College Characteristics and the Wages of Young Women

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Abstract

Using the rich data from the National Longitudinal Survey of Youth, we show that several dimensions of college quality have positive impacts on young women's wages. We find evidence of ability sorting, but controlling for ability, women who attend higher quality colleges earn higher wages. Women receive smaller gains from college quality than do men; black women receive greater gains from college quality than do white women. Controlling for quality, women who attend private colleges earn more than those who attend public colleges, and women earn lower wages, the higher the proportion of their college's students were women. A significant part of the return to college quality appears to arise from a greater likelihood of working in high-wage occupations and industries.

The college education of children represents a major investment. With tuition costs at elite colleges now in excess of $20,000 annually, parents and children must make a major financial commitment if their children are to attend such a school. For all the importance of this decision, little is known about the decision process and the subsequent impacts this decision has on students. Moreover, most of the research in this area has focused exclusively on the impact of college quality on *male* earnings.[1]

In this paper, we begin to redress this imbalance by examining the impact of college quality on the wages of young women. Only Morgan and Duncan (1979), Sweetman (1994), and Behrman *et al*. (1995) consider the impact of college quality on the wages of women. Their results are mixed: Morgan and Duncan (1979) find little evidence that college quality increases the wages of women, while Sweetman (1994) and Behrman *et al.* (1995) find evidence that college quality does increase the wages of women. Controlling for ability, we find evidence of a modest, positive effect of college quality on the wages of young women. This positive effect is substantially larger for black women than for white women, and appears to operate in large part through the effect of college quality on the occupational distribution of women. We also find that women who attend colleges with a higher fraction of female students tend to earn lower wages than those who attend colleges with relatively many male students.

College selection involves an array of factors, ranging from families' financial situation, to students' intellectual abilities, to the perceived benefits of attending various colleges. These and other factors influence both students' choice of college and colleges' choice of students. An economist looking at the consequences of these decisions can hardly ignore the non-random nature of this process and the potential for selection bias, especially ability bias. Ability bias may have been a problem for Morgan and Duncan (1979), who used the 1974 Panel Study of Income Dynamics. While the PSID contains rich data on individual and family background characteristics, it has only limited information on individuals' intellectual abilities. Behrman *et* *al.* (1995) estimate college quality effects among female twins born in Minnesota between 1936 and 1955. While twins provide an excellent opportunity to evaluate the role of unobserved endowment differences, they are an unusual segment of the population. The educational experiences of twins, especially those who attend different colleges, may be atypical.

In contrast to these earlier studies, we use unusually rich data from the National Longitudinal Survey of Youth (NLSY) to estimate quality effects from detailed wage regressions that control for previous labor market experiences, family and other background characteristics, and characteristics of respondents' high schools. The data also include a very good ability measure: individual scores on the Armed Services Vocational Aptitude Battery (ASVAB). The NLS High School Class of 1972 (NLSHS72) data used by Sweetman (1994) also include information about individuals' intellectual abilities, high school, and family background, but the NLSY contains much better controls for the labor market experiences of workers. In addition, our data cover the most recent cohorts of young women currently available. This may be important because the pattern of results from research on high school quality suggests that the link between school quality and wages has weakened over time at the secondary school level (Betts 1994).

College quality may affect wages directly, but may also act indirectly through labor force participation, the student's likelihood of attending graduate or professional school, where she lives, her industry of employment, or her marital status and the attributes of her spouse. If college quality affects any of these outcomes, then controlling for them will bias the estimated returns to college quality. Ideally, we would like to estimate a structural model that accounted for the interrelationship among these variables. Our goal for this paper, however, is more modest: we seek to establish the reduced-form relationship between the quality of college education received and female wages. We begin by reporting baseline estimates obtained by regressing log wages on a constant and individual college characteristics, with and without controls for ability. These estimates are unbiased only if all factors correlated with wages are orthogonal to college quality.

While our measures of college quality are often highly significant when we enter them individually in a wage equation, when we enter them collectively most are statistically insignificant. This reflects a high degree of correlation among the measures. We exploit this collinearity to construct a general college quality index, which we substitute for the individual college characteristics in our wage regressions. We then explore the robustness of our basic finding that women who attend higher quality colleges have higher wages, and in the process determine the relationship between wages and several college characteristics after controlling for college quality. We conclude with an empirical assessment of the plausibility of our quality effect estimates.

Our main findings are easily summarized. First, we find evidence of a positive return to college quality for young women, but this evidence is less robust than that reported for men. Without college major and industry controls 12 of the 14 quality indicators have positive coefficients statistically significant at 5 percent, but once we control for college major and industry of employment, only 4 of our 14 quality indicators produce statistically significant positive effects on the wages of women. In contrast, Daniel, Black, and Smith [DBS] (1995) report a robust relationship between many measures of college quality and young men's wages.

Second, we find that the return to college quality appears to be larger among black women than among white women. This is consistent with what Loury and Garman (1995) and DBS (1995) found for men.

Third, we find some evidence that conditional on college quality and women's abilities, attending a private college increases wages for women. Behrman *et al.* (1995) also find that women who attend private colleges earn more. In contrast, Sweetman (1994) finds no evidence that private colleges increase the wages of female students, and DBS (1995) and Solmon (1975) find no evidence among men of a wage premium for attending a private college once one controls for college characteristics.

In addition, we find that white women are more likely to work if they attended higher quality colleges, but accounting for the participation decision when estimating wages has no effect on the estimated impact of college quality on wages. Even after controlling for college quality, college major, industry of employment, family background, and high school quality, women who attended colleges with a higher fraction of female students earn lower wages.[2] Finally, we find that women's college quality is unrelated to husbands' earnings.

DATA

Our data come from three sources. Our primary source is the National Longitudinal Survey of Youth (NLSY), a panel data set based on annual surveys of a sample of men and women who were 14–21 years old on January 1, 1979. Respondents were first interviewed in 1979 and have been re-interviewed each year since then. Of the five subsamples that comprise the NLSY, we use only the representative cross-section and the minority oversamples. After deleting observations with missing or inconsistent data, we are left with a sample of about 3,000 women.

The NLSY provides unusually detailed information about respondents' employment histories, including detailed information about wages, total labor market experience, and tenure with each employer. It also provides the identity of colleges respondents attended, thereby allowing us to match college characteristics to respondents.[3]

Our sources for college characteristics are the Department of Education's Integrated Post-secondary Education Data System (IPEDS) for 1990 and the *US News and World Report's Directory of Colleges and Universities* (1991). The former source provides most of our information about the physical and financial characteristics of colleges; the latter provides most of our information about student body composition. We only included information for four-year colleges; roughly one half of the women in our sample with some type of post-secondary education attended a four-year college. The variables are described more fully in the Appendix.

Whenever necessary, we redefine the raw college characteristics so that larger values correspond to obvious notions of quality. For example, we transform the acceptance rate reported in the raw data into a rejection rate—reflecting the assumption that more selective colleges are of higher quality—but leave *size* untransformed because larger colleges may realize gains from specialization. Of course, each variable is an imperfect indicator of quality. For example, observed rejections are not the correct measure of selectivity when applying is costly at the margin. One can raise similar concerns about the other measures, but there are no compelling reasons to believe the characteristics as redefined are *inversely* related to quality. Larger values should correspond to higher quality.[4]

ESTIMATION RESULTS FOR COLLEGE QUALITY

In this section we report estimates of the effect of college quality on wages. Except where noted, the dependent variable in each regression is the natural log of the individual's real wage in 1987, and the estimated coefficients are from OLS regressions on the set of working respondents not enrolled in school. Using Koenker's (1981) robust version of Breusch and Pagan's (1979) test, we easily reject the null hypothesis of homoskedastic errors in our baseline quality index regression, described below in the section "College Quality Index in Wage Regressions." Therefore, we estimate covariance matrices using White's (1980) heteroskedasticity-consistent estimator.

We estimate standard Mincer wage equations of the form:

(1) $$\ln W_i = c + Q_i\Gamma + A_i\alpha + X_i\beta_X + Z_{Hi}\beta_H + Z_{Pi}\beta_P + Z_{HSi}\beta_{HS} + \varepsilon_i,$$

where c is a constant, Q is a vector of college characteristics (often a single characteristic), A is our set of ability controls, and X is a standard set of wage regressors. The Z_J, $J \in \{H, P, HS\}$, are vectors of background characteristics, where Z_H describes the early home environment, Z_P describes the respondent's parents, and Z_{HS} describes the respondent's high school. The residual ε_i captures the effect of all omitted influences. The regressors are explained in more detail later.

Baseline Quality Regressions

Table 1 reports the coefficients on college characteristics in wage regressions that exclude X and Z_J. These are the correct, possibly reduced-form, measures of the impact of college quality only if the college quality indicators are uncorrelated with all the omitted wage determinants or if quality determines those omitted variables for which the correlation is not zero. Neither situation is likely, but these estimates are a convenient way to present the correlations in the raw data.

Each college characteristic appears in two wage regressions. The first includes a single college characteristic, the post-secondary school indicator, and a constant; the second adds controls for ability (A). If the college characteristic was missing for a respondent, it was set to zero; all regressions include a dummy variable indicating when the college characteristic was missing. The ability controls are based on the Armed Services Vocational Aptitude Battery (ASVAB). The ability controls are the first two principal components of respondents' age-adjusted scores on the 10 exams that comprise the ASVAB, and these two variables squared.[5] We describe the ASVAB and our age adjustment procedure in the Appendix.[6]

These estimates reveal evidence of ability sorting; for almost all characteristics the point estimates are smaller when ability controls are present. Without ability controls, all 13 of the characteristics with quality interpretations have positive coefficients that are statistically significant at 10 percent or better. All but the SAT interquartile ratio (the ratio of the 25th to 75th percentile SAT scores)—a measure of the dispersion of student abilities—are significant at the 5 percent level. None of the characteristics alone explain more than 8 percent of the variance in the log wage.

