Accounting for Race and Gender Differences in College Wage Premium Changes*

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I. Introduction

Much recent research has been devoted to the rapid rise in the college wage premium during the 1980s [3; 5; 10; 13; 14]. Murphy and Welch [13] estimated that between 1979 and 1986, the college wage premium for all age groups increased almost 20 percentage points, while the college wage premium for workers with one to five years of experience grew by 38 percentage points.

While the size of the college wage premium increase is impressive, especially among recent graduates, there is substantial disparity in this change among individual race/gender groups [2; 4]. Coleman [4] found that the wage premium increase for graduates with one to five years of experience was 45 percentage points for white men, 30 percentage points for white women, and 27 percentage points for black men, while the wage premium decreased by 3 percentage points for black women.

Why did the college wage premium change so differently for different race/gender groups? Part of the disparity may be due to differences in growth rates of major-specific wage premia. It is well established that the return to a college degree varies markedly by field of study, with relatively technical degrees earning the highest wage premia [1; 5; 6; 9; 17]. If wage premia associated with different majors changed differently over time among the race/gender groups, then their respective aggregate college wage premia would likely change differently as well.

Another factor which may account for differences in college wage premium changes is changes in the distribution of graduates across majors. Grogger and Eide [5] found that men who graduated college in the mid-1980s were more likely to earn degrees in technical fields than were their predecessors from the mid-1970s. The authors found that this major distribution change, which increased the proportion of graduates in high-paying majors, accounts for one-fourth of the rise in the college wage premium between 1978 and 1986 for men who were recent graduates.[1] Hence, differences in college wage premium changes across race/gender groups may

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1. Grogger and Eide [5] also analyzed the college wage premium change for women, and found that most of the change was accounted for by major-specific premia changes, with major distribution changes playing a negligible role. While the study by Grogger and Eide examines the underlying components of college wage premium changes separately for men and women, it does not examine premium changes by race within gender.

partly be accounted for by graduates from some groups entering higher-paying fields in greater proportions than graduates from other groups.

The purpose of this paper is to quantify how major-specific premia changes and major distribution changes account for college wage premium changes between 1978 and 1986 for the race/gender groups of white men, nonwhite men, white women, and nonwhite women.[2] First, I will use data on two cohorts of recent college graduates, one from the mid-1970s and another from the mid-1980s, to estimate how the value of a college degree changed both in the aggregate and by major for each race/gender group. Next, I will use the major-specific premia estimates to decompose the college wage premium change for each race/gender group into a component which accounts for major-specific premia changes (also referred to as price changes) and a component which accounts for major distribution changes (also referred to as quantity changes). These decompositions will show the extent to which major-specific premia changes and major distribution changes account for college wage premium changes differently for different race/gender groups, and thus will yield insight into why the college wage premium for different groups may change differently over time. I will also use the price and quantity data to conduct a qualitative analysis on changes in the net demand for recent graduates from each race/gender group.

II. Data

The analysis is based on pooled data from two longitudinal surveys conducted by the U.S. Department of Education. The National Longitudinal Survey of the High School Class of 1972 (NLS72) is a longitudinal survey of roughly 21,000 high school seniors who graduated in 1972 [15]. The High School and Beyond (HSB) survey is a similar panel of about 12,000 members of the high school class of 1980, and was intended as a follow-up to the NLS72 [16]. Both studies collected extensive background information and administered similar sets of standardized tests in their base year surveys [7]. Subsequent interviews collected data on the respondents' post-secondary education, employment, and earnings.

My sample includes individuals who participated in the base year survey and the follow-up interview from which data were drawn. Except where noted, I restrict the sample to full-time workers who were not full-time students. I further restricted the sample to persons whose hourly wage was between \$1 and \$100. All monetary values are expressed in 1986 dollars.

The dependent variable in my analysis is the logarithm of the hourly wage.[3] The independent variables include educational attainment dummies, college major dummies, test scores, high school grade dummies, family background variables, labor market experience, region dummies, community residence dummies, a part-time school dummy, and a cohort dummy.

