NBER WORKING PAPER SERIES

MEASURING THE EFFECTS OF COGNITIVE ABILITY

John Cawley
Karen Conneely
James Heckman
Edward Vytlacil

Working Paper 5645

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
July 1996

We thank the Russell Sage Foundation and NSF Grant SBR 93-0248 for their support of this research. An early version of this paper was presented at a conference on Meritocracy at the University of Wisconsin, December, 1995 and a seminar at the Kennedy School at Harvard in the same month. The first draft emerged from an Economics 311 Problem Set, Winter, 1995 term. Some of this material is referenced in Heckman 1995. This paper is part of NBER's research program in Labor Studies. Any opinions expressed are those of the authors and not those of the National Bureau of Economic Research.

NBER Working Paper 5645
July 1996

MEASURING THE EFFECTS OF COGNITIVE ABILITY

ABSTRACT

This paper presents new evidence from the NLSY on the importance of meritocracy in American society. In it, we find that general intelligence, or "g"-- a measure of cognitive ability--is dominant in explaining test score variance. The weights assigned to tests by "g" are similar for all major demographic groups. These results support Spearman's theory of "g."

We also find that "g" and other measures of ability are not rewarded equally across race and gender, evidence against the view that the labor market is organized on meritocratic principles. Additional factors beyond "g" are required to explain wages and occupational choice. However, both blue collar and white collar wages are poorly predicted by "g" or even multiple measures of ability. Observed cognitive ability is only a minor predictor of social performance. White collar wages are more "g" loaded than blue collar wages. Many noncognitive factors determine blue collar wages.

John Cawley
Department of Economics
University of Chicago
1126 East 59th Street
Chicago, IL 60637

Karen Conneely
Department of Economics
Princeton University
Princeton, NJ 08542

James Heckman
Department of Economics
University of Chicago
1126 East 59th Street
Chicago, IL 60637
and NBER

Edward Vytlacil
Department of Economics
University of Chicago
1126 East 59th Street
Chicago, IL 60637

In their controversial book The Bell Curve, Richard Herrnstein and Charles Murray summarize an impressive body of research on the correlations between social outcomes and scores on tests of cognitive ability. A remarkable finding of the research they survey is that one linear combination of tests - called "g" - predicts performance almost as well as the full battery of tests.[1] Charles Spearman first proposed that general intelligence, or "g", is a common ability that explains performance on all tests of intelligence. General intelligence was also thought to be heritable although that is a completely separate matter.[2]

Both assumptions have been questioned in the scholarly literature. Theories of multiple abilities go back to Thurstone (1947). Carroll (1993) provides a comprehensive discussion of the evidence. The theory of the heritability of intelligence is simplified by, but does not require, unidimensional ability. The Bell Curve embraces both "g" and heritability. Moreover, it extends Spearman and attempts to demonstrate that differences in "g" explain discrepancies in social outcomes across race.

This paper examines the arguments for, and the empirical evidence about, g. Using the NLSY (National Longitudinal Survey of Youth) data employed by Murray and Herrnstein we demonstrate that "g" explains a majority of the variance in test scores. Other combinations explain at most a fifth of what "g" explains. Moreover, the weights of "g" on the constituent tests are remarkably similar across race and gender. The classical theory of "g" is alive and well in the NLSY. Ironically, while Herrnstein and Murray embrace the theory of "g", they use a different (though highly correlated) measure of ability in their analysis.

---

[1] "g" is formed by taking principal components of the correlation matrix of test scores. The component associated with the largest eigenvalue is multiplied by the test scores to form g. Prediction is measured by R-squared–i.e. the proportion of variance explained.

[2] See Gould (1979) for a disparaging review of the early psychometric literature. Carroll (1993) presents a more balanced discussion.

Not much should be made of the fact that "g" explains a majority of the variance in the test scores. The classical theory of "g" is an artifact of linear correlation analysis. Using a result established by Suppes and Zanotti (1981), a scalar measure of ability can always be constructed to fully explain the variance in a battery of test scores. This is a theorem in mathematics and not a statement about behavior. Ironically, Spearman and his successors rob "g" of explanatory power by estimating it using linear methods. The best measure of "g" is in general a nonlinear function of the constituent test scores.

Except for psychometricians, few persons are interested in test scores per se. Instead, interest focuses on the behavior correlated with the tests. The great contribution of Herrnstein and Murray is to relate tests to a wide range of social outcomes: education, occupational attainment, crime, unemployment, and participation in welfare. They establish that tests are strongly correlated with these outcomes although other factors are also important.

Herrnstein and Murray argue that the U.S. has become more of a meritocracy in the last generation; that ability plays an increasingly important role in determining social outcomes. They attribute disparities in social performance by gender and race to disparities in ability and they interpret the rising wage return to schooling as a rise in the return to ability.

This paper examines the role of tests in explaining wages. We consider whether more than "g" is required to summarize the effects of tests on wages. We also consider whether "g" and other components of ability are priced equally across demographic groups. Central to the theory of meritocracy is the notion that ability is the basis for achievement. If the same measures of ability are priced differently across different demographic groups, something besides the meritocratic principle is at work in producing labor market outcomes.

Our study of the NLSY data reveals that the weighting of the test scores used to produce "g" is remarkably similar across demographic groups. "g" explains between 55 and 70 percent of the total variance in the matrix of correlations of test scores for all groups.

Our evidence on the performance of "g" in predicting wages is much less favorable. First, several other components of measured ability besides "g" are statistically significant in predicting log wages. Second, measured ability accounts for a small fraction of the variance in log wages. Even after a generous allowance for measurement error in wages, ability, education, and experience combined account for at most one third of the total variance in wages. Third, in a variety of specifications of log wage equations, the economic returns to measured ability differ across demographic groups, contrary to what is predicted by the theory of meritocracy.

One reason why abilities may be priced differently across different demographic groups is that there are systematic differences in preferences for employment in different sectors for different groups. We examine this possibility below and more extensively elsewhere (Cawley, et al., 1996a) by estimating a model of occupational choice that corrects for the self-selection bias that may give rise to different measured prices of skills across sectors. This estimation reveals that "g" plays an important role both in occupational selection and in wage determination. White collar wages are more strongly correlated with "g" than are blue collar wages, but abilities orthogonal to "g" are also important in both sectors. Blue collar wages are affected by more abilities than are white collar wages. Many of the abilities important for explaining blue collar wages are not cognitive in nature. More abilities than "g" are also required to successfully predict occupational choice.