When ability controls are added to the regressions the point estimates decline, but with two exceptions—*size* and the *SAT interquartile ratio*—the estimates remain statistically significant. High ability women attend better colleges, but by almost any of our measures, conditional on ability, women who attended higher quality colleges earn higher wages.[7]

College Characteristics in Wage Regressions

This section reports estimates obtained from wage regressions that include X and Z_J. At a minimum, each regression includes a constant, quartics in four variables—age, tenure, pre-college-graduation labor market experience, and post-graduation experience—controls for race, region, urban residence, any post-secondary school completed, years of school completed, years of post-secondary school completed, having a 4-year degree, and the ability controls described earlier. These variables are summarized in the Appendix. We separated pre- and post-graduation experience because college quality might be correlated with forfeiting occupation- or industry-specific human capital acquired from pre-graduation work.[8]

In each of the tables we report results from specifications that include only the basic set of regressors described above, as well as those that add college major and/or industry and union status indicators. If better colleges produce their effect by channeling students into more remunerative majors or into jobs in high wage industries, then the basic specification provides the correct reduced form estimates.

Table 2 reports coefficients for the 13 college characteristics with quality interpretations and for *percent students female*. All of the point estimates for the 13 quality indicators are positive, except those for the *faculty-student ratio* (which are never statistically significant), but the statistical significance of the estimates is not robust across specifications. Several fail to achieve standard levels of statistical significance when controls for college major and industry are present.

Because the aggregate SAT measures—25th and 75th percentile SAT, and mean SAT—might proxy for individual scores, regressions that include aggregate SAT measures also include respondents' combined verbal and math SAT scores (see Table 2, page 25, lower panels, and accompanying note). Whether or not individual SAT scores are present makes essentially no difference.

Table 2 also reports results from regressions that include the percent of students who are female. Some have argued that students, especially female students, who attend colleges with their own gender will learn more (for example, see Tidball 1989). We find no evidence of this for women. When *percent female* enters linearly, the point estimates are negative and not statistically significant. When *percent female* is captured by quartile dummy variables, the negative effect is large and statistically significant for the top two quartiles.[9] The estimated negative effect for women in the top quartile is about the same as that for men, as reported in DBS (1995).

In Table 3 we explore the possibility that among women, *tuition*, *size*, *spending per student*, or the *faculty/student ratio* are proxying for whether the college is public or private. We find evidence of a private college premium. When we control for *spending per student*, *size*, or the *faculty/student ratio*, we find that women who attended private colleges earn wages about 6 to 8 percent higher than otherwise comparable women who attended public colleges.[10] We found no evidence of a positive private college effect for men (see DBS 1995). When the *private* indicator is present, *size*, *spending per student*, and the *faculty/student ratio* all fail to achieve statistical significance at the 10 percent level in any specification.

College Quality Index in Wage Regressions

In our sample, characteristics are strongly correlated across colleges, a feature noted by others as well (Solmon 1975; Morgan and Duncan 1979; James *et al*. 1988). This high correlation makes precise estimation difficult. For this reason, and to simplify the interpretation of our empirical results, we constructed an overall "quality index" equal to the first principal component of a subset of college characteristics.[11]

Because many colleges fail to report one or more characteristics, we were generally able to calculate a quality index for a larger number colleges, the smaller was the set of characteristics considered. Balancing this incentive to keep the set of characteristics small was the desire to use as much information as possible about each college, and the empirical fact that if we used only two measures, the rank order correlations between the indices produced were relatively small, in the range of .5 to .7. Once at least three or four variables were included in the sets, it did not matter much which variables we chose to include; all indices produced were highly correlated.[12]

The quality index is the first principal component of six variables: *spending per student*, the *faculty/student ratio*, the *rejection rate*, *average SAT* of first year students, and the percent of first year students who were in the top 10 and top 25 percent of their high school classes.[13] The principal components analysis for the six college characteristics is summarized in the Appendix. There is one dominant principal component, which explains 63 percent of the variance of the six variables. The Appendix includes a list of the top 50 colleges as ranked by this quality index. Our quality indicator ranks schools consistent with *a priori* notions of college quality. We report evidence later that after controlling for other college characteristics, tuition is positively related to this quality index.

As in the previous subsection, each table reports results from specifications that differ by whether we control for the college major of the respondent and the industry in which she works. In addition, we include background controls that fall into three categories: those describing respondents' home environments, parents, and high schools. Such characteristics have been found to be correlated with schooling in other contexts, and are plausibly correlated with omitted asset or other variables independently affecting both college choice and human capital. Some of them may be correlated with cognitive or other abilities that affect both quality choice and later wages. The background variables are described in the Appendix.

Table 4 reports results from regressions that exclude X and Z_J. These regressions are identical to those reported in Table 1, except that our quality index now replaces the 14 individual college characteristics. We find a positive relationship between wages and quality, whether or not we control for ability. In each specification, the coefficient on the quality index is almost three times as large for black women as for white women, and this difference is statistically significant at 5 or 6 percent.

Table 5 reports results from wage regressions that include all of the X and Z_J controls. These regressions are identical to those described earlier, but include the college quality index in place of individual college characteristics. The table reports results for two separate quality measures: the raw quality index and four dummy variables indicating the quality index quintile into which each college falls (the lowest quintile is the omitted category). The estimates for the quality index are significant at 5 percent in the basic regressions, and when college major controls are added, but are smaller and not significant at 10 percent when both major and industry controls are present. The quality quintile estimates provide weaker evidence of a quality effect, although the estimates for the highest quintile are roughly consistent with the quality effects implied by the linear estimates.[14] The point estimates are generally larger for the higher quintiles, but only the highest achieves 10 percent statistical significance, and it does so only when college major and industry controls are absent. For both of the measures, the point estimates for women are about half the size of comparable estimates for men reported in DBS (1995).[15]

It is possible that college quality is related to later labor force participation. In Table 6 we explore this possibility. The table compares OLS quality effect estimates to maximum likelihood quality effect estimates from joint estimation of participation and wages (see Heckman 1976, 1979). Estimating wages jointly with participation makes no difference to the quality estimates, but among white women, participation is more likely, the higher is the quality of college attended. Among black women, the estimated effect on participation is positive, but not statistically significant. One cannot reject the hypothesis that white women receive no benefit from attending higher quality colleges. The estimated effect for black women is somewhat larger than that for white men (see DBS 1995).

The next table reports estimates from regressions that include family and high school background variables. Table 7 reports results from adding background variables to the basic regressions in Table 5. Adding background controls has little effect on the estimates, although the point estimates are generally a little smaller when all background controls are present. Adding these background variables to regressions that include college major and industry controls in addition to college major controls also has little effect, as does using the most detailed college major controls (See Appendix).

Table 8 reports evidence on the relationship, after controlling for college quality, between wages and the percent of a college's students who are black. Some have made arguments suggesting this should be a quality measure for black students, but we find little evidence of this. We divided colleges into four categories: less than 5 percent black students, between 5 to 7 percent black, 8 to 17 percent black, and more than 17 percent black.[16] We report results for the whole sample as well as subsamples of white and black women. For the sample of all women, those attending colleges with between 5 and 7 percent black students earned higher wages than otherwise similar women attending colleges in any other category. This is true whether or not we control for family and high school background characteristics. This pattern, however, is not evident for white women considered separately. There is strong evidence that black women who attended colleges with between 5 and 7 percent black students earn more than those who attended colleges with less than 5 percent black students, and the point estimates suggest they earn more than otherwise similar women who attended college with more than 8 percent black students. DBS (1995) report stronger evidence that racial diversity among students may raise later wages for both black and white men.

The estimates in Table 4 and Table 8 show that black women receive a greater return to quality than do white women. Loury and Garman (1995) and DBS (1995) find similar results for men in the NLS High School Class of 1972 and in the NLSY, respectively.

Table 9 reports our estimates of the effect of *tuition*, *size*, and *percent female*, controlling for quality and for whether or not the college is private. Controlling for quality, we find little evidence that women's wages are positively related to *tuition*. The estimated effect is positive, but not statistically significant. Once we control for quality, *size* appears to have no effect, but there is a private college premium that is statistically significant except when both college major and industry are present.

Women who attend a college with a relatively high proportion of female students have lower wages. When *percent female* enters linearly, the estimates are negative, but not statistically significant. When *percent female* is represented by quartile dummies, however, the negative relationship is statistically significant. These results are similar to those reported earlier that did not control for college quality.

Difference Estimates

We now briefly explore how college quality affects wages. Specifically, we consider the possibility that a high quality college education complements or substitutes for on-the-job human capital accumulation. So far, we have assumed this is not the case; the estimates reported here suggest that this assumption is justified.

All of the estimates we have reported so far are from single period regressions of the form

(2) $\ln W_t = \gamma Q + Z\Gamma + X_t\beta + e_{t,}$

where Z represents all non-time varying controls except quality, Q, and X_t denotes all time-varying controls. In differences, this becomes

(3) $\Delta \ln W_t = \Delta X_t \beta + \Delta e_t$.

We can write our alternative hypothesis, that high quality education affects the ability to accumulate human capital, so that it includes equation (2) as a special case:

(4) $\ln W_t = \gamma Q + \delta(tQ) + Z\Gamma + X_t\beta + e_t$,

where t is tenure or post-college experience. For someone employed in both periods used to calculate the difference, this becomes

(5) $\Delta \ln W_t = \delta Q + \Delta X_t \beta + \Delta e_t$.

Equation (5) nests equation (3), so there are two ways to test whether equation (2) or (4) is correct. We can estimate equation (4) directly or we can estimate equation (5). In either case, under the alternative hypothesis the data should reject $\delta = 0$. If we have specified the functional form correctly and there is no relevant unobserved heterogeneity, then either test will reveal an interaction between quality and human capital accumulation. Equation (5) is equivalent to a fixed effects estimator, with the fixed effects removed through differencing. Thus, if the functional form is correct only up to fixed effects, then equation (5), but not equation (4), will produce an unbiased estimate of δ, and the two strategies might produce different estimates.

Whether we estimate Equation (4) or (5), we can cannot reject the null hypothesis represented by Equation (2). The top and bottom panels of Table 10 report estimates of Equations (4) and (5), respectively. There is little evidence that college quality is related to the speed with which women later accumulate human capital. The estimates are positive, but none are statistically significant Because we earlier found evidence of a private college effect, we added a private school indicator to the difference equation in the bottom panel. Women who attended private colleges had slower wage growth. Apparently, women who attend private colleges have flatter wage profiles. We repeated the analysis in Table 10 with our ability controls present to allow for the possibility that higher ability workers might accumulate human capital at different rates than lower ability workers. Including these controls had no effect on the qualitative results.