Educational attainment dummies are for the mutually exclusive categories of high school graduate, persons with some college but no degree, college graduate, and postgraduate degree recipient.[4] For college graduates, I collapsed all fields of study into one of seven categories: busi-

2. The nonwhite category is composed of the race/ethnicity groups of black, Hispanic, and other race/ethnicity (Native American, Asian-Pacific, other/missing). While it would be insightful to separately analyze these race/ethnicity groups which make up the nonwhite category, particularly since changes in some of these subgroups may mask changes in other subgroups, the number of college graduates from these groups is too small for detailed individual analysis.

3. Definitions of all variables are contained in a Data Appendix available from the author.

4. There are no high school dropouts in the sample. Since base year interviews were conducted late in the students' senior year in high school, almost all respondents either graduated or obtained an equivalency diploma. The few who did not were either non-respondents in later interview rounds or did not meet my sample inclusion criteria.

Table I. Distribution of College Graduates by Major

Field	NLS72		HSB		Changes	
	White (1)	Nonwhite (2)	White (3)	Nonwhite (4)	(3)–(1) (5)	(4)–(2) (6)
A. Men						
Business	0.272	0.181	0.318	0.483	0.046	0.302
Engineering	0.126	0.057	0.252	0.183	0.126	0.126
Physical Science	0.045	0.023	0.067	0.022	0.022	−0.001
Life Science	0.096	0.064	0.083	0.027	−0.013	−0.037
Social Science	0.236	0.408	0.146	0.242	−0.090	−0.166
Education/Letters	0.155	0.164	0.102	0.040	−0.053	−0.124
Other Major	0.071	0.102	0.032	0.002	−0.039	−0.100
B. Women						
Business	0.094	0.103	0.308	0.323	0.214	0.220
Engineering	0.009	0.034	0.096	0.098	0.087	0.064
Physical Science	0.031	0.035	0.012	0.020	−0.019	−0.015
Life Science	0.185	0.124	0.095	0.087	−0.090	−0.037
Social Science	0.242	0.345	0.199	0.267	−0.043	−0.078
Education/Letters	0.364	0.285	0.254	0.179	−0.110	−0.106
Other Major	0.074	0.074	0.037	0.027	−0.037	−0.047

Note: Based on weighted data; each individual contributes one observation. The proportion of graduates in each major for each group may not sum to one due to rounding error.

ness (including economics), engineering, physical science (including math), life science, social science, education and letters, and other major.[5] I aggregated the majors into seven broad fields primarily because the cell sizes for nonwhite college graduates are too small for more detailed analysis.

I use scores from three standardized tests which were administered during the student's senior year of high school: a math test, a vocabulary test, and a "mosaic" test which measures perceptual speed and accuracy. I also constructed two dummy variables from base-year self-reports of the student's high school grades: one indicates that the student had mostly A's and B's, and the other indicates that the student had mostly B's and C's. The test scores and high school grades are meant to proxy for individual ability.

Family background is measured by dummy variables for parental income during the student's senior year of high school. Labor market experience is an annualized measure of weeks worked since the student completed his or her full-time schooling. The region dummies are four dummies corresponding to west, south, northeast, and central U.S. The community residence dummies correspond to urban, rural, and suburban areas.

Table I presents the distribution of college graduates across majors for each race/gender

5. The detailed fields included in the seven aggregate majors are: (1) business: business management, accounting, banking and finance, business and office, economics; (2) engineering: engineering, computer and information sciences, engineering-related technologies, architecture, environmental design; (3) physical sciences: mathematics, physical sciences; (4) life science: life sciences, agriculture, agriculture sciences, renewable natural sciences; (5) social science: social sciences, communications, home economics, vocational home economics, psychology, public affairs, protective services, multi/interdisciplinary studies, area and ethnic studies; (6) education/letters: education, letters, philosophy, religion, theology, visual and performing arts, foreign languages; (7) other major: other majors not listed above or information missing.

group.[6] Panel A gives the distributions for men and panel B gives the distributions for women. Columns (5) and (6) of panel A show substantially increased proportions of both white and nonwhite men graduating in relatively technical fields. The changes were especially large for nonwhite men, where the proportion moving into business and engineering grew by over 30 percentage points and almost 13 percentage points, respectively. There were decreased proportions of both white and nonwhite men in the less-technical fields, especially social science and education/letters.

