation with high attrition rates.

10. Other interesting factoids from Table 2: A number of teachers came from normal schools and attained less than 4 years of college. In 1940 for instance, 9 to 10 percent of recent female entrants with less than a college degree are teachers. This proportion declines sharply between 1940 and 1950--only 2 percent of this education group are teachers and 1 percent by 1990.

11. The rising share of women professionals also reflects increasing numbers of previously all-male universities that opened up to be co-educational and the professional programs that admitted women in increasing numbers. Nationally, there were 23.4 men for every woman enrolled in professional schools in 1960; this ratio was 1.66 by 1988. [U.S. Dept of Education Digest 1988 and U.S. Dept of Health Education and Welfare 1960]

12. In particular cohorts who are 21-30 in 1970 to 1990.

13. The test scores for the NLS-YM and –YW are constructed IQ scores provided by the surveys that are a weighted average of various standardized tests (including the SAT and ACT) recorded in the high school transcripts of these respondents. I then generate percentile IQ scores from this average. For the NLSY respondents I use their revised percentile scores on the AFQT. I then include demographic and employment data for the survey years these respondents were aged 21 to 30 to determine their occupation.

14. The 1975 Freshman Survey does not ask respondents their career plan. It is true that not all education majors end up teaching and not all those who teach K-12 majored in education. Issues arising from using prospective major and career plan as indicators of teacher supply are discussed in the Data Appendix.

15. There is some evidence that assortative mating was not as positive in earlier years. That is, low-wage women were disproportionately married to high-wage husbands as these women specialized in home production. Over time, as women's market work has increased, assortative mating has probably become more positive. This should favor against finding any decline in teacher quality measured by using husband's characteristics.

16. Just prior to American entry into World War II, 87 percent of all school districts would not hire a married woman and 70 percent would not retain a single woman who married. Most of such bars disappeared during the War. By 1951, 18 percent had the hire bar and 10 percent the retain bar. [Goldin 1990]

17. A more detailed discussion of the sample selection criteria and imputations are in the Data Appendix.

18. I first calculate the alternative earnings for each teacher *i* as the mean among college-educated non-teachers of the same background as teacher *i* – in particular, the same state of residence and metropolitan status (SMSA), gender, race, education and age group. If the mean non-teacher earnings cannot be formed for teacher *i* using these observables, a mean is formed using a wider geographic category--from non-teachers residing in the same census region and metro status. If there are still no matching cells to form the mean non-teacher earnings, the mean is calculated among non-teachers over all ages in the same census region and metro status and of the same gender, race, and education background. Finally, the remaining unmatched teacher observations are assigned mean non-teacher earnings averaged over all ages and education groups in the same census region and metro status and of the same gender and race. For each teacher *i*, I then form a ratio of teacher *i*'s earnings relative to his group's non-teacher earnings. I then take the weighted average of these relative earnings across all teacher *i*'s.

19. See for example Blau and Kahn [1997], Goldin [1990], Heckman [1993], Pencavel [1998], Smith and Ward [1984, 1989], among others.

20. A number of studies have also demonstrated that among cross-sections of college graduates in the late 1970s, 1980s and 1990s, academic ability, as measured by standardized test scores or the quality of one's university, is inversely related to the decision to become a teacher. See for example Ballou & Podgursky [1995; 1997], and Manski [1985].

21. For the teacher wage measure, Figlio controls for the starting salary of teachers with an M.A. while Ballou & Podgursky use the state-level average salaries of all teachers relative to the average salaries of all non-teaching college graduates. In contrast I control separately for contemporaneous relative teacher wages and teacher & professional wage growth.

22. The model presented here is formally identical to that in Borjas [1985]. For simplicity, I do not include a parameter Borjas incorporated—the cost of immigration—which in this case would be the cost of switching from the non-teaching to teaching sector. Since I am thinking of an individual at the beginning of her or his career, it is more useful to abstract from switches that may occur later in the lifecycle. This parameter can also easily be included and enters as a positive term in *z* in equation (4). Various applications of the Roy model include Willis and Rosen [1979], Heckman and Sedlacek [1985].

23. The lifting of discrimination barriers affecting women and blacks would also lead to an exogenous change in earnings faced by these groups in the alternative sector.

24. Formally both ratios σ_1/σ_0 and σ_0/σ_1 are greater than ρ.

25. Formally $\sigma_1/\sigma_0 < 1$, σ_1/σ_0 is less than ρ, ρ is less than σ_0/σ_1, and ρ is sufficiently positive.

26. For example, a shock brought about by the lifting of discrimination barriers affecting women and blacks.

27. If for example changes in inequality are mainly due to technological change, it is likely that the skill levels of the population are increasing with changes in inequality.

28. Specifically in the teacher supply regressions, I estimate multinomial logit models (Y=occupation choice) and logit models (Y=1 if in teaching). Measures of teacher quality include standardized test scores in percentile terms and the probability of attending a highly selective institution.

29. Labor market area *k* is the finest geographic category available in the data sets: state*metro(IPUMS), region*metro(NLS's), state(CIRP).

30. The results reported below utilize the cross-section earnings profile by calculating the market earnings for age groups 21-30, 31-40, 41-50, and 51-60 at each year. This assumes that individuals making an occupation entry decision use today's wage profile in projecting their lifetime wages. As a sensitivity check, I also estimate marginal effects using the time-series profile in relative earnings. This is calculated by assuming perfect foresight, in that the wage profile faced by a 21 to 30 year old in 1940 are the wages of 31-40 year olds in 1950, 41-50 year-olds in 1960, and 51-60 in 1970. There are no significant differences in using the cross-section or time-series wage profile so I report results using the cross-section profile.

31. As the IPUMS are not panel data, it is difficult to disentangle true entry versus retention effects because of widespread attrition in teaching and women's labor force interruptions due to childbearing. Under the assumption that individuals make their initial occupation choice at ages 21 to 30, classifying contemporaneous wage effects into entry and retention effects seem reasonable.

32. Murnane et. al. also find that salary in the first years on the teaching job matters most in determining who leave quickly.

33. In other words, focusing on entry cohorts ignores retention effects. This may *underestimate* true wage effects as relative teacher earnings declined over time and retention rates in teaching declined across cohorts. However, it is also likely that the estimated wage effects may be an *overestimate*, if measurement error in earnings is likely to bias wage effects downward to zero.

34. An inspection of national trends, which consider the labor market at the national level, is less likely to suffer from this source of bias. As a sensitivity test, I also estimate (1.1)' using national averages for market earnings in teaching and the professions. The results of this and other sensitivity tests are available from the author.

35. A metropolitan area consists of a large population center and adjacent communities. I also classify non-identifiable areas in the 1990 sample to be non-metropolitan.

36. It can also be argued that not all metropolitan areas within a state are comparable labor markets, for example, the metro area that includes Philadelphia and that surrounding Pittsburgh in Pennsylvania. A case such as this should tend to offset each other and favor not finding any teacher wage effects, which is not what I find.