Are the Estimates Plausible?

If we are willing to make some simplifying assumptions we can answer the question: based on our estimates do wages increase enough to pay for the added financial investment required to attend a good college? Given that the additional assumptions are reasonable, we can use the answer to gauge the believability of our quality effect estimates. If the market for college quality is in equilibrium, then at the margin the price of quality should just offset its return. We have estimates of the average return. As most students are inframarginal, this average return should exceed the price of quality.

We compare our direct estimates of the wage effect produced by college quality to estimates of the wage effect that would just offset the additional cost of quality (the "break-even" wage effect). The direct financial benefit from additional college quality is the present value of the additional earnings produced by the increment in quality. The cost of quality is the present value of the additional tuition a student must pay each year to attend a higher quality college.

Denote the post-graduation wage at time t by $w(t;q)$, where q is college quality. Assume students live forever, can borrow at their discount rate r, and take c years to complete college. Ignore any effort or other non-pecuniary costs or benefits to students of attending a higher quality college, and denote the difference in post-graduation wage associated with a difference in quality of $\Delta q = q_1 - q_0$ by $\Delta w(t) = w(t;q_1) - w(t;q_0)$. Assume $\Delta w(t)$ is constant over time and therefore equal to the increment produced in the first wage received after college, $w(c)[\exp\{b\Delta q\} - 1]$, where b is the log wage regression estimate and w(c) is the first wage received after college. Denote this constant, persistent wage effect by Δw. To the extent that college quality increases wage growth Δw understates the value of quality; if quality effects diminish over time, then Δw overstates its value. Discounting reduces the importance of either of these sources of bias.

The dollar price of quality is ΔT per year in added tuition. Additional quality is worth buying if

(6)
$$\Delta w \sum_{i=c}^{\infty} (1+r)^{-i} \geq \Delta T \sum_{i=0}^{c-1} (1+r)^{-i},$$
$$\Delta w \geq \Delta T \left[\frac{1-(1+r)^{-c}}{1-(1+r)^{-1}} \right] r(1+r)^{c-1} \equiv \overline{\Delta w}.$$

To evaluate this expression, we need an estimate of the price of quality, ΔT. We estimate this price by regressing tuition on the quality index and controls not used to construct the quality index that we hope are correlated with amenities and/or the costs of providing a college education. We performed the regressions on the set of all colleges for which we had information. The controls are quartics in *size*, *percent black*, and *percent female*, a public college indicator, and interaction terms between this indicator and all other variables in the regression. We experimented with several functional forms, each differing in the way quality entered the regression. Based on R^2s and inspection of residuals we included higher-order quality terms up to the fourth power. This functional form fits the data quite well.

Table 11 reports estimates from this admittedly ad hoc hedonic price regression; Figure 1 graphs the implied tuition-quality relationship for private colleges. Table 12 uses these price estimates to derive the break-even wage effect for private colleges under different assumptions about the interest rate and time to complete a college degree. It also reports the wage effects implied by some of our earlier quality estimates for three different increments in college quality: moving from a college at the 25th percentile of the quality distribution to one at the median, moving from the median to the 75th percentile, and moving from the median to the 95th percentile. The wage effects are those implied for a woman earning $23,529, the beginning salary offered Bachelor's degree recipients in Business in 1990 (Census 1994; Table 289).[17]

The calculations show that our price and quality effect estimates are roughly consistent with one another. At an interest rate of 10 percent, all of the implied effects are somewhat smaller than the break-even effects. At an interest rate of 6 percent, the quality effects implied by our estimates are about the same size as the break-even effects. The implied quality effects are generally a little larger than the break-even effects when college major, industry, and background controls are absent; the implied quality effects are a little smaller that the break-even effects when all the controls are present. Assuming our price estimates are approximately correct, these figures suggest our quality effect estimates imply plausible wage effects. Our estimates of the quality effect on wages are small, but are in line with what it costs to buy quality.

Do Higher Quality Colleges Provide Higher Quality Husbands?

In DBS (1995) we report estimates for men that generally exceeded the break-even values; our estimates for women equal or fall a little short of the break-even values. This suggests that women may be receiving some benefit from college quality other than human capital. Especially given that men receive a larger quality premium, it is possible that women find higher quality husbands at better colleges. In order to see whether this is so, we regressed husbands' wages on controls for women's age, educational achievement, ability, region of current residence, and her college's quality. Table 13 reports the results. For white women, the estimates of the quality effect are positive and slightly larger than those for her own wage, but they are not statistically significant. The point estimates are smaller when women's family background and high school characteristics are present. For black women, the estimates are very small, sometimes negative, and are not statistically significant. The results are similar if the samples are restricted to those who attended some post-secondary school (not shown). Because black men receive a larger quality premium that do white men, the weaker evidence of a quality effect on husbands' wages for black women is additional evidence that women are not meeting higher-earning spouses at better colleges. For white women, *size*, *percent female*, and *percent black* all increase their husbands' wages. Among black women, *size* and *percent black* have little effect, but the proportion of students who are women appears to raise husbands' wages, although only when we control for college major is the effect statistically significant.

In Table 14 we explore whether a woman's college quality is related to the probability she is married. It is not. For both black and white women, the estimated effect of college quality is small and not statistically significant.[18] For white women, however, other characteristics of their colleges affect the probability they are married. They are more likely to be married if they attended a larger college, and less likely to be married, the higher proportion of students who were black. The estimated effect of the proportion of students female is positive, but not statistically significant at customary levels. There are no statistically significant relationships for black women.[19]

SUMMARY AND CONCLUSION

We find evidence of a small positive return to college quality for young women. The gain from college quality is substantially larger for black women than for white women. White women are more likely to work if they attended higher quality colleges, but accounting for the participation decision has no effect on the estimated effect of quality.

Holding constant college quality and other wage determinants, including ability, women who attend private colleges earn more than women who attend public colleges. Our most surprising finding is that women who attend schools with higher fractions of female students earn less. This pattern holds even after controlling for college quality, college major, industry of employment, family background, and high school quality.

The evidence of a positive return to college quality is less robust for young women than that for young men in DBS (1995). For young men, the relationship between college quality and earnings was positive and statistically significant in every specification examined. Comparing similar specifications, the estimated coefficient on the college quality index was generally about half as large for young women as for young men. Moreover, after controlling for college major and industry of employment, the estimated quality effect for women is substantially reduced; this was not true for the men in DBS (1995). This suggests that for women, a major advantage of attending a higher quality college may be an increased probability of winding up in a high-wage occupation or industry. We find little or no evidence that attending higher quality colleges results in women marrying higher quality husbands.

Table 1: Log Wage Regressed on Individual College Characteristics

Women 22-30
(heteroskedasticity-consistent standard errors in parentheses)

(N=2,984)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Ability Controls		YES		YES		YES		YES
College Characteristics:								
Tuition ($10,000s)	.227**	.190**						
	(.042)	(.042)						
Spending per Student			.056**	.038*				
($10,000s)			(.021)	(.021)				
Faculty / Student Ratio					1.40**	1.21**		
					(.609)	(.604)		
Size (10,000s)							.032**	.022
							(.014)	(.014)
R^2 (adjusted)	.08	.11	.07	.11	.07	.11	.07	.11

- -

(N=2,984)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Ability Controls		YES		YES		YES		YES
College Characteristics:								
Rejection Rate	.277**	.277**						
(decimal)	(.089)	(.089)						
1ST Year Retention Rate			.600**	.430**				
(decimal)			(.109)	(.109)				
Graduation Rate					.420**	.294**		
(decimal)					(.089)	(.090)		
HS Top 10%							.406**	.304**
(decimal)							(.098)	(.102)
R^2 (adjusted)	.07	.11	.08	.08	.08	.11	.07	.11

(Continues)

Table 1 (continued):
Log Wage Regressed on Individual College Characteristics
Women 22-30
(heteroskedasticity-consistent standard errors in parentheses)

(N=2,984)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Ability Controls		YES		YES		YES		YES
College Characteristics:								
Average SAT	.064**	.047**						
(100s)	(.011)	(.011)						
75th Percentile SAT			.049**	.039**				
(100s)			(.014)	(.014)				
25th Percentile SAT					.054**	.042**		
(100s)					(.015)	(.015)		
SAT Interquartile Ratio							.786*	.629
(25th / 75th)							(.405)	(.428)
R^2 (adjusted)	.08	.11	.08	.11	.08	.11	.07	.11

(N=2,984)	(1)	(2)	(3)	(4)
Ability Controls		YES		YES
College Characteristics:				
Faculty PhDs	.385**	.298**		
(decimal)	(.089)	(.089)		
Proportion Female			–.114	–.042
(decimal)			(.135)	(.128)
R^2 (adjusted)	.08	.11	.07	.11

Note: ** indicates significance at 5 percent; * indicates significance at 10 percent. Standard errors are estimated by White's (1980) heteroskedasticity-consistent method. The dependent variable is the natural log of real wage for the year ending at the 1987 interview. "Ability Controls" are the first two principal components of respondents' age-adjusted ASVAB scores, and these two variables squared. All regressions include a constant, a variable indicating whether the respondent has any post-secondary schooling, and a variable indicating when the college characteristic was unavailable.