A similar pattern for women is found in columns (5) and (6) of panel B. The largest changes are in the proportions of nonwhite and white women graduating in business, which saw increases of 22 percentage points and 21 percentage points, respectively. The proportion of white and nonwhite women graduating in engineering also increased substantially. The largest decline for both white and nonwhite women is in education and letters, where the proportion of each group fell by about 11 percentage points.

The main finding from Table I is that college graduates from each race/gender group entered more-technical (higher-paying) fields and left less-technical (lower-paying) fields between the mid-1970s and the mid-1980s.[7] How these quantity changes translate into college wage premium changes for each group is a fundamental issue addressed in this paper.

III. Estimation

Now that the major distribution changes for each race/gender group have been established, the next step is to obtain wage premia estimates for college graduates from each group. I first estimate the aggregate college wage premium and premium growth rate for each group to establish the basic results on college wage premium changes. I then estimate major-specific premia and major-specific premia growth rates for each group to be used in the decomposition analysis.

The estimation approach is based on pooled wage data from the NLS72 and the HSB. The NLS72 fourth follow-up, conducted in 1979, contributes wages from 1977, 1978, and 1979; the fifth follow-up, conducted in 1986, contributes wage data for 1986; and the HSB third follow-up contributes 1986 wage data for the later cohort.[8] Note that although all wage data come from the various follow-up interviews, many of the explanatory variables are taken from the base year surveys.

The regression equation to be estimated separately for each race/gender group is:

$$Y_{it} = \mathbf{E}_{it}\gamma_1 + (\mathbf{E}_{it}T_{it})\gamma_2 + (\mathbf{E}_{it}X_{it})\gamma_3 + \mathbf{Z}_{it}\beta + \alpha_i + \epsilon_{it}. \quad (1)$$

6. Table I represents the distribution of college graduates across majors in each cohort for each group, which is independent of the proportion of each group in each cohort who graduated college. The graduation rates for each group in the NLS72 and HSB cohorts, respectively, is as follows: (1) white men: 0.23, 0.20; (2) nonwhite men: 0.12, 0.10; (3) white women: 0.28, 0.25; (4) nonwhite women: 0.18, 0.13.

7. More formally, I performed Chi-squared significance tests for the equality of major distributions across cohorts for each race/gender group. The calculated test statistic for white men is 62.3, for nonwhite men is 163.5, for white women is 380.7, and for nonwhite women is 139.0. The Chi-square critical value for a significance level of 0.005 (with 6 degrees of freedom) is 18.55. I was therefore able to reject the null hypothesis for each group that the major distribution for the HSB cohort was equal to the major distribution for the NLS72 cohort.

8. Since the sample is restricted to full-time workers who were not attending school full-time, the panel is unbalanced. An individual from the early cohort who worked part-time in 1977, say, would contribute wage data for 1978 and 1979, and for 1986 only if the respondent were one of the two-thirds of the original sample members surveyed during the fifth follow-up.

The dependent variable is the log hourly wage of individual i in period t. The vector $\mathbf{E}_{it}$ contains for now three dummy variables measuring educational attainment: the some college dummy, the college graduate dummy, and the postgraduate dummy. The base group is high school graduates who did not attend college; therefore, the college wage premium is interpreted relative to high school graduates from the same race/gender group. T_{it} is a time trend measured in years, with a value of zero in 1978. X_{it} is actual labor market experience in years. The vector $\mathbf{Z}_{it}$ contains control variables including X_{it}, the test scores, high school grade dummies, family income dummies, region dummies, community residence dummies, a part-time school dummy, year dummies, and a cohort dummy.[9]

The part of the coefficient vector γ_1 associated with the college graduate dummy gives the college wage premium for recent graduates in 1978. Similarly, the coefficient vector γ_2 gives the annualized change in the college wage premium over time for recent graduates. Note that since an experience interaction is included in the model, γ_2 measures the extent to which wage growth over time among recent college graduates exceeded wage growth over time among high school graduates, independent of wage growth due to experience. The coefficient vector γ_3 gives the change in the college wage premium as experience increases over the early part of the career, independent of wage growth as a function of time.