The National Longitudinal Survey of Youth (NLSY) is designed to represent the entire population of American youth and consists of a randomly chosen sample of 6,111 U.S. civilian youths, a supplemental sample of 5,295 randomly chosen minority and economically disadvantaged civilian youths, and a sample of 1,280 youths on active duty in the military. All youths were between thirteen and twenty years of age in 1978 and were interviewed annually starting in 1979. The data include equal numbers of males and females. Roughly 16% of respondents are Hispanic and 25% are black. For our analysis, we restrict the sample to those not currently enrolled in school and those persons receiving an hourly wage between $.50 and $1000 in 1990 dollars (all results of this paper are reported in 1990 dollars). This paper uses the NLSY weights for each year to produce a nationally representative sample. However, our sample is not nationally representative in age; we only observe an eight year range of ages in any given year, and the oldest person in our 1993 sample is only 36.

In 1980, NLSY respondents were administered a battery of ten intelligence tests referred to as the Armed Services Vocational Aptitude Battery. We describe the ASVAB subtests in Appendix 1 and provide summary statistics in Appendix 2. Appendix 3 presents the ingredients required to construct the model of occupational choice discussed in Section 3.

1. Principal Component Analysis

The first issue we consider is the appropriate measure of intelligence to use for predicting wages. Herrnstein and Murray (1994) argue that there is only one significant intelligence factor, called general intelligence or "g." They fail to mention that many psychometricians who endorse the theory of general intelligence also maintain that there exist other factors of intelligence which have less explanatory power than "g" but are nonetheless both statistically and numerically significant in describing outcomes. For example, Spearman (1927) incorporates specific factors "s" which complement general intelligence "g." Cattell (1987) describes two forms of general intelligence: "fluid" , which is applied to all tasks, and "crystallized" which is a combination of fluid intelligence and practice or study of a specific task. Carroll (1993) posits a three-stratum theory of intelligence in which cognitive abilities range from the narrow to the highly general. By omitting mention of specific and narrow cognitive abilities, Herrnstein and Murray give the misleading impression that intelligence can be fully described by "g."

In this paper, "g" is measured by the product of the test score vector and the eigenvector associated with the largest eigenvalue of the matrix of correlations among standardized ASVAB scores. It is well known that the score on "ability" tests rises with the age and the education of the test taker. This by itself indicates that the tests measure knowledge and not some abstract ability that is independent of specific knowledge. To account for this finding, we present six sets of results, each associated with a different measure of cognitive ability. We construct these measures of "g" by estimating principal components from the matrices of correlations of:

(1) unadjusted test scores;
(2) test scores adjusted for age (as in Herrnstein and Murray).
(3), (4) two adjustments of test scores for age, race, and gender.
(5) test scores adjusted for age and education at the time of the ASVAB test, race, and gender.
(6) test scores adjusted for age and education at the time of the ASVAB test, and the highest grade of education achieved by both parents, race and gender.

By "adjusted," we mean that each of the ten ASVAB tests was regressed on the appropriate combination of age, education, and parents' education, separately by race and gender, and principal components were estimated for the residuals. For measure (2), ASVB scores were only standardized by age. Unlike the other methods, the standardization does not assume or impose a linear relationship between age and measured ability.

In our sample, the correlation between AFQT score and education at age 23 is .6. Our measures of "g" that are residualized on education produce lower-bound estimates of the importance of cognitive ability; our method attributes all overlap of ability with education to education. Likewise, all overlap of ASVAB scores with parents' education is attributed to the latter in one of our measures of "g."

We use principal components to estimate "g" but principal factor analysis and hierarchical factor analysis produce essentially the same results. The principal components method is the least affected by sampling error (Jensen, 1987), but Ree and Earles (1991) find that the correlation between each pair of the three estimates of "g" is .996. However, no matter which method is used, "g" is only as good a measure of cognitive ability as its constituent tests. Many features of personality and motivation are not captured by the ASVAB.

Herrnstein and Murray use the Armed Forces Qualification Test (AFQT) score which is the sum of the ASVAB subtests Word Knowledge, Paragraph Comprehension, Arithmetic Reasoning, and Mathematics Knowledge as their measure of general intelligence. If AFQT is the best measure of general intelligence, then the first principal component should weight each of the four subtests that constitute AFQT by an equal amount and assign zero weights to all other subtests. We do not find such a pattern in the weights of any of our six versions of the first principal component. For example, Table 1 lists the ASVAB weights for the first principal component which is standardized by age, race, and gender; these weights suggest that while AFQT is highly correlated with "g" (ρ = 0.829), it is a suboptimal measure of general intelligence, which suggests that Herrnstein and Murray underestimate the effect of intelligence on social outcomes.

Table 1 also indicates that the first principal component is strikingly similar across race and gender. This has generally been found to be true for different racial populations that share the same language and culture (Jensen, 1987). These loadings are similar to those produced if principal components are computed for the sample as a whole rather than separately for each race and gender group. Speeded tests (Numerical Operations and Coding Speed) receive little weight, while the achievement tests that constitute AFQT are heavily weighted.

For all groups except black females, the second principal component heavily weights the speeded subtests. Carroll (1993) describes this commonly-found speeded intelligence factor as "Numerical Facility." The specification of g is robust to the removal of subtests from the matrix; six subtests must be removed before the Numerical Facility factor becomes the first principal component. Beyond the second factor there are few similarities in the principal components across race and gender groups.

Table 2 contains the proportion of variance in ASVAB test scores attributable to the principal components; again, we use the first principal component standardized by age, race, and gender as an example. Results are comparable for other standardizations. Table 2 indicates that g, the first principal component, is dominant in the ASVAB test score matrix--it explains between 55.2% and 70.6% of the variation in the test scores of each race-gender group.[3] Only for white men and women does the Numerical Facility factor explain more than 10% of the variance in test scores (11.4% and 10.8% respectively). In each racial group "g" has more

[3] The amount of variance explained by g depends upon the similarity of the tests and the range of ability of the persons constituting the sample. Jensen (1987) reports that across 20 independent correlation matrices comprising a total of more than 70 tests, the average percentage of variance accounted for by g is 42.7% (with a range of 33.4% to 61.4%).

explanatory power for men than for women. For each of our six measures of general intelligence, the first principal component explains more test score variance than any other principal component.

The dominance of the first factor in explaining variance in the test correlation matrix should not be interpreted as convincing evidence in favor of a single factor called intelligence. Suppes and Zanotti (1981) have shown that it is possible to construct a scalar latent factor from a vector of test scores such that conditional on the factor, test scores are statistically independent. If $D = (d_1,\ldots,d_T)$ is a vector of T binary random variables with density f(D),then there always exists a factor g such that

$$f(D|g)=\prod_{t=1}^{T} f(d_t|g)$$

so that "g" plays the role of a single factor in conventional factor analysis; that is, conditional on "g," test scores are independent. Standard probability arguments can be used to extend their theorem to countable-valued random variables (e.g. success proportions on exams), and hence to approximate continuous variables arbitrarily well (see, e.g. Holland and Rosenbaum, 1986). "g" exists for any vector of finite-valued random variables; it is not a result derived from the nature of intelligence. The key test for a theory of single intelligence is not how well "g" explains performance on the intelligence tests from which it is derived, but how well it predicts social outcomes. This is the subject of the next two sections.