Table 2: College Characteristics in Log Wage Regressions

Women 22-30
(heteroskedasticity-consistent standard errors in parentheses)

(N=2,831)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
College Major Controls	NO	YES	YES	NO	YES	YES	NO	YES	YES
Industry Controls	NO	NO	YES	NO	NO	YES	NO	NO	YES
Tuition	.112**	.092**	.073*						
($10,000s)	(.039)	(.040)	(.039)						
Spending per Student				.031*	.026	.013			
($10,000s)				(.018)	(.018)	(.017)			
Faculty/Student Ratio							−1.41	−1.27	−1.28
							(1.70)	(1.76)	(1.69)
R^2 (adjusted)	.29	.29	.34	.29	.29	.34	.29	.29	.34

(N=2,831)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
College Major Controls	NO	YES	YES	NO	YES	YES	NO	YES	YES
Industry Controls	NO	NO	YES	NO	NO	YES	NO	NO	YES
Size	.009	.011	.009						
(10,000s)	(.013)	(.013)	(.013)						
Rejection Rate				.170**	.169**	.136			
(decimal)				(.084)	(.085)	(.085)			
1st Yr Retention Rate							.196**	.172*	.132
(decimal)							(.095)	(.094)	(.090)
R^2 (adjusted)	.29	.29	.34	.29	.29	.34	.29	.29	.34

(Continues)

Table 2 (continued): College Characteristics in Log Wage Regressions
Women 22-30
(heteroskedasticity-consistent standard errors in parentheses)

(N=2,831)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
College Major Controls	NO	YES	YES	NO	YES	YES	NO	YES	YES
Industry Controls	NO	NO	YES	NO	NO	YES	NO	NO	YES
Graduation Rate	.179**	.154*	.136*						
(decimal)	(.082)	(.082)	(.081)						
HS Top 10%				.209**	.197**	.152*			
(decimal)				(.093)	(.094)	(.091)			
SAT Interquartile							.137	.087	.066
Ratio (25th / 75th)							(.372)	(.372)	(.358)
R^2 (adjusted)	.29	.29	.34	.29	.29	.34	.29	.29	.34

(N=2,831)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
College Major Controls	NO	NO	YES	YES	NO	NO	YES	YES
Industry Controls	NO	NO	YES	YES	NO	NO	YES	YES
Respondent's SAT	NO	YES	NO	YES	NO	YES	NO	YES
Average SAT	.027**	.027**	.023**	.023**				
(100s)	(.010)	(.010)	(.010)	(.010)				
75th Percentile SAT					.011	.012	.005	.005
(100s)					(.012)	(.013)	(.012)	(.012)
R^2 (adjusted)	.29	.29	.34	.34	.29	.29	.34	.34

(N=2,831)	(1)	(2)	(3)	(4)
College Major Controls	NO	NO	YES	YES
Industry Controls	NO	NO	YES	YES
Respondent's SAT	NO	YES	NO	YES
25th Percentile SAT	.012	.015	.008	.008
(100s)	(.014)	(.014)	(.013)	(.014)
R^2 (adjusted)	.29	.29	.34	.34

(Continues)

Table 2 (continued): College Characteristics in Log Wage Regressions
Women 22-30
(heteroskedasticity-consistent standard errors in parentheses)

(N=2,831)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
College Major Controls	NO	YES	YES	NO	YES	YES	NO	YES	YES
Industry Controls	NO	NO	YES	NO	NO	YES	NO	NO	YES
Faculty Ph.Ds	.078	.072	.050						
(decimal)	(.081)	(.080)	(.078)						
Proportion Female				–.135	–.133	–.114			
(decimal)				(.113)	(.113)	(.120)			
2nd Quartile % Female							–.062*	–.056	–.046
							(.032)	(.037)	(.037)
3rd Quartile % Female							–.078*	–.072*	–.067*
							(.042)	(.041)	(.040)
Top Quartile % Female							–.100**	–.094**	–.085**
							(.039)	(.039)	(.038)
R^2 (adjusted)	.29	.29	.34	.29	.29	.34	.29	.29	.34

Note: ** indicates significance at 5 percent; * indicates significance at 10 percent. The covariance matrix is estimated by White's (1980) heteroskedasticity-consistent method. The dependent variable is the natural log of real wage for the year ending at the 1987 interview. All regressions include a constant, quartics in four variables—age, tenure, pre-college-graduation labor market experience, and post-graduation experience—controls for race, geographical region, urban residence, any post-secondary school completed, years of school completed, years of post-secondary school completed, receipt of a BA degree, and the ability controls described in the text and Appendix. "College Major Controls" are the 24 basic college majors described in the Appendix; "Industry Controls" are the 15 industry indicators described in the Appendix;

union status is included whenever industry controls are. "Respondent's SAT" is their combined math and verbal score from 1981 and is only available for students in college that year. Missing values were set to zero, and a dummy variable was included to indicate missing values.

Table 3: College Characteristics in Log Wage Regressions
With Private School Indicator
Women 22-30
(heteroskedasticity-consistent standard errors in parentheses)

(N=2,831)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
College Major Controls	NO	YES	NO	YES	NO	YES	NO	YES
Industry Controls	NO	NO	YES	YES	NO	NO	YES	YES
Tuition	.131*	.110	.106	.086				
($10,000s)	(.071)	(.070)	(.070)	(.071)				
Private	−.017	−.016	−.012	−.011				
	(.050)	(.050)	(.050)	(.050)				
JOINT SIG. P−VALUE:	.02	.07	.06	.18				
Spending per Student					.019	.016	.007	.004
($10,000s)					(.019)	(.018)	(.018)	(.029)
Private					.061**	.051*	.056*	.046
					(.029)	(.029)	(.029)	(.029)
R^2 (adjusted)	.29	.29	.34	.34	.29	.29	.34	.34

(N=2,831)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
College Major Controls	NO	YES	NO	YES	NO	YES	NO	YES
Industry Controls	NO	NO	YES	YES	NO	NO	YES	YES
Size	.025	.024	.021	.019				
(10,000s)	(.031)	(.015)	(.014)	(.014)				
Private	.086**	.072**	.071**	.057**				
	(.031)	(.031)	(.030)	(.030)				
Faculty/Student Ratio					−1.46	−1.33	−1.34	−1.33
					(1.73)	(1.79)	(1.64)	(1.71)
Private					.075**	.060**	.065**	.051*
					(.030)	(.030)	(.029)	(.029)
R^2 (adjusted)	.29	.29	.33	.34	.29	.29	.33	.34

See note to Table 2.

Table 4: College Quality and Ability
Women 22-30
(heteroskedasticity-consistent standard errors in parentheses)

	ALL WOMEN		WHITE WOMEN		BLACK WOMEN	
(N=2,984;1618;886)	(1)	(2)	(3)	(4)	(5)	(6)
Quality Index	.044**	.034**	.028**	.024*	.071**	.073**
	(.010)	(.010)	(.013)	(.013)	(.019)	(.019)
P–VALUE OF BLACK/WHITE DIFFERENCE: (TWO TAIL)					.06	.05
Any Post-secondary School	.199**	.151**	.231**	.164**	.197**	.174**
	(.018)	(.018)	(.026)	(.027)	(.030)	(.030)
Ability Controls	NO	YES	NO	YES	NO	YES
R^2 (adjusted)	.07	.11	.08	.11	.07	.08

Note: The dependent variable is log real wage. Ability controls are the first two principal components of respondents' age-adjusted ASVAB scores, and these two variables squared. The regressions include a constant in addition to the variables shown. The standard deviation of the "Quality Index" is 1.95.

Table 5: College Quality Index in Log Wage Regressions
Women 22-30
(heteroskedasticity-consistent standard errors in parentheses)

(N=2,831)	(1)	(2)	(3)	(4)	(5)	(6)
College Major Controls	NO	YES	YES	NO	YES	YES
Industry Controls	NO	NO	YES	NO	NO	YES
Quality Index	.020**	.019**	.014			
	(.009)	(.009)	(.009)			
Quality Quintiles						
2nd				−.005	−.010	−.018
				(.057)	(.057)	(.053)
3rd				.028	.011	.018
				(.057)	(.057)	(.055)
4th				.020	.030	.021
				(.062)	(.062)	(.061)
highest				.097*	.080	.050
				(.058)	(.058)	(.056)
R^2 (adjusted)	.29	.29	.34	.29	.29	.34

Note: The dependent variable is log real wage; the regressions are described in the note to Table 2. The standard deviation of the "Quality Index" is 1.95. "Quality Quintiles" are based on the Quality Index. Substituting the first principal component of *spending per student* and the *student/faculty ratio* for the Quality Index increases the size and standard error of the quality estimate slightly, but otherwise has little effect.

Table 6: Joint Estimation of Log Wages and Participation
Women 22-30
(standard errors in parentheses)

	All Women (1)	All Women (2)	White Women (3)	White Women (4)	Black Women (5)	Black Women (6)
Log Wage:						
Quality Index	.020**	.020**	.017	.015	.037**	.037**
	(.009)	(.009)	(.011)	(.011)	(.017)	(.017)
Any Post-secondary	.060	.058	.020	.010	.089	.086
	(.056)	(.056)	(.080)	(.080)	(.087)	(.085)
Years Post-secondary	.044**	.044**	.043**	.043**	.064**	.063**
	(.009)	(.009)	(.012)	(.012)	(.017)	(.017)
4-Year Degree	.087**	.086**	.046	.045	.085	.089
	(.032)	(.031)	(.042)	(.042)	(.059)	(.058)
Participation:						
Quality Index		. 097*		.252**		.034
		(.053)		(.089)		(.128)
Any Post-secondary		.435		.895*		1.29
		(.309)		(.471)		(.881)
Years Post-secondary		.062		.040		.096
		(.053)		(.070)		(.125)
4-Year Degree		.016		–.057		–.338
		(.186)		(.256)		(.431)
ρ		–.107		–.231*		–.212
n	2,831	3,413	1,556	1,832	831	1,024
log likelihood		–1,945		–1,099		–429

Note: ** indicates significance at 5 percent; * indicates significance at 10 percent. The regressors are described in the note to Table 2. The participation equation includes all the regressors in the wage equation, indicators for married, single divorced, and single cohabiting, four indicator variables for the presence of children 2 through 5 years old, an indicator for the presence of children 6 through 13 years old, interactions between the married indicator and the presence of children under 6 years old, and interactions between this indicator and the divorced indicator. Adding family and high school background controls does not change the qualitative results. For white women, adding background controls reduces the quality coefficient in the wage equation to .013 and raises it in the participation equation to .435. For black women, the quality coefficient in the wage equation is unchanged, but rises to .593 (still not significant at the 10 percent level) in the participation equation.