The error term in this model has two components, α_i and ϵ_{it}, both of which have zero mean. This is a random-effects specification; the term α_i is individual-specific and time-invariant, and generates correlation over time across the observations of a given individual. Because of this correlation, OLS applied to the model is inefficient, and the estimated standard errors are inconsistent. I therefore estimated the model using a Generalized Least Squares (GLS) approach which takes the random-effects structure into account [8].

IV. Results

College Wage Premia

The GLS estimation results for each race/gender group are presented in Table II, where the estimated college wage premia for men and women are given in panels A and B, respectively.[10] Columns (1) and (4) give the estimated college wage premia for recent graduates in 1978; columns (2) and (5) give the annual growth rate in college premia over time; and columns (3) and (6) give the annual growth rate in college premia due to experience.

The results show that each group except white men earned a significant college wage premium in 1978, with nonwhite women earning the highest wage premium at 26 percent. In contrast, white men who were college graduates earned about 8 percent less than white men who were high school graduates. The wage premium for recent graduates grew significantly over time for white men and white women, although the rate for white men was almost double the rate for white women. Relative wage growth rose with experience for white men and nonwhite men. Thus, even though white men who were college graduates initially earned less than high school graduates, after a few years of work experience they earned a positive college wage premium.

9. I also included a dummy variable equal to one if experience was missing, in which case experience was set to zero, and a dummy variable equal to one if a test score was missing, in which case the test score was set to zero.

10. My focus is on wage premium estimates for college graduates, and so for brevity sake I do not report wage premium estimates for those with some college or postgraduate degrees. These estimates are available upon request from the author.

Table II. College Wage Premia: GLS Estimates

Variable	White: 1978 Level (1)	White: Time Interaction (2)	White: Experience Interaction (3)	Nonwhite: 1978 Level (4)	Nonwhite: Time Interaction (5)	Nonwhite: Experience Interaction (6)
A. Men						
College Graduate	−0.0782	0.0132	0.0212	0.0727	0.0035	0.0149
	(0.0166)	(0.0029)	(0.0035)	(0.0372)	(0.0051)	(0.0069)
Adjusted R^2	0.118			0.137		
Number of Observations	15,073			4,524		
B. Women						
College Graduate	0.1489	0.0074	0.0029	0.2638	−0.0048	−0.0007
	(0.0149)	(0.0024)	(0.0031)	(0.0312)	(0.0046)	(0.0063)
Adjusted R^2	0.169			0.202		
Number of Observations	11,903			4,319		

Note: Standard errors in parentheses. Regressions also include in levels and with time and experience interactions the some college and postgraduate degree indicators and the math test score; included in levels are the vocabulary and mosaic test scores, high school grade dummies, experience, a cohort dummy, year dummies, a part-time school dummy, community residence dummies, region dummies, and family income dummies.

Major-Specific Wage Premia

Having determined some baseline estimates of the college wage premium for each group, I now turn to estimating major-specific wage premia for recent graduates, as well as major-specific premia growth rates over time and with experience. These estimates will show how the returns to college varied by major for each group.

To obtain major-specific premia estimates, I now replace the college graduate indicator in $\mathbf{E}_{it}$ with a set of seven mutually exclusive and exhaustive college major indicators. The some college and postgraduate degree indicators remain in $\mathbf{E}_{it}$, and the base group is still high school graduates who have not attended college. The coefficients in the vector γ_1 corresponding to the college major indicators measure the return to a college degree in a given field among recent graduates in 1978, relative to the earnings of a high school graduate.[11] The coefficients in the vector γ_2 measure the growth in relative major-specific wage premia over time for recent graduates, and the coefficients in the vector γ_3 measure growth rates in major-specific premia as a function of experience.

The major-specific premia estimates for men and women are presented in Tables IIIa and IIIb, respectively (the layouts are identical to Table II). The estimates for white men show that of the seven majors, six earned less than a high school graduate in 1978. The exception was engineering, which had a positive and significant wage premium. The fields of business, engineering, physical science, and social science had wage premia which increased significantly as a function of time between 1978 and 1986, with increases ranging from 7 percentage points ($= 0.0092 * 8$) for social science to 37 percentage points ($= 0.0468 * 8$) for physical science. Major-specific premia for white men increased with experience for all majors except physical science.