2. Wages and Ability

Herrnstein and Murray note that large residuals are common in wage regressions, and speculate:

> "What then is this [wage] residual, this X factor, that increasingly commands a wage premium over and above education? It could be a variety of factors... but readers will not be surprised to learn that we believe that it includes cognitive ability."[4]

They perform no empirical analysis of wages but cite a study of the NLSY by Blackburn and Neumark (1993) which concludes that the rise in the return to education is concentrated among the smartest workers. Elsewhere (Cawley et al., 1996b), we test and refine the conclusions of Blackburn and Neumark.

If this, and the assumption of general intelligence, are correct, then the coefficient for "g" in wage regressions should be numerically important and statistically significant. Previous research (Ree and Earles, 1991; Ree, Earles, and Teachout, 1994) has concluded that "g" is "dominant" in explaining job performance. Dominance in this context means that the contribution to R^2 of additional test score components is "small" relative to that of "g." Close examination of this work reveals that the additional components are statistically significant and that "g" explains much less than half of the variance in the outcomes studied (supervisor ratings and success in military occupational training schools).

This section examines the relationship between the ability and wages in our sample. We estimate the following model of wages:

$$W_{it} = \beta a_i + \gamma X_{it} + \tau_t + \varepsilon_{it}$$

$$E(\tau_t \mid a_i, X_{it}) = 0$$

$$E(\varepsilon_{it} \mid a_i, X_{it}) = 0$$

where W_{it} is the log of hourly wages for person i in year t, a_i is measured ability, which may

[4] Herrnstein and Murray, 1994, p. 97.

be a scalar or a vector, X_{it} is a set of "human capital" measures, and τ_t is an intercept term for year t.[5] ε_{it} is the error term for individual i in year t, and Σ_i is the covariance matrix of the error terms across time for individual i. ε_{it} and $\varepsilon_{jt'}$ are statistically independent for all i $\neq$ j. We specify the human capital variables to include schooling (measured as grades completed), schooling squared (to allow for diminishing returns to education), weeks of tenure in the current job, tenure squared, labor market experience (defined by Mincer (1974) as age minus schooling minus 6) and experience squared.

The series of tables labelled "3" contain the coefficient estimates of our wage model using as ability measures our six versions of the ten principal components of the ASVAB test score matrix. Two versions of this table were estimated for each of the six measures: version A uses only the ten principal components as regressors and version B includes education, Mincer experience and Mincer experience squared, job tenure and job tenure squared, controls for the national and local unemployment rates, and a linear time trend. All ability measures are normalized to have a mean of zero and a standard deviation of one. We fit separate regressions for each race-gender group. Using F tests, the statistics from which are reported at the bottom of each table, we decisively reject the null hypothesis that the wage returns to ability are equal across race and gender groups. We reject this hypothesis for all six measures of cognitive ability and both versions of the regression. Especially relevant are Tables 3RA and 3RB, for which the principal components are standardized only by year of birth; these indicate that an

[5]We test our assumption of linear returns to ability using a generalized additive model and super smoother for transforming the regressors. (See Venables and Ripley, p. 250). Given separability of the regression model and the scoring method of ability, the optimal nonlinear transformation of ability with the closest fit to log wages appears to be linear except at the extremes (which applies to few people). An assumption of linear returns to cognitive ability is justified. This finding that the effects of ability are robust to monotonic transformation is useful for studies of value-added measures in education (e.g. teacher salaries with incentives based on students' exam performance). (See Cawley, Heckman and Meyer, 1996).

equal gain in cognitive ability is rewarded in significantly different ways across race and gender in the labor market. In general, females earn a higher return to "g."

Our stacked regression model is motivated by the failure to reject in a joint F-test the null hypothesis that the coefficients are equal across years. Because of the panel nature of the data, the error term is correlated across time for individuals. We correct for this by using Eicker-White standard errors generalized for panel data. Because we restrict analysis to individuals who are out of school and employed, each individual is not necessarily in our sample for all fifteen years; the panel is unbalanced.[6]

The results in Tables 3 support the theory of multiple strata of intelligence, with "g" dominant in explaining social outcomes.[7] In each case, the first principal component, "g", is statistically significant and positive for all race-gender groups.[8] The coefficient of "g" is almost always larger than that of any other principal component, but the gap depends on how much the test scores have been adjusted. The gap is largest for the principal components associated with unadjusted test scores (Table 3QA and Table 3QB) and is smallest for the principal components associated with the most highly-residualized test scores (Table 3OA and Table 3OB), where the

[6]The analysis of this paper focuses on out-of-school workers, because even persons of high cognitive ability are often forced to take low-paying jobs while enrolled. To include such persons in our sample would cause downward bias in ability coefficients. Unemployed workers are also excluded from the sample, since their wage is not observed. .8% of all person-year observations are excluded due to unemployment, and 24.7% are excluded because of school enrollment. This does not affect our estimates as long as the population of interest is employed, out-of-school workers. However, if the population of interest includes the unemployed and students then it is necessary to correct for self-selection into the sample. We use a multinomial probit selection model to correct for this bias using Lee's (1983) generalization of the Heckman two step method, and find that these corrected results are similar to our reported results.

[7]The signs of the coefficients of the second through tenth principal components are irrelevant because each principal component can be reconstructed using the negative of its ASVAB weights to explain an equal amount of ASVAB variance. This reconstructed principal component would have a coefficient of equal magnitude, but opposite sign. The coefficient of the first principal component is meaningful because it has positive weights on all ASVAB subtests; a negative coefficient unequivocally means that less intelligent workers earn more.

[8]Because our sample sizes are large, we use a significance level of 0.01 throughout the paper. It should be noted, however, that the power of significance tests is not equal across demographic groups since the group sizes are unequal. Rather than arbitrarily equalizing the power of our tests, which would lead to equal incidence of type II errors but unequal incidence of Type I error across groups, we present p values in tables to permit readers to draw their own conclusions.

coefficient of the third principal component exceeds that of "g" for hispanic males. On the whole, these results are similar to those found by Ree et al. for job training and job performance; secondary factors are statistically significant but contribute little to the predictive power (R^2) of the model. Because principal components are mutually orthogonal and their variances equal, their marginal contribution to R^2 is proportional to their coefficients in the models with only test scores as regressors. Thus there is meaning attached to the notion that one variable in a regression contributes more than another in regressions which only include the test scores (See Goldberger, 1968).