Table 7: College Quality and Background Characteristics
Basic Regressors Only
Women 22-30
(heteroskedasticity-consistent standard errors in parentheses)

(N=2,831)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Home	YES			YES	YES			YES
Parents		YES		YES		YES		YES
High School			YES	YES			YES	YES
Quality Index	.020**	.019**	.019**	.017*				
	(.009)	(.009)	(.009)	(.009)				
Quality Quintile								
2nd					−.008	−.001	−.002	.003
					(.057)	(.056)	(.057)	(.056)
3rd					.025	.026	.026	.028
					(.057)	(.057)	(.057)	(.057)
4th					.021	.019	.018	.020
					(.062)	(.063)	(.062)	(.063)
highest					.092	.096*	.088	.085
					(.006)	(.058)	(.058)	(.058)
R^2 (adjusted)	.29	.29	.29	.29	.29	.29	.29	.29

Note: The dependent variable is log real wage; the regressions are described in the note to Table 2. The "Basic Regressors" do not include college major or industry controls. Quality coefficient estimates from regressions including these controls are shown in the Appendix. Substituting the first principal component of *spending per student* and the *student/faculty ratio* for the quality measure increases the size and standard error of the quality estimate slightly, but otherwise has little effect.

Table 8: Percent Students Black, Common Categories
Women 22-30
(heteroskedasticity-consistent standard errors in parentheses)

	All Women			White Women			Black Women		
(N=2,831; 1,619; 760)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Background Controls	NO	NO	NO	NO	NO	NO	NO	NO	NO
College Major Controls	NO	YES	YES	NO	YES	YES	NO	YES	YES
Industry Controls	NO	NO	YES	NO	NO	YES	NO	NO	YES
Quality Index	.019**	.017*	.012	.016	.015	.012	.034**	.026*	.014
	(.009)	(.009)	(.009)	(.012)	(.012)	(.012)	(.015)	(.016)	(.015)
Percent Black:									
5%–7%	.078*	.080**	.076*	.050	.052	.042	.165*	.196**	.244**
	(.040)	(.040)	(.039)	(.052)	(.052)	(.050)	(.098)	(.099)	(.088)
8%–17%	–.006	–.006	–.005	.037	.029	.027	.029	.026	.072
	(.039)	(.038)	(.037)	(.048)	(.046)	(.046)	(.099)	(.099)	(.086)
greater than 17%	.012	.023	–.006	.046	.048	.074	.125	.133	.130
	(.045)	(.045)	(.044)	(.092)	(.100)	(.105)	(.103)	(.103)	(.089)
R^2 (adjusted)	.29	.29	.34	.26	.27	.31	.32	.32	.38

	All Women			White Women			Black Women		
(N=2,831; 1,619; 760)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Background Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES
College Major Controls	NO	YES	YES	NO	YES	YES	NO	YES	YES
Industry Controls	NO	NO	YES	NO	NO	YES	NO	NO	YES
Quality Index	.016	.014	.009	.015	.014	.010	.035**	.027*	.016
	(.009)	(.010)	(.009)	(.012)	(.012)	(.012)	(.016)	(.016)	(.015)
Percent Black:									
5%–7%	.075*	.076*	.072*	.045	.045	.033	.174*	.208**	.239**
	(.040)	(.040)	(.039)	(.051)	(.052)	(.049)	(.097)	(.101)	(.089)
8%–17%	–.012	–.012	–.013	.015	.012	.006	.021	.023	.067
	(.038)	(.038)	(.038)	(.047)	(.046)	(.046)	(.099)	(.101)	(.086)
greater than 17%	.018	.021	–.010	.035	.038	.059	.135	.146	.145
	(.045)	(.045)	(.044)	(.093)	(.101)	(.106)	(.103)	(.105)	(.090)
R^2 (adjusted)	.29	.30	.35	.27	.28	.33	.30	.30	.37

See the notes to Table 2. The results are nearly identical when a private college control is included. The omitted first category includes 45 percent of the white women and 11 percent (30 women) of black women whose colleges report *percent black*. Thirty-four percent of white women in the sample, and 24 percent of black women, attended colleges with 5 to 7 percent black students. Seventeen percent of white women, and 22 percent of black women, attended colleges with between 8 and 17 percent black students. Four percent of white women (23 women), and 43 percent of black women attended colleges with greater than 17 percent black students. The only differences between black and white women significant at 5% are those for the coefficients on 5–7 percent students black when both major and industry controls are present.

Table 9: Tuition, Size, Proportion Students Female
Controlling for Quality
Women 22-30
(heteroskedasticity-consistent standard errors in parentheses)

(N=2,831)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
College Major Controls	NO	YES	NO	YES	NO	YES	NO	YES
Industry Controls	NO	NO	YES	YES	NO	NO	YES	YES
Quality Index	.008	.009	.006	.007	.012	.012	.010	.009
	(.011)	(.011)	(.011)	(.011)	(.010)	(.010)	(.010)	(.010)
Tuition	.109	.083	.090	.067				
($10,000s)	(.086)	(.086)	(.085)	(.085)				
Private	−.008	−.005	−.006	−.004	.072**	.059*	.060*	.048
	(.055)	(.054)	(.062)	(.053)	(.035)	(.034)	(.033)	(.033)
Size					.021	.012	.017	.016
(10,000s)					(.016)	(.010)	(.016)	(.015)
R^2 (adjusted)	.29	.29	.33	.34	.29	.29	.34	.34

(N=2,831)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Background Controls	NO	NO	YES	YES	NO	NO	YES	YES
College Major Controls	NO	YES	NO	YES	NO	YES	NO	YES
Industry Controls	NO	YES	NO	YES	NO	YES	NO	YES
Quality Index	.019**	.014	.016*	.010	.014	.009	.010	.005
	(.009)	(.009)	(.009)	(.009)	(.010)	(.010)	(.010)	(.010)
Proportion Female	−.079	−.077	−.010	−.091				
(decimal)	(.111)	(.110)	(.113)	(.112)				
Proportion Female								
2nd quartile					−.053	−.043	−.065	−.051
					(.040)	(.040)	(.040)	(.039)
3rd quartile					−.075*	−.074*	−.080**	−.076*
					(.043)	(.041)	(.043)	(.041)
highest quartile					−.083**	−.074*	−.090**	−.077*
					(.042)	(.040)	(.042)	(.040)
R^2 (adjusted)	.29	.34	.29	.34	.30	.35	.29	.34

See the note to Table 2. The estimates in the top panel do not change appreciably when background controls are added.

Table 10: College Quality and Wage Growth
(heteroskedasticity-consistent standard errors in parentheses)

WOMEN 22–30 IN 1987

Equation 4
Dependent Variable: Log Wage

(N=2,262)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Background Controls	NO	NO	NO	NO	YES	YES	YES	YES
College Major Controls	NO	NO	YES	YES	NO	NO	YES	YES
Industry Controls	NO	NO	YES	YES	NO	NO	YES	YES
Quality Index	.012	.009	.007	.007	.012	.009	.006	.007
	(.010)	(.019)	(.010)	(.018)	(.010)	(.019)	(.010)	(.018)
Quality × Experience		.050		–.013		.047		–.018
(1,000s)		(.275)		(.262)		(.275)		(.261)
R^2 (adjusted)	.29	.29	.34	.36	.29	.29	.33	.33

Equation 5
Dependent Variable: $(\ln W_{89} - \ln W_{87})$

(N=2,262)	(1)	(2)	(3)	(4)
Ability Controls	NO	NO	YES	YES
Δ (Quality × Experience)	.047	.097	.027	.078
(1,000s)	(.089)	(.092)	(.090)	(.094)
Private		–.060*		–.062*
		(.035)		(.035)
R^2 (adjusted)	.05	.05	.09	.09

Note: The dependent variable is natural log of real wage; the regressions are described in the note to Table 2. For all regressions the sample is restricted to those who worked and had valid data in both 1987 and 1989. “Experience” in the interaction term is post-college experience.

Table 11: The Price of College Quality
(standard errors in parentheses)

Dependent Variable: Tuition

Regressors (N=1,289)	
Quality Index	–1,774**
	(422.4)
Quality^2	858.4**
	(128.9)
Quality^3	–91.5**
	(14.9)
Quality^4	2.94**
	(.569)
public	–5,012**
	(1,497)
public × Quality	429.8
	(429.3)
public × Quality^2	–56.8
	(244)
public × Quality^3	–55.3
	(43.6)
public × Quality^4	5.35**
	(2.38)
R^2 (adjusted)	.80

Note: The dependent variable is tuition (in-state tuition for public schools). The regressions are estimated using the full set of four-year colleges for which we have information. In addition to the variables shown, they also include a constant, quartics in *size*, *proportion female*, and *percent* *black*, and interactions between each of these variables and the public school indicator. The quality index is normalized so that its minimum value is zero. Adding the quality variables increases R^2 by about 0.15.

Table 12: Are the Quality Estimates Plausible?
(dollars)

	$\overline{\Delta w}$ (break-even)	Δw (quality effects)	
	(1)	(2)	(3)
Major & Industry Controls		NO	YES
Background Controls		NO	YES
Graduate in 4 years, r=.06:			
25th %ile to Median	$220	$400	$240
Median to 75th %ile	$390	$520	$310
Median to 95th %ile	$1,450	$2,250	$1,320
Graduate in 4 years, r=.10:			
25th %ile to Median	$390	$400	$240
Median to 75th %ile	$700	$520	$310
Median to 95th %ile	$2,570	$2,250	$1,320
Graduate in 5 years, r=.06:			
25th %ile to Median	$290	$400	$240
Median to 75th %ile	$510	$520	$310
Median to 95th %ile	$1,870	$2,250	$1,320
Graduate in 5 years, r=.10:			
25th %ile to Median	$520	$400	$240
Median to 75th %ile	$910	$520	$310
Median to 95th %ile	$3,370	$2,250	$1,320

Note: See Equation 6 on page 15. The break-even point in the first column is based on the estimated cost of quality at private colleges reported in Table 11. The quality effects are from estimates in Table 5 and Table A10. They are evaluated at $23,529, the average beginning salary offered Bachelor's degree recipients in Business in 1990 (Census 1994; Table 289). Quality effects (Δw) are linear in starting salary, so evaluation at the average beginning salary for graduates in the Humanities ($23,213), Social Sciences ($21,627), or Computer Science ($29,804) does not substantially change the result. The 25th, 50th, 75th and 95th percentiles of normalized quality are 2.08, 2.95, 4.05, and 7.42, respectively.