37. Regressions for white males and white females pass Hausman tests for IIA (independence of irrelevant alternatives). I get negative chi-squared statistics in regressions for blacks.

38. Whether lifetime earnings in each occupation is specified in terms of levels at each 10-year age interval, or as wage growth [ln w(t+30)/w(t+10)], the coefficients on the lifecycle are not consistently significant across specifications. In Table 5, I report results from a specification using wage growth to control for lifetime earnings.

39. Because these are logit coefficients, it is difficult to interpret the magnitude of these estimates for comparisons across specifications and groups. Marginal effects are also discussed below.

40. The insignificant wage effects estimated over the population of blacks in cols 4-5 may be due to relatively lower rates of overall labor force participation for these groups. In specifications estimated over employed blacks only (cols 9-10) teacher wage effects are significant and in the expected direction.

41. Changes in own-race school-age population are weakly significant in determining black females' relative teacher earnings, but only in non-preferred specifications and the second stage results are still insignificant.

42. Another potential reason for the greater magnitude of IV estimates is measurement error, as measurement error in wages is not going to be related with error in measuring the school-age population (i.e. sampling error). Extra instruments are also valid in tests of overidentifying restrictions. IV specifications with state and year fixed effects yield generally the same results. For the sake of consistency in explaining a time series pattern, the tables present results with state fixed effects only.

43. As in Glen Cain and Ross Finnie's [1990] study of black-white youth employment.

44. The following report results using NLS data only. Using CIRP data, I also estimate equation (1.1)' on prospective teachers only, with Y equal to 1 if prospective teacher *i* is from a highly selective insitution. Overall I find that relative teacher wages are positive and significant in attracting prospective teachers from highly selective institutions. These results are available from the author.

45. I use the finest geographic classification that is available in the data: metropolitan and non-metropolitan labor markets at the region level.

46. Declines over time in fertility and technical improvements in home production also allowed women to pursue occupations that are not as complementary to child-rearing. Other potential sources of shifts in female labor supply include changes in marriage rates, divorce laws or day care arrangements. There seems to be no intuitive story that any one of these supply-side events should disproportionately increase female labor supply in teaching relative to alternatives, particularly at the top of the quality distribution, leading to the observed relative wage decline.

47. Measures of student outcomes include high-school dropout rates at the state-level and NAEP long-term trend test scores at the region-level. I find that teacher relative wages, particularly of women and blacks, are a significant determinant of high school dropout rates. Quality measures of teachers matched from the NLS's are also found to be significantly related to NAEP long-term trend test scores.

Table I.

Decline in Proportion that Teach: Fraction College-Educated Popn in Teaching
(SAMPLE: IPUMS with at least 2 years college)

WHITE FEMALE

	Census Year					
birth cohort	1940	1950	1960	1970	1980	1990
1901-09	0.19	0.2	0.29			
1910-19	0.23	0.14	0.25	0.23		
1920-29		0.11	0.18	0.19	0.14	
1930-39			0.26	0.25	0.18	0.1
1940-49				0.29	0.19	0.12
1950-59					0.15	0.09
1960-69						0.06
Total	0.21	0.15	0.24	0.25	0.16	0.09

BLACK FEMALE

	Census Year					
birth cohort	1940	1950	1960	1970	1980	1990
1901-09	0.38	0.32	0.39			
1910-19	0.36	0.28	0.37	0.33		
1920-29		0.27	0.32	0.33	0.25	
1930-39			0.31	0.36	0.27	0.17
1940-49				0.26	0.21	0.12
1950-59					0.12	0.08
1960-69						0.03
Total	0.37	0.29	0.34	0.32	0.19	0.08

WHITE MALE

	Census Year					
birth cohort	1940	1950	1960	1970	1980	1990
1901-09	0.08	0.06	0.06			
1910-19	0.08	0.05	0.05	0.04		
1920-29		0.05	0.05	0.04	0.04	
1930-39			0.07	0.06	0.05	0.04
1940-49				0.09	0.05	0.04
1950-59					0.04	0.02
1960-69						0.01
Total	0.08	0.05	0.06	0.06	0.05	0.03

BLACK MALE

	Census Year					
birth cohort	1940	1950	1960	1970	1980	1990
1901-09	0.19	0.09	0.12			
1910-19	0.15	0.15	0.13	0.11		
1920-29		0.15	0.14	0.1	0.06	
1930-39			0.16	0.12	0.07	0.04
1940-49				0.1	0.05	0.04
1950-59					0.04	0.02
1960-69						0.01
Total	0.17	0.14	0.14	0.11	0.05	0.03

Table II. Regional Variation in Decline for New Entrants (Age 21-30)
First row: Fraction in Teaching, With Some College
Second row: Fraction in Teaching, College+

WHITE FEMALE

	Census year					
Region	1940	1950	1960	1970	1980	1990
NEast	0.10	0.02	0.01	0.01	0.01	0.01
	0.22	0.14	0.21	0.29	0.16	0.08
NCentral	0.11	0.04	0.04	0.01	0.00	0.01
	0.25	0.17	0.23	0.34	0.21	0.11
South	0.12	0.02	0.01	0.01	0.01	0.01
	0.33	0.19	0.24	0.31	0.22	0.14
West	0.06	0.01	0.01	0.00	0.00	0.01
	0.23	0.15	0.22	0.26	0.14	0.09
Total	0.10	0.02	0.02	0.01	0.00	0.01
	0.26	0.16	0.22	0.30	0.18	0.11

BLACK FEMALE

	Census year					
Region	1940	1950	1960	1970	1980	1990
NEast	0.04	0	0.01	0.02	0	0
	0.04	0.31	0.23	0.21	0.16	0.06
NCentral	0.06	0	0.01	0	0.01	0
	0.42	0.2	0.26	0.41	0.2	0.09
South	0.26	0.07	0.01	0.02	0.01	0.01
	0.46	0.53	0.52	0.46	0.21	0.09
West	0	0	0	0.01	0	0.01
	0.2	0	0.21	0.26	0.11	0.02
Total	0.09	0.02	0.01	0.01	0.01	0.01
	0.28	0.26	0.31	0.34	0.17	0.06

WHITE MALE

	Census year					
Region	1940	1950	1960	1970	1980	1990
NEast	0.01	0.00	0.00	0.00	0.00	0.00
	0.07	0.06	0.09	0.14	0.06	0.02
NCentral	0.02	0.00	0.01	0.00	0.00	0.00
	0.11	0.08	0.13	0.18	0.08	0.03
South	0.03	0.01	0.01	0.00	0.00	0.00
	0.12	0.07	0.08	0.10	0.05	0.03
West	0.01	0.01	0.00	0.00	0.00	0.00
	0.12	0.08	0.10	0.08	0.05	0.03
Total	0.02	0.01	0.00	0.00	0.00	0.00
	0.10	0.08	0.10	0.13	0.06	0.03