The results in the Table 3 series conflict with the model of cognitive determinism implicit in Herrnstein and Murray. The highest R^2 from these regressions is .2852, for black females (goodness of fit is higher for women than men in each racial group). Even accounting for measurement error using the estimates of Bound (1993), ability, education, experience, and job tenure account for less than a third of wage variation.

The structure of wage residuals confirms that a single form of cognitive ability is driving wage outcomes. Principal components were estimated for the wage residuals formed from a regression of log wages on the background model (time dummies and human capital measures). The results, in Table 4, indicate that a single principal component is dominant in explaining each group's wage residuals (between 41.9% and 54.1%), which is consistent with the hypothesis of a single omitted ability variable.

The contribution of ability measures to the overall fit of the model is dwarfed by that of other observed characteristics. Tables 5A, 5B, 5C, and 5D provide upper and lower bounds on the contribution of our six ability measures, plus AFQT, to R^2 in log wage regressions. If ability is the only regressor, ability contributes between .068 and .179 to R^2; when human capital measures are controlled for, the marginal R^2 of ability falls to between .034 and .005. There are two important conclusions. First, if there exists some "X factor" that can explain the large residuals common in wage regressions, it is not measured cognitive ability. Second, it makes little difference in terms of predictive power which measure of ability is used; the difference in R^2 between them (controlling for education, experience, and job tenure) is less than .09 for each race-gender group.

3. Ability, Wages, and the Choice of Occupation

There are at least two possible routes through which cognitive ability can affect wages. First, it can influence the choice of occupation. Second, it can affect wages within occupations. The factors of intelligence that drive occupational choice may differ from those which determine wages within occupations. In this section, we explore how "g" determines occupational choice and wages conditional on that choice. For this section, we use only the "g" standardized by race, gender, and age.

We classify all occupations as either white collar or blue collar. White collar workers are those working in sectors described by the U. S. Census as "Professional, Technical, and Kindred Workers," "Non-Farm Managers and Administrators," "Sales Workers," and "Clerical and Unskilled Workers." The last group encompasses only white-collar unskilled workers, such as cashiers, file clerks, bill collectors, and messengers.

We simultaneously estimate choice of occupation and wages conditional on that choice. Following Cameron and Heckman (1992, revised; 1996), we estimate the following version of the Roy model of wages and occupational choice. Individual subscripts are suppressed.

$$\text{Net Gain:} \qquad Y_t = Z_t\beta + (W_{1,t} - W_{0,t})\gamma + \varepsilon_t$$

$$\text{Wage in occupation } \ell\text{:}\ W_{\ell,t} = X_t\phi_\ell + \eta_{\ell,t}, \quad \ell = 0,1$$

$$\varepsilon_t = \alpha f + \nu_t$$

$$\eta_{\ell,t} = \rho_\ell f + u_{\ell,t} \qquad \ell = 0,1$$

$$i_t = 1(Y_t > 0)$$

where 1 is the indicator function that sets $i_t = 1$ if the statement inside the argument is true and is zero otherwise. We assume that $(\varepsilon_t, \eta_{1t}, \eta_{0t})$ are independent across persons and are independent within persons conditional on f. f is assumed to be statistically independent of (ν_t, u_{0t}, u_{1t}). We further assume that

$$E(f) = 0 \qquad E(\nu_t) = 0; \quad E(u_{\ell,t}) = 0, \ E(\eta_{\ell,t}) = 0 \text{ all } \ell,t, \qquad E(f) = 0$$

and we normalize variance of $\nu_t = 1$; and define the variance of $u_{1t} = \sigma_1^2$ while the variance of $u_{0t} = \sigma_0^2$. Y_t is the difference in expected lifetime utility from being in a white collar occupation versus being in a blue collar occupation at date *t*, and $W_{1,t} - W_{0,t}$ is the difference in the potential log wages in the white collar versus blue collar sector at date *t*. In our case, *t*=1,...,15 and the indicator variable i_t equals one if $Y_t > 0$, in which case the individual selects into a white collar occupation at date *t*, and equals zero otherwise. The event $i_t = 1$ thus corresponds to choice of occupation 1 while the event $i_t = 0$ corresponds to choice of occupation 0.

Instead of assuming joint normality of ε_t and $\eta_{0,t}, \eta_{1,t}$, we estimate a nonparametric factor structure model to account for the correlation in an individual wages over time. ρ and α are factor loadings and f is an unobserved factor that does not vary over time; it might be unobserved ability, for example, or motivation. In this model, f is the sole source of dependence between error terms at a point in time and the sole source of dependence for a given error term over time.[9] We do not know the distribution of the unobserved factor *f* but we can consistently estimate the distribution using a discrete approximation (see Heckman and Singer, 1984 and Cameron and Heckman, 1987). In this paper, we find that a discrete approximation ($f = f_1$ or $f = f_2$) fits the data well. We estimate the probability of each value of f, $P(f = f_1) = P_1$, $P(f = f_2) = P_2 = 1 - P_1$ as well as the values of f. The fitted model is thus a binomial discrete factor model. Details on constructing the likelihood are given in Appendix 3. The basic approach goes back to Heckman and Singer (1984) and Cameron and Heckman (1987).

In our model, Z_t contains variables that affect preferences for a white collar or blue collar occupation. These include test scores, years of education, Mincer's measure of potential experience, and indicator variables for the year the observation is recorded and whether the respondent's mother or father had a white collar job. X_t contains the variables that affect wages, which in our model include test scores, years of education, Mincer's measure of potential experience, local and national unemployment rates, and indicator variables for the year and region of residence.

Table 6 contains estimated occupational choice coefficients from a model in which wages and occupational choices are determined simultaneously. The parameters corresponds to the net gain equation. These coefficients represent preferences by the worker for a specific sector of employment. Table 6 indicates that while "g" has a substantial effect on occupational choice, other characteristics are also important. The difference in log wages between the two sectors has a statistically-significant correlation with choice of occupation, as does education. Moreover, "g" is not the only important factor in wages; the second principal component is statistically

[9] Heckman (1981) introduced factor structure models for simple computation of discrete choice and censored data models.

significant for all groups.

Table 7 contains the coefficients in the blue collar wage regression simultaneously estimated with the model for occupational choice; the table indicates that "g" is not dominant in explaining wage differences across blue collar workers. Many other factors besides "g" are statistically significant. For four of the six race-gender groups, the return to a standard deviation of "g" is less than that accorded an extra year of education. For all groups, the wage effects of region of residence can offset the wage effect of an extra standard deviation of "g." For five of the six race/gender groups, the wage effects of local or national unemployment offset the wage gain from an extra standard deviation of "g."