Table 13: Husband's Wage and College Quality
(heteroskedasticity-consistent standard errors in parentheses)

MARRIED WHITE WOMEN 22–30 IN 1987

Dependent Variable: Log Husband's Wage (N=855)	(1)	(2)	(3)	(4)	(5)
Background Controls	NO	YES	NO	YES	YES
College Major Controls	NO	NO	NO	NO	YES
Quality Index	.032	.019	.030	.018	.024
	(.029)	(.029)	(.029)	(.030)	(.033)
Size			.116**	.106**	.113**
(10,000s)			(.034)	(.035)	(.036)
Proportion Students Female		1.03**	.973**	1.10**	
			(.421)	(.438)	(.382)
Proportion Students Black		1.81**	1.44**	1.14*	
			(.660)	(.691)	(.676)
R^2 (adjusted)	.07	.07	.09	.09	.09

MARRIED BLACK WOMEN 22–30 IN 1987

(N=228)	(1)	(2)	(3)	(4)	(5)
Background Controls	NO	YES	NO	YES	YES
College Major Controls	NO	NO	NO	NO	YES
Quality Index	.014	–.023	.018	–.010	–.015
	(.040)	(.042)	(.045)	(.048)	(.059)
Size			.034	.026	.033
(10,000s)			(.103)	(.089)	(.110)
Proportion Students Female		.818	1.31**	1.07*	
			(.508)	(.554)	(.589)
Proportion Students Black		.060	.112	.123	
			(.247)	(.243)	(.265)
R^2 (adjusted)	.11	.20	.09	.19	.17

Note: ** indicates significance at 5 percent; * indicates significance at 10 percent. All regressions include quartics in the woman's age, ability controls, years of school completed, any post-secondary school, years of post-secondary school completed, an indicator for having a 4-year degree, and regional indicator variables. The results are similar if the samples are restricted to those who attended some post-secondary school.

Table 14: Probit Estimates: Marital Status and College Quality
(asymptotic standard errors in parentheses)

WHITE WOMEN 22–30 IN 1987

Dependent Variable: Married in 1987

(N=1,896)		**dP/dx**			**dP/dx**			**dP/dx**
Background Controls	YES			YES			YES	
College Major Controls	NO			NO			YES	
Quality Index	–.018	–.006		–.021	–.008		–.018	–.006
	(.034)			(.035)			(.034)	
Size				.106*	.039		.098 *	.036
(10,000s)				(.055)			(.056)	
Proportion Students Female			.770	.280		.786	.284	
(decimal)				(.523)			(.539)	
Proportion Students Black			–1.82**	–.663		–1.80**	-.653	
(decimal)				(.894)			(.864)	
Log Likelihood	–1,186			–1,181			–1,173	

BLACK WOMEN 22–30 IN 1987

(N=1,115)		**dP/dx**			**dP/dx**			**dP/dx**
Background Controls	YES			YES			YES	
College Major Controls	NO			NO			YES	
Quality Index	–.029	–.011		–.025	–.009		–.001	–.000
	(.061)			(.064)			(.068)	
Size				.026	.010		.025	.009
(10,000s)				(.105)			(.109)	
Proportion Students Female			.957	.351		1.06	.384	
(decimal)				(.871)			(.932)	
Proportion Students Black			–.286	–.105		–.313	–.113	
(decimal)				(.270)			(.277)	
Log Likelihood	–699			–697			–687	

Note: ** indicates significance at 5 percent; * indicates significance at 10 percent. The columns labeled "dP/dx" report the mean numerical derivatives implied by the probit coefficient estimates. All regressions include quartics in the woman's age, ability controls, years of school completed, any post-secondary school, years of post-secondary school completed, an indicator for having a 4-year degree, regional indicator variables, a catholic religion indicator, and family and high school background variables.

Figure 1: Tuition and Quality

RELATIONSHIP FOR PRIVATE COLLEGES IMPLIED BY ESTIMATES IN TABLE 11

The range in quality shown includes over 85 percent of the colleges for which we can construct the quality index.

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Appendix

Table A1 describes the basic set of regressors included in the log wage regressions. Table A2 reports the results of the principal components analysis used to create the ability controls. Our ability controls were created in two steps. First, we created age-adjusted ASVAB scores by regressing each of the ten ASVAB scores for each individual on age dummy variables and an indicator of whether or not the respondent had completed high school when she took the ASVAB. The residuals from these regressions are the age-adjusted scores. These are the data for the principal components analysis. The first two principal components of the age-adjusted scores are the ability controls used in the wage regressions throughout the paper.

Table A3 describes the family and other background variables included as controls in some of the regressions. Table A4 describes the college characteristics we use as indicators of quality. Table A5 reports descriptive statistics for the college characteristics. Table A6 lists and describes our two sets of college major controls. Table A7 summarizes the principal components analysis that produced our quality index; Table A8 lists the top 50 colleges and universities as ranked by this index. Tables A9 and A10 show that adding background controls to the regressions reported in the text has little effect on the quality estimates. Table A11 shows that using the most disaggregated college major controls has little effect on the quality estimates. Table A12 shows that adding the second principal component of the quality measures has little effect. Table A13 reports coefficient estimates for many of the individual background controls in regressions that control for college quality. Table A14 and Table A15 report the distributions of white and black women across schools, defined by the percent of students who are black.

We tested the exclusion restrictions in the joint estimation reported in Table 6. We did so by including subsets of the excluded variables in the wage regression (the probit always had the full set of excluded variables) and testing the restriction that their coefficients are jointly zero. We cannot reject the exclusion restrictions for most subsets of variables at usual levels of significance, although whether or not we reject the exclusion restrictions is somewhat sensitive to how the variables are grouped for testing. Across all specifications created by including subsets of the excluded variables the quality estimates are extremely stable; the coefficients are always within +/– .002 of those we report.

Table A1: Regressors for Log Wage Regressions

log wage	Log of average real wage (1982 dollars) on all jobs held during the year 1987 or 1989, as indicated
west, south, northeast	dummy variables indicating region of residence at the interview 1987 or 1989 interview, as indicated
smsa	dummy variable indicating that respondent lived in an SMSA at 1987 or 1989 interview, as indicated
union	indicates whether any job held during the year was covered by a collective bargaining agreement
age	respondent's age at the 1987 interview
experience	total months the respondent has been employed since age 16
tenure	total months the respondent has worked for the current employer
BA degree	dummy variable indicating the respondent has a 4-year college degree as of 1987 interview
highest grade completed	highest grade or year of school the respondent completed as of the 1987 interview
black	dummy variable indicating the respondent is black
hispanic	dummy variable indicating the respondent is hispanic (black & hispanic are mutually exclusive)
ability	The first and second principal components of the 10 age-adjusted Armed Services Vocational Aptitude Battery scores, and these two principal components squared. The ASVAB was administered in 1980. The age adjustment procedure and principal components analysis are described in this Appendix.

Table A2: Construction of Age-Adjusted Ability Measure

Ability is First Two Principal Components of ASVAB Residuals

Component	Eigenvalue	Difference	Explained Proportion	Cumulative Explained
1	6.23577	4.99921	0.6236	0.6236
2	1.23656	0.65324	0.1237	0.7472
3	0.58332	0.09641	0.0583	0.8056
4	0.48691	0.17106	0.0487	0.8543
5	0.31585	0.01784	0.0316	0.8858
6	0.29880	0.05809	0.0298	0.9156
7	0.23991	0.00929	0.0240	0.9396
8	0.23062	0.03448	0.0231	0.9627
9	0.19614	0.01922	0.0196	0.9823
10	0.17692		0.0177	1.0000

Eigenvectors, 1st and 2nd Principal Components

	1st PC	2nd PC
general science residuals	0.34983	–0.15182
arithmetic reasoning residuals	0.34406	0.04834
word knowledge residuals	0.34782	0.04514
paragraph comprehension residuals	0.32261	0.15402
numerical operations residuals	0.27533	0.47801
coding speed residuals	0.24530	0.53074
auto and shop knowledge residuals	0.27982	–0.45859
mathematics knowledge residuals	0.32972	0.14300
mechanical comprehension residuals	0.32099	–0.32185
electrical information residuals	0.32887	–0.32301

Note: The ASVAB scores are adjusted for age by regressing each test score on age dummy variables and a variable indicating whether the respondent had completed high school when the ASVAB was administered. Principal components analysis is performed on the residuals from these regressions.

Table A3: Family Background & High School Controls

Home: magazine	"When you were about 14 years old, did you or anyone else living with you get magazines regularly?"
Home: newspaper	"When you were about 14 years old, did you or anyone else living with you get a newspaper regularly?"
Home: library card	"When you were about 14 years old, did you or anyone else living with you have a library card?"
Parents: mom education	Highest grade or year of school completed by respondent's mother.
Parents: mom living	Was the respondent's mother living at the 1979 interview (when respondents were between 14 and 22 years old)?
Parents: mom age	At the 1987 interview.
Parents: dad education	Highest grade or year of school completed by respondent's father.
Parents: dad living	Was the respondent's father living at the 1979 interview?
Parents: dad age	At the 1987 interview.
Parents: living together	Indicator for whether the respondent's mother and father lived in the same household at the 1979 interview.
Parents: mom occupation	Occupation of job held longest by mother or stepmother in 1978, represented by dummy variables for each Census 2-digit occupation.
Parents: dad occupation	Occupation of job held longest by father or stepfather in 1978, represented by dummy variables for each Census 2-digit occupation.
HS: Size	Asked of respondents' high schools: "As of 10/1/79 [or nearest date] what was [your] total enrollment?"
HS: books	Asked of respondents' high schools: "What is the approximate number of catalogued volumes in the school library (enter 0 if your school has no library)." [in 1979]
HS: teacher salary	Asked of respondents' high schools: "What is the first step on an annual salary contract schedule for a beginning certified teacher with a bachelor's degree?" [in 1979]
HS: disadvantaged	Asked of respondents' high schools: "What percentage of the students in [the respondent's high school] are classified as disadvantaged according to ESEA [or other] guidelines?" [in 1979]

Table A4: College Characteristics Definitions

tuition	1990. For public schools, tuition is that for in-state residents.
acceptance rate	Percent of applicants accepted, fall 1990.
spending per student	Educational and general expenditures per full-time equivalent student, 1990.
1st year retention (%)	Average percent of 1987-89 freshmen who enrolled as sophomores.
graduation rate (%)	Average percent of 1983-85 freshmen who graduated within 5 years.
faculty/student ratio	Based on full-time equivalent total faculty and students, fall 1990.
size (# full-time students)	Fall 1990.
% of faculty with Ph.D.	Percent of full-time faculty with doctorate or highest terminal degree.
% students black	Fall 1990.
% students female	Fall 1990
average SAT	Average SAT scores of fall 1990 freshmen.
25th %ile SAT	25th percentile of SAT scores of fall 1990 freshmen.
75th %ile SAT	75th percentile of SAT scores of fall 1990 freshmen.
25th / 75th %ile SAT	Ratio of 25th to 75th percentile SAT scores of fall 1990 freshmen.
HS top 10, HS top 25	Percent of fall 1990 freshmen who graduated in the top 10 or top 25 percent of their high school class.