BLACK MALE

	Census year					
Region	1940	1950	1960	1970	1980	1990
NEast	0.00	0.00	0.02	0.01	0.01	0.00
	0.10	0.00	0.08	0.08	0.03	0.02
NCentral	0.00	0.03	0.01	0.00	0.00	0.00
	0.27	0.22	0.20	0.17	0.06	0.05
South	0.02	0.00	0.01	0.00	0.00	0.00
	0.31	0.44	0.39	0.29	0.10	0.03
West	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.17	0.08	0.04	0.04
Total	0.01	0.01	0.01	0.00	0.00	0.00
	0.17	0.17	0.21	0.16	0.06	0.04

Table III. Fraction With College Who Are Professionals, Age 21-30

WHITE FEMALE

	Census year					
Region	1940	1950	1960	1970	1980	1990
NEast	0.10	0.18	0.14	0.19	0.31	0.46
NCentral	0.11	0.11	0.13	0.17	0.28	0.42
South	0.07	0.14	0.12	0.17	0.28	0.41
West	0.08	0.14	0.10	0.16	0.28	0.41
Total	0.09	0.14	0.12	0.17	0.29	0.43

BLACK FEMALE

	Census year					
Region	1940	1950	1960	1970	1980	1990
NEast	0.04	0.00	0.17	0.32	0.25	0.39
NCentral	0.07	0.30	0.17	0.17	0.33	0.40
South	0.06	0.11	0.07	0.17	0.25	0.35
West	0.20	0.00	0.00	0.20	0.24	0.41
Total	0.09	0.10	0.10	0.22	0.27	0.39

WHITE MALE

	Census year					
Region	1940	1950	1960	1970	1980	1990
NEast	0.30	0.53	0.49	0.51	0.49	0.54
NCentral	0.33	0.48	0.47	0.47	0.48	0.57
South	0.34	0.46	0.40	0.42	0.48	0.54
West	0.33	0.48	0.46	0.44	0.45	0.51
Total	0.32	0.49	0.45	0.46	0.48	0.54

BLACK MALE

	Census year					
Region	1940	1950	1960	1970	1980	1990
NEast	0.10	0.33	0.32	0.47	0.37	0.45
NCentral	0.25	0.33	0.18	0.43	0.38	0.48
South	0.15	0.22	0.18	0.28	0.37	0.42
West	0.00	0.00	0.17	0.39	0.34	0.40
Total	0.12	0.22	0.21	0.39	0.36	0.44

Table IV.

Decline in Teacher Quality As Evidenced by Test Scores:
Among Female Teachers, Fraction Scoring Lower or Upper 20 % On IQ, AFQT
(Source: NLSYW,YM,Y79)

Birth Cohort	*Above 80th percentile*	*Below 20th percentile*
1941-45	0.41	0.08
1946-49	0.40	0.05
1951-53	0.34	0.06
1957-59	0.44	0.06
1960-62	0.20	0.12
1963-64	0.19	0.19

Table V.

Decline in Teacher Quality As Evidenced by Positive Assortative Mating:
Occupation Distribution of Married Women, IPUMS 1960-90

Women Whose Husbands Are On Upper 25th Wage Percentile On The Male Wage Distn

	OCCUPATION		
Year	*UNEMP, NILF*	*TEACHER*	*PROFSNL*
1960	61.99	22.24	15.78
1970	51.81	29.63	18.55
1980	62.06	15.79	22.15
1990	70.39	6.00	23.61
Total	62.40	16.88	20.72

Women Whose Husbands Attained Greater Than College

	OCCUPATION		
Year	*UNEMP, NILF*	*TEACHER*	*PROFSNL*
1960	49.78	29.88	20.34
1970	41.38	36.01	22.61
1980	52.50	20.73	26.77
1990	53.88	10.33	35.79
Total	48.95	24.95	26.10

Table VI. Multinomial Logit Estimates On Market Real Earnings (MARGINAL EFFECTS)
DEPVAR: Pr(teacher, profsnl, non-profsnl, non-employment as baseline)
SAMPLE: Age 21-60 with at least 2 years of college, IPUMS

	WHITE MALE			***WHITE FEMALE***		
	(1) teacher	(2) profsnl	(3) non-profsnl	(4) teacher	(5) profsnl	(6) non-profsnl
teach ln w(t)	0.002	-0.001	0.003	**0.086**	**-0.170**	**-0.070**
	(0.002)	(0.009)	(0.008)	**(0.014)****	**(0.025)****	**(0.018)****
***(age=31-40)**	0.004	0.004	-0.006	-0.044	0.051	0.035
	(0.002)	(0.004)	(0.004)	(0.015)**	(0.010)**	(0.010)**
***(age=41-50)**	0.002	-0.003	0.000	-0.058	0.058	0.034
	(0.002)	(0.004)	(0.004)	(0.016)**	(0.012)**	(0.011)**
***(age=51-60)**	0.003	-0.003	0.002	-0.007	0.046	0.011
	(0.002)	(0.004)	(0.003)	(0.017)	(0.014)**	(0.014)
teach wage growth	-0.001	-0.002	0.003	-0.002	0.005	-0.007
	(0.000)	(0.002)	(0.002)	(0.002)	(0.005)	(0.004)
***(age=41-50)**	0.001	0.002	-0.004	-0.001	0.013	0.020
	(0.001)	(0.003)	(0.003)	(0.004)	(0.008)	(0.010)*
***(age=51-60)**	0.000	0.006	-0.007	-0.007	0.043	0.031
	(0.000)	(0.003)*	(0.003)*	(0.006)	(0.016)**	(0.014)*
profsnl ln w(t)	-0.003	-0.071	0.097	**-0.035**	**0.275**	**0.031**
	(0.007)	(0.028)*	(0.026)**	**(0.011)****	**(0.040)****	**(0.020)**
***(age=31-40)**	-0.012	0.099	-0.098	0.003	-0.074	0.047
	(0.007)	(0.039)*	(0.034)**	(0.007)	(0.041)	(0.018)**
***(age=41-50)**	0.003	0.121	-0.168	0.011	-0.070	0.020
	(0.008)	(0.042)**	(0.039)**	(0.006)	(0.038)	(0.016)
***(age=51-60)**	0.017	0.074	-0.136	0.031	-0.115	0.000
	(0.010)	(0.045)	(0.039)**	(0.027)	(0.042)**	(0.027)
profsnl wage growth	-0.003	0.017	0.011	0.013	-0.026	-0.019
	(0.006)	(0.028)	(0.026)	(0.004)**	(0.011)*	(0.008)*
***(age=41-50)**	0.005	-0.040	0.025	0.004	-0.076	0.034
	(0.008)	(0.038)	(0.035)	(0.007)	(0.043)	(0.014)*
***(age=51-60)**	0.001	0.028	-0.059	-0.016	0.017	0.012
	(0.007)	(0.039)	(0.037)	(0.010)	(0.019)	(0.016)
non-profsnl ln w(t)	-0.005	0.036	-0.059	**-0.063**	**-0.108**	**0.103**
	(0.007)	(0.029)	(0.026)*	**(0.017)****	**(0.041)****	**(0.024)****
***(age=31-40)**	0.009	-0.101	0.101	0.051	0.002	-0.119
	(0.007)	(0.041)*	(0.036)**	(0.018)**	(0.044)	(0.021)**
***(age=41-50)**	-0.006	-0.106	0.158	0.054	0.000	-0.078
	(0.008)	(0.044)*	(0.041)**	(0.018)**	(0.041)	(0.020)**
***(age=51-60)**	-0.021	-0.060	0.121	-0.027	0.069	-0.022
	(0.010)*	(0.048)	(0.040)**	(0.029)	(0.044)	(0.027)
non-prof wage growth	0.003	-0.010	-0.018	-0.016	0.046	0.040
	(0.006)	(0.030)	(0.028)	(0.004)**	(0.011)**	(0.009)**
***(age=41-50)**	-0.004	0.028	-0.016	0.010	0.018	-0.094
	(0.008)	(0.041)	(0.037)	(0.008)	(0.045)	(0.017)**
***(age=51-60)**	-0.001	-0.040	0.070	0.033	-0.104	-0.075
	(0.008)	(0.042)	(0.040)	(0.011)**	(0.023)**	(0.022)**
STATE FE	Yes	Yes	Yes	Yes	Yes	Yes