Table 8 contains the coefficients in the white collar wage regression simultaneously estimated with the model for occupational choice. In contrast to the blue collar wage regression, for this group "g" has the largest correlation with wages of any principal component; this means that white collar occupations are more "g" loaded. Fewer ability components are statistically significant than is the case for blue collar wages. Once again, the returns to cognitive ability seem small in relation to that of other variables. The return to a standard deviation of "g" is rivalled by that to two years of education, and can be offset by region of residence and local unemployment rates.

The coefficient on schooling is significantly larger in the white collar sector than the blue collar sector for each race-gender group. This is consistent with the finding of Keane and Wolpin (1994) who use simulation and interpolation to solve a discrete-choice dynamic programming problem of schooling and occupational choice for NLSY males 1979-88, and find that schooling increased white collar skill 7% and blue collar skill 2.4%.

The overall results indicate that the correlations of "g" with occupational choice and wages within sectors are generally statistically significant but modest in magnitude. The effects of a few years of education, the sector of parent's employment, and region of residence combined with the local unemployment rate rival or exceed the coefficient of "g" in magnitude.

4. Conclusion

Our results are consistent with the theory of general intelligence: "g" explains a majority of the variance in test scores and "g" is remarkably similar across race and gender. However, our results conflict with the predictions of Herrnstein and Murray; the correlations of "g" with wages and occupational choice are modest compared to those of education, family background, and region of residence. We also find that the returns to "g" differ significantly across race and gender; payment is not made for "ability" alone. Judged by contribution to R-squared in a regression of wages on ability, education, and work experience, none of our six measures of "g" is preferable to any other. White collar wages are more highly loaded on "g" than are blue collar wages. Ability factors other than "g" are economically useful in both sectors. More than "g" drives occupational choice. In sum, measured cognitive ability is correlated with wages but explains little of the variance in wages across individuals and time, a finding mirrored in Ecclesiastes 9:11:

> ...[T]he race is not to the swift, nor the battle to the strong, neither yet bread to the wise, nor yet riches to men of understanding, nor yet favour to men of skill; but time and chance happeneth to them all.

References

Becker, Gary S., Human Capital, (Chicago: University of Chicago Press) 1975.

Blackburn, McKinley L., and David Neumark, "Omitted-Ability Bias and the Increase in the Return to Schooling," *Journal of Labor Economics*, v. 11(3), 1993, pp. 521-44.

Cameron, Steven V. and James J. Heckman, "The Dynamics of Educational Attainment For Blacks, Whites, and Hispanics," unpublished manuscript, Department of Economics, University of Chicago, 1992, revised 1996.

_____, "Son of CTM: The DCPA Approach Based on Discrete Factor Structure Models", unpublished manuscript, University of Chicago, 1987.

Carroll, John B., Human Cognitive Abilities: A Survey of Factor-Analytic Studies, (Cambridge: Cambridge University Press) 1993.

Cattell, R.B., Intelligence: Its Structure, Growth, and Action, (New York: North-Holland) 1987.

Cawley, John, James Heckman and Robert Meyer, "Log Wages are Linear in Normalized Test Scores: Anchoring The Evaluation of Educational Reforms in Reality", unpublished manuscript, University of Chicago, April, 1996.

Cawley, John, James Heckman, and Edward Vytlacil, "Measuring the Effects of Cognitive Ability on Choice of Occupation," unpublished manuscript, University of Chicago, 1996a.

Cawley, John, James Heckman, and Edward Vytlacil, "Measuring the Effects of Cognitive Ability Over Age and Time: A Nonparametric Approach," unpublished manuscript, University of Chicago, 1996b.

French, John W., "The Relationship of Problem-Solving Styles to the Factor Composition of Tests," *Educational and Psychological Measurement*, v. 25(1), 1965, pp. 9-28.

Goldberger, Arthur, Topics in Regression Analysis, McMillan, New York, 1986.

Gould, Stephen, The Mismeasure of Man, London, W.W. Norton, 1981.

Grogger, Jeff and Eric, Eide, "Changes in College Skills and the Rise in the College Wage Premium", *Journal of Human Resources*, Spring 1995, 280-310.

Heckman, James J., "Lessons From the Bell Curve," *Journal of Political Economy*, October 1995.

_____, "Statistical Models For Discrete Panel Data", in Charles Manski and Daniel McFadden (editors), Structural Analysis of Discrete Data, Cambridge, MIT Press, pp. 114-178.

Heckman, James and Burton Singer, ""A Method for Minimizing the Impact of Distributional Assumption in Econometric Models for Duration Data" (with B. Singer), *Econometrica* (March, 1984), 271-320.

Herrnstein, Richard J. and Charles Murray, The Bell Curve, (New York: Free Press) 1994.

Holland, Paul W. and Paul Rosenbaum, 1986, "Conditional Association and Unidimensionality in Monotone Latent Variable Models," *Annals of Statistics*, v. 14(4), pp. 1523-1543.

Jensen, Arthur R., "The g Beyond Factor Analysis," in Ronning, R.R., J.A. Glover, J.C. Conoley, and J.C. Dewitt (eds.) The Influence of Cognitive Psychology on Testing and Measurement, (Hillsdale, NJ: L. Erlbaum Associates) 1987.

-----, Bias in Mental Testing, (New York: Free Press) 1980.

Keane, and Wolpin, "Career Decisions of Young Men," unpublished manuscript, September 1994.

Mincer, Jacob, Schooling, Experience, and Earnings. (New York: Columbia University Press), 1974.

Murnane, R.J., J.B. Willett, and F. Levy, "The Growing Importance of Cognitive Skills in Wage Determination," *Review of Economics and Statistics*, v. 77(2), 1995, pp. 251-266.

Ree, Malcolm James and James A. Earles, "Predicting Training Success: Not Much More Than *g*," *Personnel Psychology*, v. 44, 1991, pp. 321-32.

Ree, Malcolm James, James A. Earles, and Mark S. Teachout,"Predicting Job Performance: Not Much More Than *g*," *Journal of Applied Psychology*, v. 79(4), 1994, pp. 518-524.

Spearman, Charles, The Abilities of Man: Their Nature and Their Measurement (New York: Macmillan) 1927 [reprinted: New York: AMS Publishers 1981].

Spence, Michael "Job Market Signalling," *Quarterly Journal of Economics*, v. 87, 1973, pp. 355-75.

Suppes, Patrick and Mario Zanotti, "When are Probabilistic Explanations Possible?," *Synthese*, v. 48, 1981, pp. 191-199.

Thurstone, Lous, Multiple Factor Analysis: A Development and Expansion of The Vectors of The Mind, Chicago, University of Chicago Press, 1947.

Venables, W.N. and B.D. Ripley, Modern Applied Statistics With S+, (Springer-Verlag: Berlin), 1994.