11. A potential concern about the major-specific premia estimates is that they may be biased due to students' self-selection into majors. Lee [11] outlined an approach for correcting for multi-variate selectivity such as this. The approach would require estimation of major-specific wage equations (with the inclusion of a correction term related to an inverse mills ratio) for each group, however, and the number of college graduates in each group is not sufficient to make this approach feasible. I therefore focus on the GLS estimates in Table III.

Table IIIa. Major-Specific Wage Premia: GLS Estimates for Men

Variable	White 1978 Level (1)	White Time Interaction (2)	White Experience Interaction (3)	Nonwhite 1978 Level (4)	Nonwhite Time Interaction (5)	Nonwhite Experience Interaction (6)
Business	−0.0485	0.0135	0.0205	0.1256	0.0043	0.0210
	(0.0241)	(0.0047)	(0.0056)	(0.0638)	(0.0083)	(0.0102)
Engineering	0.1392	0.0156	0.0213	0.1225	0.0190	0.0494
	(0.0327)	(0.0060)	(0.0071)	(0.1423)	(0.0190)	(0.0245)
Physical Science	−0.1644	0.0468	−0.0002	0.7120	−0.0669	−0.0919
	(0.0536)	(0.0123)	(0.0148)	(0.1700)	(0.0203)	(0.0316)
Life Science	−0.1055	−0.0002	0.0212	0.1138	−0.0142	0.0436
	(0.0358)	(0.0084)	(0.0102)	(0.1310)	(0.0265)	(0.0380)
Social Science	−0.1537	0.0092	0.0320	0.0122	0.0087	0.0143
	(0.0250)	(0.0056)	(0.0070)	(0.0572)	(0.0092)	(0.0124)
Education/Letters	−0.1529	0.0051	0.0199	−0.0761	0.0004	0.0162
	(0.0285)	(0.0062)	(0.0079)	(0.0703)	(0.0114)	(0.0173)
Other Major	−0.0619	0.0053	0.0280	0.0201	−0.0193	0.0314
	(0.0380)	(0.0081)	(0.0092)	(0.0909)	(0.0154)	(0.0195)
Adjusted R^2	0.134			0.149		
Number of Observations	15,073			4,524		

Note: Standard errors in parentheses. Regressions also include in levels and with time and experience interactions the some college and postgraduate degree indicators and the math test score; included in levels are the vocabulary and mosaic test scores, high school grade dummies, experience, a cohort dummy, year dummies, a part-time school dummy, community residence dummies, region dummies, and family income dummies.

For nonwhite men, those with degrees in business and physical science earned wage premia of about 13 percent and 71 percent, respectively, although the premia did not grow significantly over time. Graduates with degrees in business and engineering did, however, enjoy significant wage premia growth with experience.

Major-specific premia estimates for white women were significant, irrespective of major. The highest wage premium was 37 percent in physical science, and the lowest was 8 percent in education/letters. The wage premia for business and life science saw rapid growth as a function of time between 1978 and 1986, with increases of about 8 percentage points for each major. The fields of business and social science had substantial wage growth with experience.[12]

The major-specific premia estimates for nonwhite women were large and significant, with the exception of engineering. The wage premia for business, life science, and other major all exceeded 30 percent, and the wage premia for education and letters, social science, and physical science were around 20 percent. While the 1978 wage premium for engineering was not significant, its

12. Research by Mincer and Ofek [12] has shown that women's wages are often depressed in the first few years of work after childrearing. I attempted to control for this possibility by re-estimating the models for women, including in the specification the number of children the woman had at each survey date, as well as interactions of the number of children with time and experience. The results show that wage premia growth for white and nonwhite women remained largely unchanged after the inclusion of these controls, likely because the women in these samples are relatively young. Furthermore, many women work part-time, which may lead to lower wage growth with experience. To control for this I restrict the samples to full-time workers. To the extent that women who work full-time in the current period worked part-time in previous periods, the estimated interactions may be affected. I thank an anonymous referee for bringing these points to my attention.