	BLACK MALE			***BLACK FEMALE***		
	(7) teacher	(8) profsnl	(9) non-profsnl	(10) teacher	(11) profsnl	(12) non-profsnl
teach ln w(t)	0.004	-0.006	0.002	**0.041**	**-0.059**	**-0.039**
	(0.001)**	(0.010)	(0.010)	**(0.009)****	**(0.010)****	**(0.012)****
***(age=31-40)**	-0.000	0.001	-0.001	-0.002	-0.003	0.015
	(0.001)	(0.003)	(0.003)	(0.012)	(0.006)	(0.009)
***(age=41-50)**	0.000	-0.004	0.007	-0.009	0.009	-0.005
	(0.001)	(0.003)	(0.004)	(0.012)	(0.006)	(0.009)
***(age=51-60)**	0.001	-0.001	0.003	-0.010	-0.003	0.012
	(0.001)	(0.004)	(0.004)	(0.011)	(0.006)	(0.009)
teach wage growth	-0.000	0.002	-0.001	-0.002	0.004	-0.002
	(0.000)	(0.002)	(0.003)	(0.002)	(0.003)	(0.003)
***(age=41-50)**	0.001	-0.005	0.000	-0.001	-0.004	0.002
	(0.000)	(0.003)	(0.004)	(0.002)	(0.007)	(0.006)
***(age=51-60)**	0.000	-0.004	0.001	0.001	0.002	0.005
	(0.000)	(0.003)	(0.004)	(0.002)	(0.005)	(0.006)
profsnl ln w(t)	-0.001	0.054	-0.083	**-0.003**	**0.066**	**-0.056**
	(0.001)	(0.015)**	(0.019)**	**(0.006)**	**(0.014)****	**(0.017)****
***(age=31-40)**	-0.001	-0.018	0.017	-0.001	0.002	0.000
	(0.001)	(0.010)	(0.010)	(0.002)	(0.011)	(0.009)
***(age=41-50)**	-0.000	0.001	0.003	-0.001	-0.016	0.015
	(0.001)	(0.014)	(0.012)	(0.003)	(0.011)	(0.010)
***(age=51-60)**	-0.000	-0.024	0.014	-0.001	0.017	-0.020
	(0.001)	(0.012)	(0.010)	(0.003)	(0.013)	(0.010)*
profsnl wage growth	-0.000	0.004	-0.005	-0.002	0.004	-0.002
	(0.000)	(0.004)	(0.004)	(0.001)	(0.002)	(0.003)
***(age=41-50)**	0.001	-0.006	0.009	0.005	-0.002	-0.003
	(0.000)*	(0.006)	(0.006)	(0.002)**	(0.005)	(0.006)
***(age=51-60)**	-0.000	-0.003	0.011	0.001	-0.007	-0.005
	(0.001)	(0.007)	(0.007)	(0.002)	(0.004)	(0.005)
non-profsnl ln w(t)	-0.007	-0.085	0.118	**-0.053**	**-0.023**	**0.142**
	(0.001)**	(0.015)**	(0.020)**	**(0.013)****	**(0.012)**	**(0.022)****
***(age=31-40)**	0.002	0.019	-0.013	0.012	-0.011	-0.024
	(0.001)	(0.011)	(0.011)	(0.013)	(0.014)	(0.014)
***(age=41-50)**	0.001	0.009	-0.007	0.018	-0.001	-0.016
	(0.001)	(0.014)	(0.013)	(0.013)	(0.012)	(0.013)
***(age=51-60)**	-0.000	0.033	-0.030	0.016	-0.012	-0.003
	(0.001)	(0.013)*	(0.011)**	(0.012)	(0.014)	(0.013)
non-prof wage growth	-0.001	-0.002	0.003	-0.005	0.011	0.009
	(0.000)**	(0.006)	(0.006)	(0.002)*	(0.005)*	(0.005)
***(age=41-50)**	0.001	0.004	0.000	0.011	-0.029	-0.012
	(0.001)	(0.009)	(0.009)	(0.004)**	(0.009)**	(0.011)
***(age=51-60)**	0.002	0.002	-0.001	0.010	-0.030	-0.008
	(0.001)*	(0.010)	(0.010)	(0.004)**	(0.008)**	(0.010)
STATE FE	Yes	Yes	Yes	Yes	Yes	Yes

NOTES: Standard errors are in parentheses, estimated assuming non-zero covariance within local labor market area and independence across. * denote significant at 5% level; ** denote significant at 1% level. Market earnings are calculated among teachers, professionals, and non-professionals, of the same race, gender, age group and residing in the same state and metropolitan category. Models are also estimated with education and experience categories, marital status, dummy for metropolitan area, controls for missing variables, and excludes a constant. All regressions are weighted to add up to the U.S. population. Baseline category of model: non-employment (NILF or unemployed).

Table VII. Cross-Section Analysis as Sensitivity Test.
ENTRY WAGE EFFECTS ON RECENT ENTRANTS: Logit Coefficients

DEPVAR: Probability (teacher=1)