Appendix 1: The Armed Services Vocational Aptitude Battery		
Subtest	Minutes	Description
General Science	11	Knowledge measuring the physical and biological sciences.
Arithmetic Reasoning	36	Ability to solve arithmetic word problems.
Word Knowledge	11	Ability to select the correct meaning of words presented in context and to identify the best synonym for a given word.
Paragraph Comprehension	13	Ability to obtain information from written passages.
Numerical Operations	3	Ability to perform arithmetic computations (speeded).
Coding Speed	7	Ability to use a key in assigning code numbers to words (speeded).
Auto and Shop Information	11	Knowledge of automobiles, tools, and shop terminology and practices.
Mathematics Knowledge	24	Knowledge of high school mathematics principles.
Mechanical Comprehension	19	Knowledge of mechanical and physical principles and ability to visualize how illustrated objects work.
Electronics Information	9	Knowledge of electricity and electronics.
ASVAB Testing Time	144	

Appendix 2: Variable Means and Standard Deviations

NLSY code	Variable Description	N	Mean	S.D.
Years of Education:				
R4418500	HIGHEST GRADE COMPLETED (HGC) 93	9002	12.89	2.43
R4007400	HGC AS OF MAY 1 SURVEY YEAR 92	9002	12.85	2.42
R3656900	HGC AS OF MAY 1 SURVEY YEAR 91	8963	12.83	2.41
R3401500	HGC AS OF MAY 1 SURVEY YEAR 90	10358	12.75	2.45
R3074800	HGC AS OF MAY 1 SURVEY YR 89	10536	12.71	2.43
R2871100	HGC AS OF MAY 1 SURVEY YR 88	10382	12.67	2.40
R2445400	HGC AS OF MAY 1 SRVY YR 87	10405	12.63	2.35
R2258000	HIGHEST GRADE COMPLETED AS OF 05/01/86	10589	12.54	2.31
R1890900	HIGHEST GRADE COMPLETED AS OF 05/01/85	10847	12.44	2.23
R1520200	HIGHEST GRADE COMPLETED AS OF 05/01/84	12037	12.32	2.07
R1145000	HIGHEST GRADE COMPLETED AS OF 05/01/83	12158	12.14	1.98
R0898200	HIGHEST GRADE COMPLETED AS OF 05/01/82	12073	11.90	1.91
R0618900	HIGHEST GRADE COMPLETED AS OF 05/01/81	12183	11.54	1.89
R0406400	HIGHEST GRADE COMPLETED AS OF 05/01/80	12139	11.08	1.94
R0216700	HIGHEST GRADE COMPLETED AS OF 05/01/79	12679	10.50	2.05
Cognitive Ability				
R0615000	ASVAB VOC TEST SEC 1-GEN SCIENCE 81	11914	14.36	5.25
R0615100	ASVAB VOC TEST SEC 2-ARITH REASON 81	11914	15.82	7.22
R0615200	ASVAB VOC TEST SEC 3-WORD KNOWLEDGE 81	11914	23.55	8.53
R0615300	ASVAB VOC TEST SEC 4-PARAGRAPH COMP 81	11914	9.94	3.71
R0615400	ASVAB VOC TEST SEC 5-NUMERIC OPERS 81	11914	31.73	11.52
R0615500	ASVAB VOC TEST SEC 6-CODING SPEED 81	11914	42.19	16.76
R0615600	ASVAB VOC TEST SEC 7-AUTO+SHOP INFO 81	11914	12.61	5.55
R0615700	ASVAB VOC TEST SEC 8-MATH KNOWLEDGE 81	11914	12.00	6.17
R0615800	ASVAB VOC TEST SEC 9-MECH COMP 81	11914	12.63	5.30
R0615900	ASVAB VOC TEST SEC 10-ELCTRNIC INFO 81	11914	10.18	4.37
	First Group-Spec Principal Component	11914	-0.05	1.03
	Second Group-Spec Principal Component	11914	-0.02	1.00
	Third Group-Spec Principal Component	11914	0.03	1.00
	Fourth Group-Spec Principal Component	11914	0.01	1.01
	Fifth Group-Spec Principal Component	11914	0.02	0.99
	Sixth Group-Spec Principal Component	11914	0.01	1.00
	Seventh Group-Spec Principal Component	11914	-0.00	1.00
	Eighth Group-Spec Principal Component	11914	0.01	1.00
	Ninth Group-Spec Principal Component	11914	-0.01	1.00
	Tenth Group-Spec Principal Component	11914	-0.02	1.01
Dependent Variable is Log of Following Hourly Wages				
R4416800	HRLY RATE OF PAY CPS JOB (cents) 93	7271	2277.96	72805.86
R3728500	HRLY ROP CURRENT/MOST RECENT JOB 92	7282	1673.05	39570.51
R3523500	HRLY ROP CURRENT/MOST RECENT JOB 91	7351	1437.10	28081.13
R3127800	HRLY ROP CURRENT/M-RCNT JOB 88 90	8649	1619.14	28164.66
R2925010	HRLY ROP CURRENT/MOST RECENT JOB 89	8724	2621.58	68283.59
R2526010	HRLY ROP CURRENT/MOST RECENT JOB 88	8720	1635.43	36955.99
R2318210	HRLY ROP CURRENT/MOST RECENT JOB 87	8636	1535.14	37701.08
R1923410	HRLY ROP CURRENT/MOST RECENT JOB 86	8683	679.58	468.09
R1650810	HRLY ROP CURRENT/MOST RECENT JOB 85	8643	615.86	359.54
R1256010	HRLY ROP CURRENT/MOST RECENT JOB 84	9101	570.10	471.07
R0945610	HRLY ROP CURRENT/MOST RECENT JOB 83	8938	525.25	370.71
R0702510	HRLY ROP CURRENT/MOST RECENT JOB 82	8916	490.06	277.33
R0446810	HRLY ROP CURRENT/MOST RECENT JOB 81	6130	464.86	390.25
R0263710	HRLY ROP CURRENT/MOST RECENT JOB 80	5562	403.26	208.39
R0047010	HRLY ROP CURRENT/MOST RECENT JOB 79	4657	1106.60	48853.24