Whenever a school quality measure appears, missing values are set to zero and a dummy variable indicating whether the quality measure is missing is included.

Table A5: College Characteristics—Women
(unweighted)

	mean	25th %ile	median	75th %ile	N
tuition	$4,220	$1,470	$2,020	$6,080	878
rejection rate (%)	26	14	23	35	868
spending per student	$11,560	$6,980	$9,020	$13,160	844
1st year retention (%)	72	65	74	82	854
graduation rate (%)	43	30	43	55	809
faculty/student ratio	.067	.053	.059	.077	877
size (# full-time students)	11,700	3,450	8,380	16,300	923
private college or university	.32	•	•	•	925
% of faculty with Ph.D.	72	61	75	86	844
% students black	15	4	6	12	838
% students female	56	51	55	59	923
average SAT	912	815	890	1,002	798
25th %ile SAT	831	705	830	920	515
75th %ile SAT	1,059	955	1,060	1,160	517
25th / 75th %ile SAT	.78	.75	.79	.81	515
HS top 10	25	10	19	32	562

Table A6: College Major Controls

Agriculture (24)
agriculture

Architecture (11)
architecture
interior design
misc. architecture

Area Studies (1)
area studies

Biology (54)
biochemistry
biology
microbiology
pre-med
zoology
misc. biology

Business (282)
accounting
banking and finance
business administration
economics
international business
institutional management
marketing
misc. business

Communications (45)
advertising
communications
journalism
radio & TV
misc. Communications

Computer Science (41)
computer science
misc. computer science

Education (150)
education

Engineering (104)
aerospace engineering
chemical engineering
civil engineering
electrical engineering
engineering technologies
general engineering
industrial engineering
mechanical engineering
misc. engineering

Fine Arts (58)
art
commercial arts
drama
design
fine arts
music performing
music liberal arts
studio arts
misc. fine arts

Foreign Languages (14)
french
spanish
misc. foreign language

Health Professions (159)
nursing
misc. health professions

Home Economics (16)
home economics
nutrition
misc. home economics

Interdisciplinary Studies (66)
general studies
liberal arts, & other interdisciplinary studies
misc. other

Law (11)
law
pre-law
misc. law

Letters (25)

english
misc. letters

Mathematics (9)
applied mathematics
mathematics
misc. mathematics

Military (1)
military science

Office Occupations (53)
data processing
secretarial studies

(Continues)

Physical science (31)
chemistry
geology
physics
misc. physical sciences

Psychology (35)
psychology
misc. psychology

Public Service (46)
law enforcement
social work
misc. public service

Social Science (66)
anthropology
history
political Science
sociology
misc. social science

Theology (12)
theology

This table lists the two aggregations of college majors used. Respondents for whom there is no college major information have all of the indicator variables set to zero. Regressions that include college major controls also include a dummy variable indicating whether college major information was available for the respondent.

Detailed controls: The detailed measure recognizes 82 distinct college majors, listed above.

Basic controls: The 82 “detailed” college majors were aggregated into 24 areas. These are listed in boldface, with the number of respondents reporting a major in each of these categories given in parentheses.

(Continues)

Table A7: Construction of Quality Index

Quality is 1st Principal Component

Component	Eigenvalue	Difference	Proportion	Explained
1	3.77657	2.84119	0.6294	0.6294
2	0.93538	0.26290	0.1559	0.7853
3	0.67248	0.41523	0.1121	0.8974
4	0.25725	0.01780	0.0429	0.9403
5	0.23946	0.12060	0.0399	0.9802
6	0.11886		0.0198	1.0000

Eigenvector, 1st Principal Component

spending per student	0.43209
faculty/student ratio	0.30544
rejection rate	0.32705
ave. SAT	0.45207
high school top25%	0.43904
high school top10%	0.46466

standard deviation of quality index: 1.94

Note: The quality index is the first principal component, constructed by multiplying each term in the 1st eigenvector by the corresponding variable. The variables were normalized for the principal components analysis.

(Continues)

Table A8: Top 50 Colleges as Ranked by Quality Index

		Quality Index
1.	California Institute of Technology	11.20
2.	Johns Hopkins University (MD)	8.43
3.	Yale University (CT)	8.34
4.	Stanford University (CA)	8.27
5.	Massachusetts Institute of Technology	7.95
6.	Harvard University (MA)	7.41
7.	Princeton University (NJ)	7.20
8.	Columbia University (NY)	7.03
9.	Dartmouth College (NH)	7.01
10.	Washington University (MO)	6.99
11.	United States Air Force Academy (CO)	6.89
12.	Duke University (NC)	6.87
13.	Wake Forest University (NC)	6.55
14.	University of Chicago (IL)	6.43
15.	United States Military Academy (NY)	6.21
16.	University of Pennsylvania	5.94
17.	Cornell University (NY)	5.90
18.	Amherst College (MA)	5.88
19.	Rice University (TX)	5.75
20.	Pomona College (CA)	5.65
21.	United States Coast Guard Academy (CT)	5.57
22.	Williams College (MA)	5.56
23.	Cleveland Institute of Music (OH)	5.56
24.	Case Western Reserve University (OH)	5.55
25.	Harvey Mudd College (CA)	5.53
26.	Swarthmore College (PA)	5.51
27.	Northwestern University (IL)	5.45
28.	Bowdoin College (ME)	5.34
29.	Georgetown University (DC)	5.09
30.	Vanderbilt University (TN)	5.03
31.	Brown University (RI)	4.99
32.	Tufts University (MA)	4.67
33.	Wesleyan University (CT)	4.63
34.	University of California at Berkeley	4.62
35.	Wellesley College (MA)	4.59
36.	University of California at San Diego	4.50
37.	Haverford College (PA)	4.49
38.	University of Notre Dame (IN)	4.44
39.	University of Virginia	4.41

(Continues)

40.	University of Rochester (NY)	4.40
41.	Carnegie Mellon University (PA)	4.18
42.	Claremont McKenna College (CA)	4.15
43.	Carleton College (MN)	4.14
44.	Univ. of North Carolina at Chapel Hill	4.14
45.	Middlebury College (VT)	4.12
46.	Bryn Mawr College (PA)	4.07
47.	Emory University (GA)	4.02
48.	Vassar College (NY)	3.88
49.	Washington and Lee University (VA)	3.85
50.	New York University	3.80

Note: This list represents approximately the upper 9 percent of colleges for which we were able to construct our quality index (50 colleges represent about 4 percent of 4-year colleges). Because there appears to be a tendency for better colleges to report more data, “upper 9 percent” probably understates the relative quality of the colleges on this list compared to their position in the distribution of quality if we could calculate our quality index for all colleges.

Table A9: College Quality and Background Characteristics

College Major Controls and Basic Regressors
Women 22-30
(heteroskedasticity-consistent standard errors in parentheses)

(N=2,831)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Home	YES			YES	YES			YES
Parents		YES		YES		YES		YES
High School			YES	YES			YES	YES
Quality Index	.018**	.017*	.017*	.017*				
	(.009)	(.009)	(.009)	(.009)				
Quality Quintile								
2nd					−.013	−.003	−.006	−.001
					(.057)	(.055)	(.056)	(.055)
3rd					.008	.012	.009	.014
					(.057)	(.058)	(.057)	(.057)
4th					.030	.031	.027	.031
					(.062)	(.063)	(.062)	(.063)
highest					.074	.079	.073	.070
					(.058)	(.057)	(.058)	(.058)
R^2 (adjusted)	.30	.29	.30	.29	.29	.29	.29	.30

Note: The dependent variable is log real wage; the regressions are described in the note to Table 2. The college major controls are described in the text and the Appendix. Substituting the first principal component of *spending per student* and the *student/faculty ratio* for the quality measure increases the size and standard error of the quality estimate slightly, but otherwise has little effect.

Table A10: College Quality and Background Characteristics

Industry Controls, College Major Controls and Basic Regressors
Women 22-30
(heteroskedasticity-consistent standard errors in parentheses)

(N=2,831)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Home	YES			YES	YES			YES
Parents		YES		YES		YES		YES
High School			YES	YES			YES	YES
Quality Index	.014	.012	.013	.012				
	(.009)	(.009)	(.009)	(.009)				
Quality Quintile								
2nd					–.021	–.009	–.015	–.009
					(.053)	(.052)	(.053)	(.052)
3rd					.014	.019	.017	.020
					(.055)	(.054)	(.054)	(.054)
4th					.021	.022	.018	.022
					(.061)	(.062)	(.060)	(.061)
highest					.044	.048	.043	.038
					(.056)	(.056)	(.056)	(.056)
R^2 (adjusted)	.34	.34	.34	.34	.34	.34	.34	.34

Note: The dependent variable is log real wage; the regressions are described in the note to Table 2. The college major controls are described in the text and the Appendix. The industry controls include union status. Substituting the first principal component of *spending per student* and the *student/faculty ratio* for the quality measure increases the size and standard error of the quality estimate slightly, but otherwise has little effect.