SAMPLE: Recent Labor Market Entrants, IPUMS

SAMPLE	***POPULATION, AGE 21-30, AT LEAST 2 YRS OF COLLEGE***					***EMPLOYED POPULATION, AGE 21-30, AT LEAST 2 YRS OF COLLEGE***				
WHITE MALE	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Teachers' beginning W	-0.358	0.050	0.041	-0.027	-0.025	0.026	0.345	0.356	0.343	0.349
	(0.016)**	(0.108)	(0.126)	(0.143)	(0.132)	(0.029)	(0.044)**	(0.046)**	(0.042)**	(0.038)**
Profsnls' beginning W		-0.410	-0.399	-1.849	-1.316		-0.192	-0.185	-0.215	-0.204
		(0.108)**	(0.126)**	(0.257)**	(0.278)**		(0.080)*	(0.082)*	(0.070)**	(0.067)**
ln(teachers/profsnls W)		0.410	0.286	0.610	0.316		0.373	0.358	0.312	0.311
		(0.151)**	(0.178)	(0.299)*	(0.154)*		(0.058)**	(0.054)**	(0.037)**	(0.032)**
WHITE FEMALE										
Teachers' beginning W	-0.242	1.143	1.229	0.310	0.384	0.055	0.249	0.366	0.287	0.187
	(0.018)**	(0.201)**	(0.206)**	(0.137)*	(0.115)**	(0.044)	(0.055)**	(0.073)**	(0.047)**	(0.042)**
Profsnls' beginning W		-1.415	-1.530	-0.685	-0.646		-0.169	-0.178	-0.121	-0.117
		(0.208)**	(0.212)**	(0.137)**	(0.115)**		(0.032)**	(0.033)**	(0.029)**	(0.027)**
ln(teachers /profsnls W)		0.848	1.139	0.476	0.424		0.204	0.241	0.112	0.122
		(0.199)**	(0.214)**	(0.173)**	(0.119)**		(0.028)**	(0.032)**	(0.028)**	(0.026)**
BLACK MALE										
Teachers' beginning W	-0.283	0.271	0.214	0.055	-0.048	0.253	0.381	0.456	0.376	0.447
	(0.053)**	(0.140)	(0.152)	(0.145)	(0.142)	(0.030)**	(0.043)**	(0.047)**	(0.035)**	(0.039)**
Profsnls' beginning W		-0.667	-0.718	-0.560	-0.409		-0.235	-0.222	-0.172	-0.168
		(0.149)**	(0.178)**	(0.153)**	(0.160)*		(0.033)**	(0.034)**	(0.030)**	(0.028)**
ln(teachers /profsnls W)		0.461	0.353	0.075	-0.075		0.316	0.338	0.239	0.262
		(0.157)**	(0.175)*	(0.166)	(0.155)		(0.032)**	(0.027)**	(0.025)**	(0.024)**
BLACK FEMALE										
Teachers' beginning W	-0.210	0.453	0.625	-0.112	-0.019	0.219	0.296	0.392	0.287	0.372
	(0.045)**	(0.150)**	(0.139)**	(0.138)	(0.119)	(0.042)**	(0.042)**	(0.061)**	(0.036)**	(0.043)**
Profsnls' beginning W		-0.760	-0.910	-0.270	-0.285		-0.234	-0.228	-0.138	-0.136
		(0.152)**	(0.137)**	(0.137)*	(0.119)*		(0.030)**	(0.031)**	(0.031)**	(0.031)**
ln(teachers /profsnls W)		0.561	0.886	-0.042	0.089		0.307	0.333	0.171	0.184
		(0.189)**	(0.163)**	(0.171)	(0.122)		(0.033)**	(0.034)**	(0.027)**	(0.028)**
State FE	No	No	Yes	No	Yes	No	No	Yes	No	Yes
Time FE	No	No	No	Yes	Yes	No	No	No	Yes	Yes

NOTES: Std errors are in parentheses, estimated assuming non-zero covariance within local labor market area and independence across. * denote significant at 5% level; ** at 1% level. Sample includes pop'n 21-30, at least 2 years of college and not in school. Market earnings are calculated among teachers and professionals of the same age, race, gender, and same state and metro category. Models are also estimated with controls for wage growth, education & experience categories, marital status, dummies for metropolitan area, for south (in specifications without state FE), for missing variables, and excludes a constant. All regressions are weighted to add up to the U.S. population.

Table VIII. First Stage 2SLS Regressions

DEPVAR: Relative Teacher Earnings: ln(teachers/profsnls W)

INSTRUMENTS	*WHITE MALE*	*WHITE FEMALE*	*BLACK MALE*	*BLACK FEMALE*
DEMOGRPAHICS				
log total schlage pop	-0.013	0.015	0.01	-0.028
	(0.008)	(0.005)**	(0.016)	(0.017)
F-Stat	2.64	10.38	0.41	2.78
10-YEAR LAG IND STRUCTURE				
log(fed govt emp share)	0.062	0.101	0.053	0.237
	(0.032)*	(0.030)**	(0.126)	(0.086)**
log(services emp share)	0.027	0.154	0.195	0.353
	(0.054)	(0.039)**	(0.166)	(0.112)**
log(mfg emp share)	-0.066	-0.367	-0.310	-0.876
	(0.055)	(0.055)**	(0.229)	(0.173)**
F-Stat	5.62	21.05	1.08	10.35
DEMOGRAPHICS, IND MIX, AND INTERACTIONS				
log schlage pop	-0.009	0.015	0.013	-0.038
	(0.007)	(0.004)**	(0.018)	(0.017)*
log(fed govt emp share)	0.172	-0.072	-0.580	-0.693
	(0.337)	(0.339)	(1.218)	(0.855)
***schlage pop**	-0.009	0.011	0.043	0.069
	(0.024)	(0.025)	(0.090)	(0.062)
log(services emp share)	-0.995	-0.899	-1.806	2.031
	(0.466)*	(0.423)*	(1.181)	(0.788)*
***schlage pop**	-0.085	-0.110	-0.297	-0.100
	(0.052)	(0.055)*	(0.186)	(0.158)
log(mfg emp share)	1.144	1.215	3.913	0.491
	(0.725)	(0.768)	(2.619)	(2.228)
***schlage pop**	0.074	0.077	0.145	-0.129
	(0.035)*	(0.031)*	(0.092)	(0.057)*
R-squared	0.67	0.49	0.46	0.48
F-Stat	3.00	14.74	1.09	7.35

Standard errors are in parentheses, calculated assuming non-zero covariance within state and year. * denote significant at 5% level; ** significant at 1% level. In addition to state fixed effects, models are also estimated with controls for any missing values as well as all other exogenous regressors in Table IX. F-statistics reported in the last two rows test whether instruments jointly equal zero.

Table IX. 2SLS COEFFICIENTS ON *ENTRY* REAL EARNINGS

DEPVAR: Probability (teacher=1)
SAMPLE: Recent Labor Market Entrants, IPUMS

	(1) *OLS*	*(2)* *IV = school-age popn*	*(3)* *IV = 10-yr lag indstrl mix*	*(4)* *IV = school-age popn, indstrl mix, and interactions*
IV for ln(teachers/profsnls W)				
white male	-0.003	-0.635	0.120	0.093
	(0.006)	(0.418)	(0.055)*	(0.054)
white female	0.147	1.227	0.988	0.968
	(0.023)**	(0.325)**	(0.252)**	(0.124)**
black male	0.016	0.938	0.594	0.118
	(0.008)*	(1.916)	(0.299)*	(0.054)*
black female	0.063	-0.580	0.503	0.251
	(0.015)**	(0.453)	(0.247)*	(0.058)**
IV for ln(teachers/profsnls W) relative to white male				
white female		0.103	0.081	0.046
		(0.041)*	(0.022)**	(0.014)**
black male		0.239	0.116	0.042
		(0.419)	(0.048)*	(0.020)*
black female		-0.481	0.12	0.049
		(1.068)	(0.076)	(0.028)

NOTES:
Column (2) use the natural log of the population aged 5-17 at the state level as instruments; column (3) use the fraction employed in the federal government, services, and manufacturing sectors lagged 10 years; column (4) use both sets of IV's and interactions. Standard errors are in parentheses, estimated assuming non-zero covariance within local labor market area and independence across. * denote significant at 5% level; ** denote significant at 1% level. Sample includes population aged 21-30, with at least 2 years of college education and currently not in school. Market earnings are calculated among teachers and professionals, of the same race, gender, agegroup, and residing in the same state and metropolitan category. Models are also estimated with controls for wage growth, education and experience categories, marital status, dummy for metropolitan area, dummy for south (in specifications without state FE), controls for missing variables, and excludes a constant. All regressions are weighted to add up to the U.S. population. Baseline category: 0 yrs LF experience, less than 4 yrs college. For more discussion, see details in text.