NLSY code	Variable Description	N	Mean	S.D.
Married, Spouse Present Dummy Variable Constructed Using:				
R4418300	MARITAL STATUS (COLLAPSED) 93	9011	1.90	0.67
R4007200	MARITAL STATUS (COLLAPSED) 92	9016	1.88	0.67
R3656700	MARITAL STATUS (COLLAPSED) 91	9018	1.84	0.67
R3401300	MARITAL STATUS (COLLAPSED) (1990)	10435	1.84	0.68
R3074600	MARITAL STATUS (COLLAPSED) 89	10605	1.80	0.68
R2870900	MARITAL STATUS (COLLAPSED) 88	10461	1.75	0.68
R2445300	MAR STAT (COLLAPSED) 87	10485	1.68	0.68
R2257900	MARITAL STATUS (COLLAPSED) 86	10655	1.60	0.66
R1890800	MARITAL STATUS (COLLAPSED) 85	10893	1.53	0.66
R1520100	MARITAL STATUS (COLLAPSED) 84	12068	1.49	0.64
R1144900	MARITAL STATUS (COLLAPSED) 83	12219	1.42	0.61
R0898400	MARITAL STATUS (COLLAPSED) 82	12119	1.35	0.57
R0618600	MARITAL STATUS (COLLAPSED) 81	12195	1.27	
R0405600	MARITAL STATUS (COLLAPSED) 80	12139	1.20	0.47
R0217500	MARITAL STATUS (COLLAPSED) 79	12684	1.14	0.41
Region of Residence Dummies Constructed Using:				
R4418200	REGION OF RESIDENCE 93	8788	2.63	0.99
R4007100	REGION OF CURRENT RESIDENCE 92	8889	2.64	0.99
R3656600	REGION OF CURRENT RESIDENCE 91	8892	2.63	0.99
R3401200	REGION OF CURRENT RESIDENCE (1990)	10292	2.61	1.00
R3074500	REGION OF CURRENT RESIDENCE 89	10248	2.60	1.00
R2870800	REGION OF CURRENT RESIDENCE 88	10403	2.59	1.00
R2445200	REGION OF CURRENT RESIDENCE 87	10419	2.60	1.01
R2257800	REGION OF C_RES 86	10573	2.59	1.01
R1890700	REGION OF C_RES 85	10809	2.59	1.01
R1520000	REGION OF C_RES 84	11884	2.60	1.02
R1144800	REGION OF C_RES 83	12145	2.59	1.01
R0897910	REGION OF C_RES 82	12048	2.58	1.01
R0602810	REGION OF C_RES 81	12129	2.57	1.01
R0405700	REGION OF C_RES 80	12105	2.56	1.01
R0216400	REGION OF C_RES 79	12447	2.55	1.02
Local Unemployment Rate Dummies Constructed Using:				
R4420300	UNEMPLOYMENT RATE (COLLAPSED) 93	8788	3.02	0.90
R4009200	UNEMPL RATE LAB MAR CURR RES 92	8779	3.19	0.86
R3658700	UNEMPL RATE LAB MAR CURR RES 91	8656	2.97	0.90
R3403300	UNEMPL RATE LAB MAR CURR RES (90)	10047	2.38	0.68
R3076600	UNEMP RATE LAB MAR CURR RES 89	10246	2.36	0.72
R2872900	UNEMP RATE LAB MAR CURR RES 88	9976	2.57	0.87
R2447100	UNEMPMT RATE FOR LABOR MRKT CURR RES 8	9863	2.93	0.90
R2259600	UNEMPLOYMENT RATE L_MKT OF C_RES 86	9480	3.15	0.97
R1892500	UNEMPLOYMENT RATE L_MKT OF C_RES 85	9698	3.23	1.03
R1521800	UNEMPLOYMENT RATE L_MKT OF C_RES 84	10530	3.38	1.12
R1146600	UNEMPLOYMENT RATE L_MKT OF C_RES 83	10696	4.29	1.14
R0898100	UNEMPLOYMENT RATE L_MKT OF C_RES 82	11198	3.84	1.10
R0646800	UNEMPLOYMENT RATE L_MKT OF C_RES 81	11284	3.19	0.96
R0393540	UNEMPL RATE FOR L_MKT OF C_RES 80	11116	2.85	0.81
R0216000	UNEMP RATE FOR L_MKT OF C_RES 79	11310	2.55	0.73
Occupation				
R4182100	TYPE OF OCCUPATION DOING LAST WK 93	7560	471.17	288.99
R3727800	TYPE OF OCCUPATION DOING LAST WK 92	7664	465.27	286.01
R3522800	TYPE OF OCCUPATION DOING LAST WK 91	7627	468.85	286.42
R3127100	TYPE OF OCCUPATION DOING LAST WK 90	8952	474.06	283.96
R2924400	TYPE OF WRK R WAS DOING LAST WE 89	9048	481.46	284.92
R2525400	TYPE OF WRK DOING LAST WK 88	8989	477.46	281.95
R2317600	OCC AT CURRENT JOB/M-RCNT JOB 87	8929	480.80	282.51
R1922800	OCCUPA @MOST RECENT JOB CP86	8990	513.91	284.38
R1650200	OCCUPA @MOST RECENT JOB CP85	9021	528.57	280.36
R1255400	OCCUPA @MOST RECENT JOB CP84	9536	525.59	281.15
R0945000	OCCUPA @MOST RECENT JOB CP83	9418	562.29	277.19
R0702100	OCCUPA @MOST RECENT JOB CP82	9285	569.93	272.62
R0446400	OCCUPA @MOST RECENT JOB CP81	6341	566.92	274.03
R0263400	OCCUPA @MOST RECENT JOB CP80	5750	599.81	263.17
R0046400	OCCUPA @MOST RECENT JOB CP79	5201	628.22	260.47