Table IIIb. Major-Specific Wage Premia: GLS Estimates for Women

Variable	White 1978 Level (1)	White Time Interaction (2)	White Experience Interaction (3)	Nonwhite 1978 Level (4)	Nonwhite Time Interaction (5)	Nonwhite Experience Interaction (6)
Business	0.1876	0.0097	0.0144	0.3244	−0.0091	0.0244
	(0.0304)	(0.0048)	(0.0059)	(0.0679)	(0.0092)	(0.0127)
Engineering	0.2780	0.0147	−0.0205	0.0451	0.0452	0.0235
	(0.1014)	(0.0131)	(0.0196)	(0.1313)	(0.0174)	(0.0240)
Physical Science	0.3721	−0.0065	0.0295	0.2300	−0.0046	0.0302
	(0.0554)	(0.0158)	(0.0191)	(0.1351)	(0.0254)	(0.0388)
Life Science	0.2859	0.0104	−0.0050	0.4785	−0.0330	0.0300
	(0.0256)	(0.0058)	(0.0072)	(0.0811)	(0.0125)	(0.0167)
Social Science	0.0912	0.0016	0.0159	0.1944	−0.0015	−0.0072
	(0.0215)	(0.0043)	(0.0054)	(0.0451)	(0.0072)	(0.0100)
Education/Letters	0.0845	0.0052	−0.0031	0.2166	0.0033	−0.0096
	(0.0189)	(0.0035)	(0.0047)	(0.0484)	(0.0084)	(0.0118)
Other Major	0.1616	0.0105	−0.0070	0.4468	−0.0261	−0.0341
	(0.0336)	(0.0067)	(0.0080)	(0.0744)	(0.0122)	(0.0175)
Adjusted R^2	0.185			0.212		
Number of Observations	11,903			4,319		

Note: Standard errors in parentheses. Regressions also include in levels and with time and experience interactions the some college and postgraduate degree indicators and the math test score; included in levels are the vocabulary and mosaic test scores, high school grade dummies, experience, a cohort dummy, year dummies, a part-time school dummy, community residence dummies, region dummies, and family income dummies.

premium grew rapidly by 36 percentage points ($=0.0452*8$) between 1978 and 1986. The wage premia for business and life science increased rapidly with experience.

To this point, the analysis has shown that for each race/gender group there were sizeable changes in the distribution of college majors, as well as substantial variation in major-specific premia.[13] In the next section I use these findings to quantify the relative importance of price and quantity changes in accounting for college wage premium changes between 1978 and 1986 for each group.

Decomposition Analysis

The first step in the decomposition analysis is to use the price and quantity data to construct a simulated college wage premium in 1978 and 1986 for each race/gender group. I then decompose the change in the simulated premium for each group into components due to price changes and quantity changes, along with a remainder term of price and quantity interactions. Results from the decomposition analysis allow me to assess the relative importance of each component in accounting for changes in the simulated premium.

Let p_{jc} denote the wage premium for students of cohort c who studied field j, and let q_{jc} denote the proportion of college graduates in cohort c who studied field j, where $c = 1$ denotes

13. I also estimated major-specific premia after adding occupation dummies to the existing variables. The results were qualitatively the same, and so I focus on the original specification.

Table IV. Decomposition of Change in Simulated College Wage Premium, 1978–1986

Group	Change in Simulated College Wage Premium, 1978–1986 (1)	δ_p (2)	δ_q (3)
White Men	0.144	0.088	0.037
	(0.024)	(0.023)	(0.005)
Nonwhite Men	0.100	0.008	0.054
	(0.044)	(0.045)	(0.030)
White Women	0.071	0.047	0.012
	(0.019)	(0.020)	(0.011)
Nonwhite Women	−0.022	−0.041	−0.006
	(0.037)	(0.038)	(0.018)

Note: Standard errors in parentheses. The term δ_p measures how much of the change in the simulated premium is accounted for by major-specific premia changes; the term δ_q measures how much of the change in the simulated premium is accounted for by major distribution changes. The remaining change is accounted for by an interaction term, which is not reported here.