Table X. Teacher Quality and Relative Teacher Entry Earnings: Quantile regression coefficients

DEPVAR: IQ/AFQT Percentile Score
Sample: Teachers in the NLSYW,YM,Y-79

	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*	*(10)*	*(11)*	*(12)*
Quantile	25	Median	75	25	Median	75	25	Median	75	25	Median	75
white female	6.481	-0.807	-3.976	1.875	-6.130	-8.295	7.086	0.000	-2.539	-1.073	-6.451	-9.500
	(3.893)	(3.751)	(1.610)*	(3.710)	(3.696)	(2.613)**	(3.676)	(2.700)	(1.663)	(5.381)	(3.484)	(2.479)**
black male	-36.572	-36.905	-37.617	-41.205	-46.618	-43.116	-36.777	-35.897	-29.936	-43.372	-44.689	-32.791
	(7.072)**	(10.133)**	(13.079)**	(6.180)**	(7.363)**	(18.019)*	(4.802)**	(6.312)**	(11.975)*	(8.263)**	(6.592)**	(17.475)
black female	-31.948	-38.457	-41.000	-34.918	-45.538	-44.528	-32.107	-35.354	-29.539	-38.399	-44.063	-32.900
	(6.111)**	(8.812)**	(8.243)**	(5.856)**	(6.820)**	(17.133)**	(4.063)**	(8.517)**	(7.956)**	(7.567)**	(5.613)**	(16.854)
metro area	4.632	8.652	6.156	8.111	13.959	10.959	5.079	9.322	5.546	8.313	15.411	11.685
	(2.323)*	(3.088)**	(2.303)**	(3.963)*	(3.209)**	(2.478)**	(3.850)	(2.384)**	(1.779)**	(4.344)	(2.619)**	(2.380)**
metro*black	-6.089	-8.868	-3.235	-8.464	-5.697	-9.050	-6.399	-11.026	-10.009	-7.320	-9.451	-20.681
	(4.677)	(5.756)	(9.196)	(5.703)	(5.529)	(17.842)	(5.248)	(8.216)	(8.233)	(5.136)	(4.688)*	(17.198)
ln(teacher/profsnl W)	**10.265**	**16.606**	**23.586**	**16.497**	**32.481**	**35.653**	**7.833**	**8.887**	**14.119**	**23.278**	**26.180**	**29.485**
	(8.212)	**(6.026)****	**(6.027)****	**(6.666)***	**(8.593)****	**(6.029)****	**(6.670)**	**(13.621)**	**(4.125)****	**(9.001)****	**(11.283)***	**(10.451)****
Constant	41.705	58.346	85.000	48.445	65.220	90.001	41.282	59.393	83.171	51.080	65.061	89.216
	(5.733)**	(5.675)**	(3.807)**	(5.998)**	(6.459)**	(3.379)**	(4.721)**	(3.667)**	(4.022)**	(6.553)**	(6.995)**	(5.941)**
Observations	731	731	731	731	731	731	731	731	731	731	731	731
Region FE	No			Yes			No			Yes		
Cohort FE	No			No			Yes			Yes		

NOTES:
Bootstrapped standard errors are in parentheses. * denote significant at 5% level; ** denote significant at 1% level. Sample includes NLS respondents with at least 2 years of college education and currently not in school, who was ever a teacher between ages 21-30. Percentile test scores are generated from IQ test scores in the NLSYW & YM and AFQT in the NLSY79. Models are also estimated with controls for the lifetime cross-section wage profile (market earnings at ages 31-40, 41-50, 51-60) and with education, race and gender categories and interactions, and controls for missing variables. Baseline category: white male teacher with some college living in the Northeast. Finally, earnings are calculated from the IPUMS among teachers and professionals & managers (excluding teachers & nurses), and merged onto the NLS's by birth cohort, race, gender, region and metropolitan category. For discussion, see details in text.

Figure I. The Rise of Women and Black Professionals (Age 21-30)