Table A11: College Quality and Background Characteristics

Detailed College Major Controls and Basic Regressors
Women 22-30
(heteroskedasticity-consistent standard errors in parentheses)

(N=2,831)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Home	YES			YES	YES			YES
Parents		YES		YES		YES		YES
High School			YES	YES			YES	YES
Quality Index	.015*	.014	.015	.013				
	(.009)	(.009)	(.009)	(.009)				
Quality Quintile								
2nd					−.009	.000	−.003	.003
					(.059)	(.058)	(.059)	(.058)
3rd					.031	.032	.032	.038
					(.059)	(.059)	(.059)	(.059)
4th					.061	.061	.056	.061
					(.063)	(.064)	(.063)	(.064)
highest					.065	.072	.064	.064
					(.058)	(.057)	(.058)	(.057)
R^2 (adjusted)	.30	.30	.30	.30	.30	.30	.30	.30

Note: The dependent variable is log real wage; the regressions are described in the note to Table 2. There are 81 "Detailed College Major Controls," as described in the Appendix. Substituting the first principal component of *spending per student* and *the student/faculty ratio* for the quality measure increases the size and standard error of the quality estimate slightly, but otherwise has little effect.

Table A12: First Two Quality Principal Components in Log Wage Regressions
Women 22-30
(heteroskedasticity-consistent standard errors in parentheses)

(N=2,831)	(1)	(2)	(3)	(4)	(5)	(6)
College Major Controls	NO	YES	YES	NO	YES	YES
Industry Controls	NO	NO	YES	NO	NO	YES
1st Principal Component	.020**	.019**	.015*			
(Quality Index)	(.009)	(.009)	(.009)			
2nd Principal Component	.004	–.001	–.008	.011	.018	.019
	(.017)	(.017)	(.017)	(.018)	(.027)	(.026)
1st Principal Component Quintiles						
2nd				.012	.005	.000
				(.055)	(.054)	(.052)
3rd				.047	.027	.036
				(.055)	(.055)	(.053)
4th				.041	.046	.038
				(.060)	(.061)	(.059)
highest				.116**	.095*	.068
				(.056)	(.056)	(.055)
R^2 (adjusted)	.29	.29	.34	.29	.29	.34

Note: The dependent variable is log real wage; the regressions are described in the note to Table 2. The first principal component is the "quality index" used throughout the paper.

Table A13: College Quality and Background Characteristics

Quality Index

Women 22-30

(heteroskedasticity-consistent standard errors in parentheses)

(N=2,831)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Detailed College Major	NO	NO	NO	NO	YES	YES	YES	YES
Industry	NO	NO	NO	NO	YES	YES	YES	YES
QUALITY INDEX	.020**	.019**	.019**	.017*	.014	.012	.13	.011
	(.009)	(.009)	(.009)	(.009)	(.090)	(.009)	(.009)	(.009)
HOME (JOINT SIG.)	(1%)			(4%)	(1%)			(4%)
magazine	.037**			.036*	.031*			.030*
	(.018)			(.018)	(.017)			(.018)
newspaper	.015			.008	.022			.016
	(.019)			(.019)	(.018)			(.019)
library card	.038**			.032*	.038**			.032*
	(.018)			(.018)	(.018)			(.018)
PARENTS (JOINT SIG.)	(1%)		(1%)		(1%)		(4%)	
mom education		.047		.035		.043		.031
(10s)		(.036)		(.036)		(.035)		(.035)
mom living		.028		.029		–.001		.003
		(.061)		(.060)		(.060)		(.059)
dad education		.012		–.004		.020		.004
(10s)		(.031)		(.031)		(.030)		(.030)
dad living		.000		–.001		–.000		.002
		(.035)		(.035)		(.034)		(.034)
living together		–.041		–.049		–.053		–.060
		(.053)		(.053)		(.050)		(.050)
mom occupation		YES		YES		YES		YES
dad occupation		YES		YES		YES		YES
HIGH SCHOOL (JOINT SIG.)			(1%)	(2%)			(1%)	(2%)
size			.310**	.298**			.335**	.270**
(10,000s)			(.118)	(.121)			(.137)	(.118)
books			.000	.000			–.008	–.003
(10,000s)			(.008)	(.008)			(.012)	(.008)
disadvantaged			–.065	–.057			–.017	–.056
(decimal)			(.042)	(.043)			(.041)	(.042)
teacher salary			.070	.078			.193**	.107**
($10,000s)			(.074)	(.074)			(.077)	(.070)
R^2 (adjusted)	.29	.29	.29	.29	.34	.34	.34	.34

Note: The dependent variable is log real wage; the regressions are described in the note to Table 2. The 81 detailed college major controls are described in the text and the Appendix. The "Home," "Parents," and "High School" variables are described in the Appendix. The covariance matrix is estimated using White's (1980) heteroskedasticity-consistent method.

Table A14: Distribution of White Women Among Colleges, by Percent Students Black

College's Percent Students Black	Number of White Women	Cumulative Percent of White Women
0	6	1.19
1	40	9.07
2	73	23.47
3	45	32.35
4	64	44.97
5	61	57.00
6	35	63.91
7	42	72.19
8	35	79.09
9	27	84.42
10	9	86.19
11	12	88.56
12	8	90.14
13	4	90.93
14	9	92.70
15	4	93.49
16	3	94.08
17	9	95.86
19	2	96.25
21	3	96.84
22	2	97.24
23	2	97.63
24	3	98.22
25	3	98.82
26	1	99.01
38	2	99.41
62	1	99.61
82	1	99.80
92	1	100.00
Total	507	

Table A15: Distribution of Black Women by Colleges' Percent Students Black

College's Percent Students Black	Number of Black Women	Cumulative Percent of Black Women
1	2	.78
2	2	1.57
3	10	5.49
4	12	10.20
5	13	15.29
6	18	22.35
7	26	32.55
8	6	34.90
9	9	38.43
10	5	40.39
11	4	41.96
12	3	43.14
13	1	43.53
14	2	44.31
15	3	45.49
16	17	52.16
17	11	56.47
18	1	56.86
19	7	59.61
23	4	61.18
24	3	62.35
25	8	65.49
26	1	65.88
27	1	66.27
28	1	66.67
31	2	67.45
60	1	67.84
62	2	68.63
65	1	69.02
68	2	69.80
72	2	70.59
75	6	72.94
78	3	74.12
79	4	75.69
82	2	76.47
83	12	81.18
84	7	83.92
86	2	84.71
88	1	85.10
89	2	85.88
90	9	89.41
91	1	89.80
92	2	90.59
93	9	94.12
96	2	94.90
97	3	96.08
98	1	96.47
99	9	100.00
TOTAL	255	

[1] Weisbrod and Karpoff (1968), Reed and Miller (1970), Wales (1973), Solmon (1975), Solomon and Wachtel (1975), Wachtel (1976), James *et al*. (1988), Loury and Garman (1995), and Daniel, Black, and Smith (1995) all focus exclusively on the impact of college quality on males.

[2] DBS (1995) find only very weak evidence for men that a higher fraction of female students lowers wages.

[3] We attach these college characteristics: nominal tuition, spending per student, total enrollment, student/faculty ratio, percent of faculty with a Ph.D. or comparable terminal degree, acceptance rate, 1st-year retention rate, graduation rate, percent of students who are black, percent of students who are women, mean, 25th, and 75th percentile SAT or ACT scores of first-year students (ACT scores are converted to SAT equivalents), percent of first-year students who were in the top 10 and top 25 percent of their high school classes, and an indicator of whether the college is public or private.

[4] One concern that can be raised about many of the statistics is that colleges realize prospective students treat them as quality indicators. *The Wall Street Journal* (1995) reports that many colleges misreport these statistics for marketing purposes, but it is unlikely that misreporting produces a negative relationship between reported and actual values. The IPEDS data are presumably less subject to misreporting.

[5] See Cawley, *et al.* (1995) on using the first two principal components of the ASVAB scores.

[6] We have repeated much of our analysis using only the first principal component of the unadjusted ASVAB scores, and using (unadjusted) Armed Forces Qualifying Test (AFQT) scores in place of our age-adjusted principal components. In both cases we obtain results very similar to those reported. The AFQT is a weighted average of scores on four of the ten ASVAB tests.

[7] The qualitative results are the same if we use the usual OLS estimates of the standard errors in place of the heteroskedasticity-consistent estimates reported.

[8] Treating pre-graduation and post-graduation experience separately is justified by F-tests at better than a 1 percent level of significance, but has little effect on our estimates of the effect of quality. Overall, separating experience marginally improved the precision of some estimates in some specifications.

[9] This does not necessarily imply that women do not benefit financially from attending all-female colleges. Most of the variation in *percent female* occurs in a relatively narrow range. Mean *percent female* in the first quartile is 44 percent; mean *percent female* in the top quartile is 68 percent. Only about 10 percent of working women in the sample attended colleges at which more than two-thirds of the students were women.

[10] Substituting the more detailed college major controls described in the Appendix does not change this result (not shown).

[11] Factor analysis and principal components analysis produced indices with very high rank order correlation (.99 for the six variables we use).

[12] For sets larger than two, the correlations between the quality indices produced were quite high, generally greater than .8 and often greater than .9.

[13] To check the robustness of our results, we experimented with an alternative quality index constructed from only two characteristics describing educational inputs, *spending per student* and *the faculty/student ratio*. The ranking of colleges implied by this alternative index differed somewhat from that produced by the index we use throughout this paper, but substituting it in regressions had little effect, as described in the notes accompanying some of the tables that follow.

[14] The mean value of quality in the first quintile is -2.00, in the highest quintile, 3.15.

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[15] We find no evidence that the college quality effect varies by the intensity of women's college experiences, as measured by years of post-secondary education or receipt of a 4-year degree.

[16] These categories were chosen to ensure that each had sufficient numbers of black and white women. See the Appendix for the distribution of women across colleges defined by *percent students black* see the note to Table 8 for category cell sizes.

[17] Evaluation at the average beginning salary for Humanities graduates ($23,213) does not greatly change the estimates.

[18] For white women, the probit point estimates suggest that moving from a college at the 25th percentile of quality to one at the 95th percentile lowers the probability of being married by about 4 percentage points.

[19] The results are similar if we replace the dependent variable "currently married" with "ever married."