the NLS72 cohort and $c = 2$ denotes the HSB cohort.[14] Let the column-vector of major-specific premia for cohort c be given by $\mathbf{p}_c \equiv [p_{1c}, \ldots, p_{7c}]'$, and similarly define $\mathbf{q}_c \equiv [q_{1c}, \ldots, q_{7c}]'$. The simulated college wage premium for each group is computed as the weighted average of the major-specific premia, and is given by $\mathbf{p}_1'\mathbf{q}_1$ for the NLS72 cohort, and $\mathbf{p}_2'\mathbf{q}_2$ for the HSB cohort. The change in the simulated college wage premium is therefore given by $\mathbf{p}_2'\mathbf{q}_2 - \mathbf{p}_1'\mathbf{q}_1$, which is then decomposed into three components. The first component shows how the college wage premium would have changed if the major distribution had remained fixed at its initial level, and major-specific premia had changed in the observed way. This measure is computed as $\delta_p \equiv (\mathbf{p}_2 - \mathbf{p}_1)'\mathbf{q}_1$, and it gives the relative importance of price changes in accounting for changes in the college wage premium. The second component shows how the college wage premium would have changed if major-specific premia had remained fixed at 1978 levels, but the major-distribution had changed in the observed way. This measure is computed as $\delta_q \equiv \mathbf{p}_1'(\mathbf{q}_2 - \mathbf{q}_1)$ and it gives the importance of quantity changes in accounting for changes in the college wage premium. The remainder of the change is given by an interaction of price and quantity, computed as $\delta_{pq} = (\mathbf{p}_2 - \mathbf{p}_1)'(\mathbf{q}_2 - \mathbf{q}_1)$. I use the major-specific premia estimates from Table III and the major distribution data from Table I to compute these quantities.

Table IV presents changes in the simulated college wage premium between 1978 and 1986 for each group, as well as the calculated values of δ_p and δ_q.[15] Among white men, the simulated premium increased significantly from −0.078 to 0.067, for a cross-cohort change of over 14 percentage points (see column (1)). About 61 percent (= 0.088/0.144) of the simulated premium change is accounted for by price changes, while nearly 26 percent (= 0.037/0.144) of the change can be accounted for by quantity changes. Both price and quantity changes contribute significantly to the overall increase in the simulated premium.

14. The major-specific premium for field j in cohort 2 is found by multiplying the estimated wage growth rate over time for field j (found in column (2) of Table III) by 8, and adding the product to the 1978 wage premium for field j (found in column (1) of Table III).

15. The standard errors reported in Table IV were calculated based on the estimated variances and covariances of the GLS coefficients, with the major distributions serving as weights.

For nonwhite men, the simulated premium increased significantly by 10 percentage points, from 0.048 to 0.148.[16] Price changes account for about 8 percent (=0.008/0.100) of the simulated change, while quantity changes account significantly for 54 percent (=0.054/0.100) of the overall change.

The simulated premium for white women increased significantly by over 7 percentage points, from 0.149 to 0.220. About 66 percent (0.047/0.071) of the simulated change is accounted for (significantly) by price changes, while 17 percent (=0.012/0.071) of the change can be accounted for by major distribution changes.

Nonwhite women experienced a slight decline in the simulated premium, although the change is not statistically significant. This fall is due mostly to price changes, as quantity changes are very small. The price and quantity changes are both insignificant.

These decomposition results show that the college wage premium increases for white men and white women are mainly accounted for by price increases, that is, increases in the value of different majors. Table III revealed that these wage gains were typically greatest for more-technical fields. A smaller, albeit significant for white men, part of the overall premium increase for white men and white women can be accounted for by quantity changes, which are characterized by a greater proportion of students graduating in more-technical (higher-paying) fields.

In contrast, the significant rise in the college wage premium for nonwhite men was due mostly to significant major distribution changes. That is, even though the value of the fields into which nonwhite men moved did not increase over time, the overall premium rose as relatively more nonwhite men moved into the highest-paying fields.