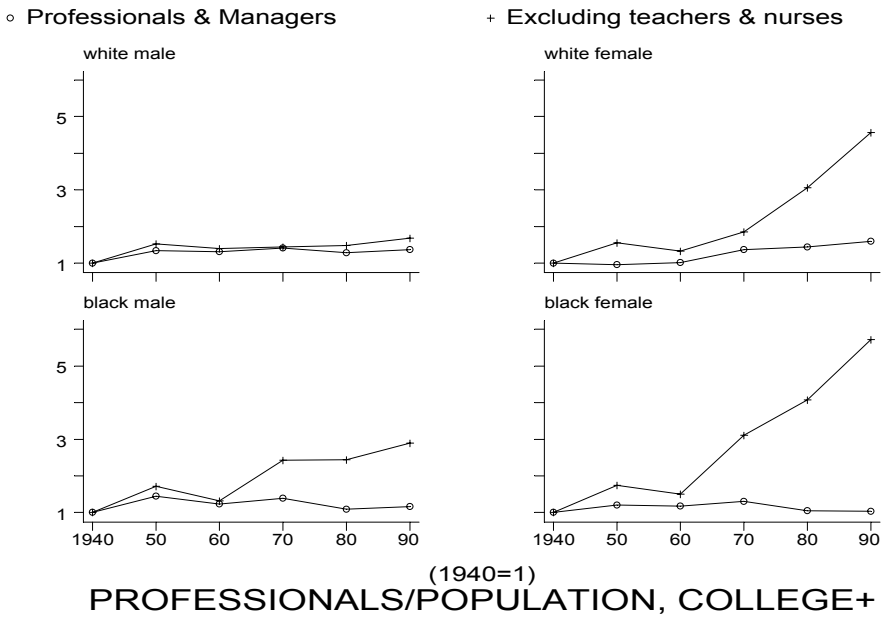


Figure II. Decline of Female and Black Employment in Teaching

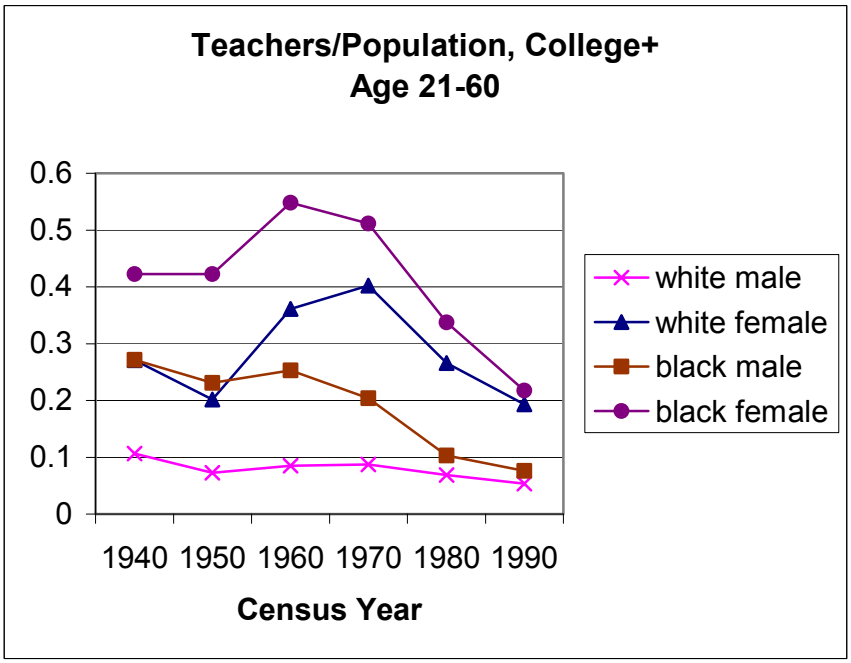


Figure III. Decline in Teacher Quality: Evidence from standardized test scores

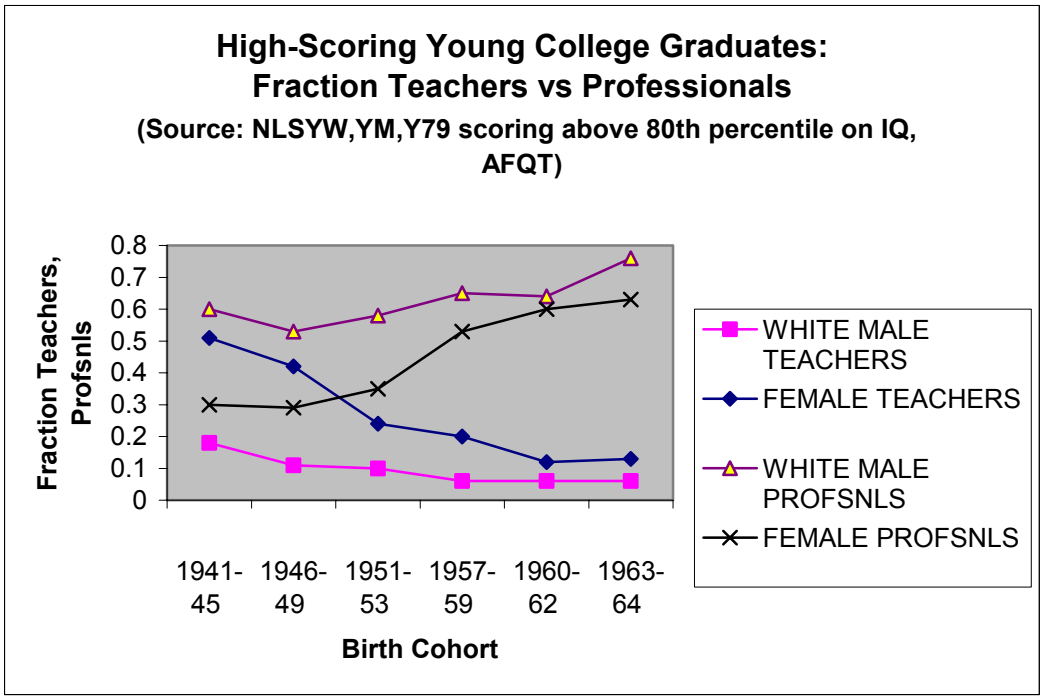
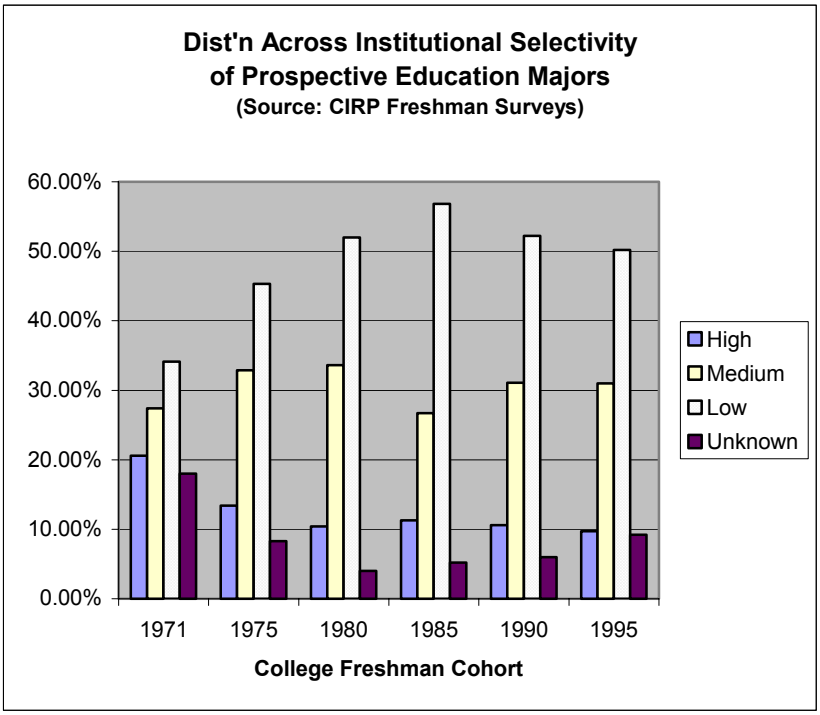


Figure IV. Decline in Teacher Quality: Evidence from Undergraduate Institution Selectivity