For nonwhite women, neither the overall change in the simulated premium nor either of the components is significant. The reason the quantity changes are small and negative, even though a substantial proportion of nonwhite women moved into business and engineering, is that nonwhite women moved out of life science and other major, which had the highest 1978 wage premia.

Supply and Demand Analysis of Price and Quantity Changes

The decomposition analysis revealed that price and quantity changes played very different roles in the college wage premium change for each race/gender group. A detailed quantitative analysis of the underlying supply and demand factors which yielded these changes would be valuable, but is beyond the scope of this paper. I do, however, offer some qualitative supply and demand analysis. I use the basic principle that if relative prices did not fall when relative quantities rose, then net demand must have increased. As a price measure I use the major-specific premia from Table III. As a quantity measure I use the number of graduates in each major as a proportion of the entire cohort, shown in Table V. I use this measure rather than the major distribution data in Table I because it accounts for changes in graduation rates over time, whereas data in Table I only capture the change in the proportion of college graduates in each field.

This analysis shows that white men in business, engineering, and physical science, white women in business, and nonwhite women in engineering experienced both a significant price increase and a quantity increase, which suggests that net demand for these graduates rose. Nonwhite men in business and engineering, and white women in engineering had insignificant price

16. The reason the change in the simulated college wage premium for nonwhite men is significant while the change in the estimated college wage premium in Table II is not is that the simulated premium takes into account major distribution changes, while the change in the estimated premium is based on a weighted average of the NLS72 and HSB major distributions.

Table V. College Major Distributions as a Proportion of the Entire Cohort

Field	NLS72 White (1)	NLS72 Nonwhite (2)	HSB White (3)	HSB Nonwhite (4)	Changes (3)–(1) (5)	Changes (4)–(2) (6)
A. Men						
Business	0.064	0.022	0.064	0.049	0.000	0.027
Engineering	0.030	0.007	0.051	0.019	0.021	0.012
Physical Science	0.010	0.003	0.013	0.002	0.003	−0.001
Life Science	0.023	0.008	0.017	0.003	−0.006	−0.005
Social Science	0.055	0.050	0.029	0.025	−0.026	−0.025
Education/Letters	0.036	0.020	0.021	0.004	−0.015	−0.016
Other Major	0.017	0.012	0.006	0.000	−0.011	−0.012
B. Women						
Business	0.027	0.018	0.078	0.043	0.051	0.025
Engineering	0.003	0.006	0.024	0.013	0.021	0.007
Physical Science	0.009	0.006	0.003	0.003	−0.006	−0.003
Life Science	0.052	0.022	0.024	0.011	−0.028	−0.011
Social Science	0.069	0.062	0.051	0.035	−0.018	−0.027
Education/Letters	0.103	0.051	0.065	0.024	−0.038	−0.027
Other Major	0.021	0.013	0.009	0.004	−0.012	−0.009

Note: Based on weighted data; each individual contributes one observation.

increases together with quantity increases, so net demand may have risen for them as well. Nonwhite women in business also experienced quantity increases, but had negative and insignificant price decreases. In this case, the data suggest that large increases in the supply of nonwhite women in business may have swamped any price increases which occurred due to increases in demand. Overall, this qualitative supply and demand analysis suggests strong evidence of an increase in net demand for white men, and to a lesser extent for white women. The evidence of a net demand increase for nonwhites is weaker, however. These race/gender differences in net demand increases likely underlie differences among the groups in college wage premia growth.

V. Conclusion

In this paper I examined how changes in major-specific premia and changes in the major distribution account for changes in college wage premia between 1978 and 1986 for the race/gender groups of white men, nonwhite men, white women, and nonwhite women. I found that major distribution changes account for a significant part of the college wage premium change for white men and nonwhite men, while major-specific premia changes account for a significant portion of the aggregate premium change for white men and white women. Major-specific premia changes played essentially no part in the college wage premium change among nonwhite men and nonwhite women.

The qualitative supply and demand analysis suggests that these racial differences in major-specific premia growth are likely due to net demand increases for white men and white women in technical fields which were less evident among their nonwhite counterparts. The next step to understanding racial and gender differences in college wage premium changes is understanding why net demand for these groups changed differently over time.

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