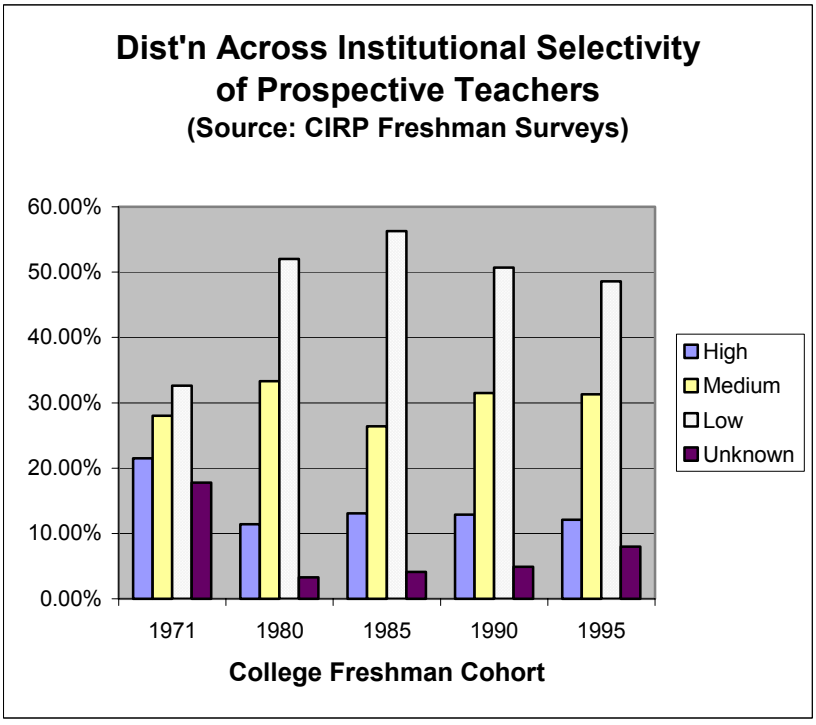
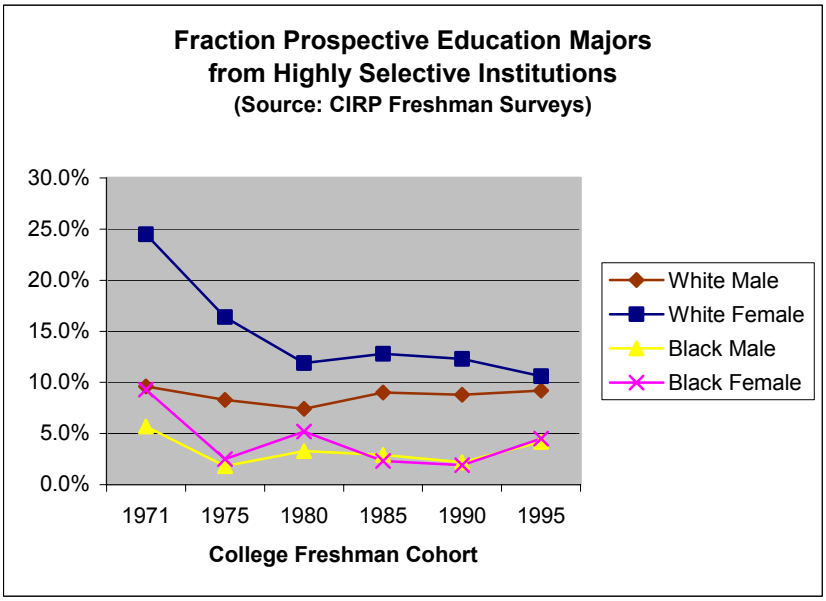


Figure V. Decline in Teacher Quality: Prospective Teachers from Highly Selective Institutions



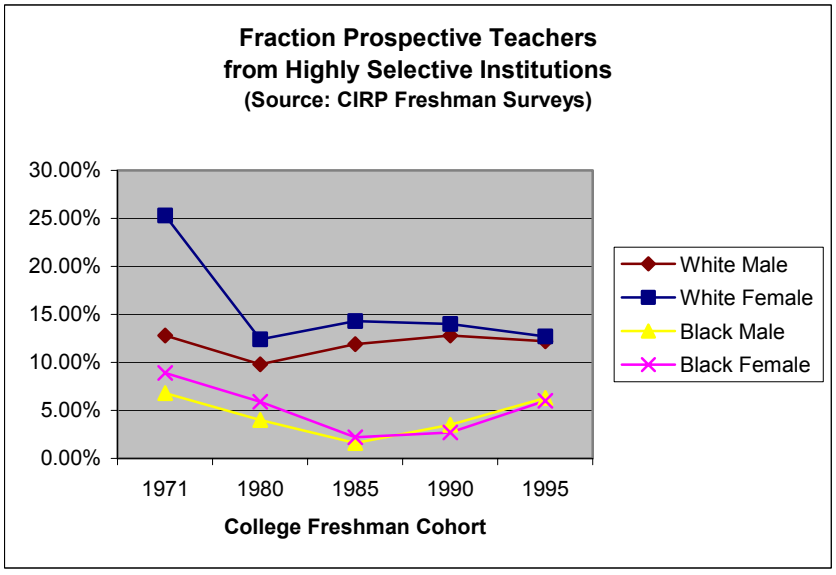
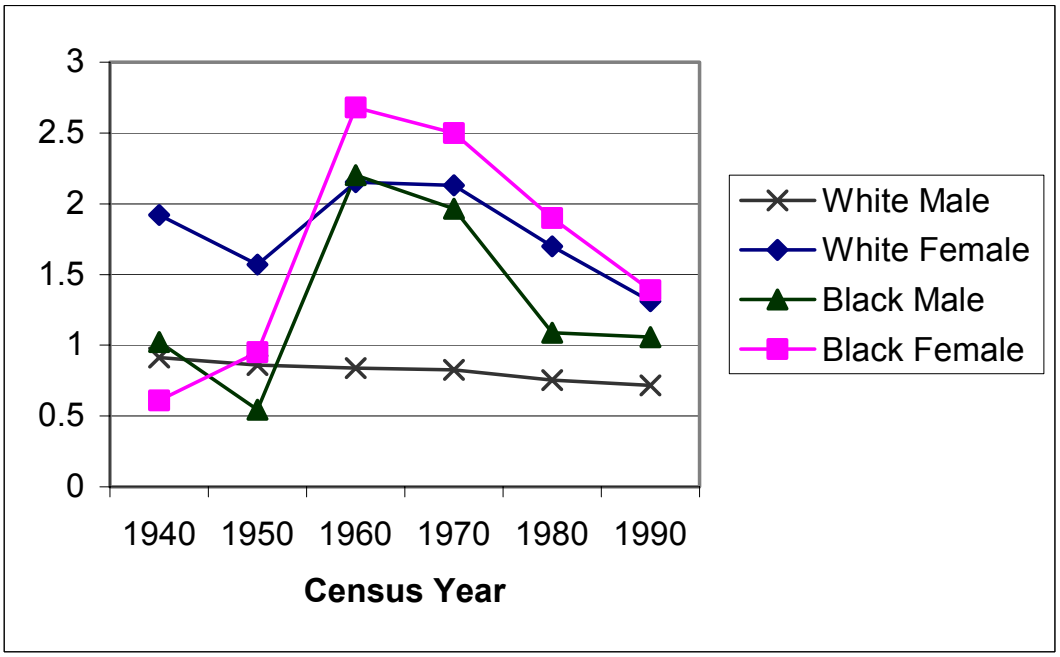


Figure VI. Decline in Teacher Earnings relative to Non-teachers



Mean relative earnings over all teacher i's relative to non-teacher college-graduate j's are calculated as $\frac{1}{N_i}\sum_i \frac{y_i}{Y_j}$, where $Y_j \equiv \frac{1}{N_j}\sum_j y_j \,|\, X_i = X_j$ and X include state of residence, SMSA status, gender, race, education group, and age group. For more details, see discussion in text.