NLSY code	Variable Description	N	Mean	S.D.
Persons enrolled in school dropped; enrollment determined by:				
R4418600	ENROLLMT STAT MAY 1 SURVEY YR 93	8995	3.52	1.05
R4007500	ENRLMNT STAT MAY 1 SVY YR 92	8998	3.49	1.07
R3657000	ENRLMNT STAT MAY 1 SVY YR 91	8995	3.48	1.08
R3401600	ENRLMNT STAT MAY 1 SVY YR(90)	10405	3.42	1.12
R3074900	ENRLMNT STAT AS OF MAY 1 SURVEY YR 89	10583	3.41	1.13
R2871200	ENRLMNT STAT AS OF MAY 1 SURVEY YR 88	10432	3.40	1.14
R2445500	ENRLMNT STAT AS OF MAY 1 SRVY YR 87	10432	3.38	1.14
R2258100	ENROLLMENT STATUS AS OF 05/01/86	10605	3.32	1.16
R1891000	ENROLLMENT STATUS AS OF 05/01/85	10859	3.28	1.17
R1520300	ENROLLMENT STATUS AS OF 05/01/84	12029	3.26	1.15
R1145100	ENROLLMENT STATUS AS OF 05/01/83	12158	3.19	1.16
R0898300	ENROLLMENT STATUS AS OF 05/01/82	12066	3.02	1.17
R0619000	ENROLLMENT STATUS AS OF 05/01/81	12183	2.85	1.16
R0406500	ENROLLMENT STATUS AS OF 05/01/80	12138	2.68	1.11
R0216600	ENROLLMENT STATUS AS OF 05/01/79	12679	2.52	1.04
Job Tenure (in Weeks):				
R4416300	TOTAL TENURE JOB # 1 93	7471	217.85	207.56
R3947800	TENURE WITH EMPLOYER JOB #1 1992	7558	199.64	194.80
R3597610	TENURE WITH EMPLOYER JOB #1 1991	7554	181.88	179.96
R3332610	TENURE WITH EMPLOYER JOB #1 1990	8871	163.18	167.97
R3005210	TENURE WITH EMPLOYER JOB #1 1989	8989	148.10	153.81
R2763410	TENURE WITH EMPLOYER JOB #1 1988	9010	133.68	141.16
R2372510	TENURE WITH EMPLOYER JOB #1 1987	8893	121.82	126.42
R2165110	TENURE WITH EMPLOYER JOB #1 1986	8920	105.98	112.98
R1803510	TENURE WITH EMPLOYER JOB #1 1985	9013	93.80	100.19
R1456710	TENURE WITH EMPLOYER JOB #1 1984	9561	82.55	86.32
R1081010	TENURE WITH EMPLOYER JOB #1 1983	9447	73.05	73.64
R0833810	TENURE WITH EMPLOYER JOB #1 1982	9397	59.54	61.16
R0539410	TENURE WITH EMPLOYER JOB #1 1981	9130	49.98	50.46
R0333221	TENURE WITH EMPLOYER JOB #1 1980	8475	38.72	39.06
R0068710	TENURE WITH EMPLOYER JOB #1 1979	5119	37.22	33.44
Sampling Weights				
R4417400	SAMPLING WEIGHT 93	12686	264535.01	261589.09
R4006300	SAMPLING WEIGHT 92	12686	264541.07	261080.95
R3655800	SAMPLING WEIGHT 91	12686	264533.07	260223.70
R3400200	SAMPLING WEIGHT 90	12686	264539.23	246378.99
R3073800	SAMPLING WEIGHT 89	12686	264538.24	242892.85
R2870000	SAMPLING WEIGHT 88	12686	264542.99	244899.12
R2444500	SAMPLING WEIGHT 87	12686	264538.74	244881.62
R2257300	SAMPLING WEIGHT 86	12686	264531.78	241040.23
R1890200	SAMPLING WEIGHT 85	12686	264533.18	235427.19
R1519600	SAMPLING WEIGHT 84	12686	264516.11	229106.45
R1144400	SAMPLING WEIGHT 83	12686	264519.30	224058.15
R0896700	SAMPLING WEIGHT 82	12686	264539.59	225545.70
R0614600	SAMPLING WEIGHT 81	12686	264561.86	224855.45
R0405200	SAMPLING WEIGHT 80	12686	264604.33	225487.44
R0216100	SAMPLING WEIGHT 79	12686	264539.71	214475.99
Miscellaneous				
R0001610	LIVED IN SOUTH AT AGE 14	12230	0.36	0.48
R2737900	LIVED W BOTH PARENTS UNTIL 18TH BDAY	10465	0.60	0.49
R0006500	HGC BY R'S MOTHER	11878	10.87	3.17
R0007900	HGC BY R'S FATHER	10880	10.95	3.93
R0214800	SEX OF RESPONDENT	12686	1.50	0.50
R0214700	RACIAL/ETHNIC COHORT /SCREENER	12686	2.43	0.75
R0000500	DATE OF BIRTH - YEAR	12686	60.34	2.25
R0002200	JOB OF FEMALE PARENT @ AGE 14	6189	567.15	297.76
R0002500	JOB OF MALE PARENT @ AGE 14	8812	499.62	251.23

Appendix 3: The Sample Likelihood For The Model of Occupational Choice

We impose the exclusion restriction that region of residence and local and national unemployment rates are included in X_t but not in Z_t. Those variables are assumed to affect wages but not preferences; such exclusion restrictions augmented with additional full support conditions permit nonparameteric identification of the model given the one factor structure. We assume that ν_t and u_t are normally distributed, but allow the distribution of f to be arbitrary, subject to regularity conditions. We find that a two point distribution for f is adequate to fit the data.

The likelihood function is formed assuming independent sampling across persons. Assuming that the support of common factor f is discrete, contribution to likelihood £ of a person is:

$$\textit{Increment to } \pounds = \left[\sum_j g(W_{1,t}|X_t f_j) Pr(i_t=1|X_t,Z_t f_j)P_j\right]^{i_t} \cdot \left[\sum_j g(W_{0,t}|X_t f_j) Pr(i_t=0|X_t,Z_t f_j)P_j\right]^{1-i_t}$$

The conditional density of wages in occupation "0" is:

$$g(W_{0,t}|X_t f_j) = \frac{1}{\sigma_0}\phi\left(\frac{W_{0,t}-X_t\phi_0-\rho_0 f_j}{\sigma_0}\right)$$

The conditional density of wages in occupation "1" is:

$$g(W_{1,t}|X_t f_j) = \frac{1}{\sigma_1}\phi\left(\frac{W_{1,t}-X_t\phi_1-\rho_1 f_j}{\sigma_1}\right)$$

The conditional probability that occupation 1 selected is:

$$Pr(i_t=1|X_t,Z_t f_j) = \Phi\left[\frac{Z_t\beta+X_t\gamma(\phi_1-\phi_0)+f_j(\gamma(\rho_1-\rho_0)+\alpha)}{(\gamma^2(\sigma_0^2+\sigma_1^2)+\sigma_\nu^2)^{1/2}}\right]$$

where $\sigma_v^2 = 1$ and where we denote the standard normal distribution by Φ and the standard normal density by ϕ. We estimate the distribution of f nonparametrically with a finite mixing distribution, estimating P_j and f_j along with the remaining parameters of the model.

Table 1
Construction of "g" by Race and Gender

ASVAB SUBTEST	BLACK FEMALES	BLACK MALES	HISPANIC FEMALES	HISPANIC MALES	WHITE FEMALES	WHITE MALES
General Science	0.351	0.338	0.340	0.336	0.343	0.344
Arithmetic Reasoning	0.325	0.319	0.331	0.325	0.356	0.341
Word Knowledge	0.375	0.352	0.346	0.342	0.354	0.347
Paragraph Comprehension	0.360	0.332	0.339	0.329	0.331	0.331
Numerical Operations	0.311	0.292	0.287	0.287	0.277	0.285
Coding Speed	0.281	0.278	0.274	0.286	0.248	0.270
Auto + Shop Information	0.257	0.302	0.304	0.301	0.272	0.264
Math Knowledge	0.343	0.314	0.319	0.309	0.338	0.324
Mechanical Comprehension	0.243	0.304	0.302	0.316	0.311	0.315
Electronic Information	0.289	0.324	0.312	0.327	0.311	0.328

Table 2
Proportion of Variance in Test Scores Attributable to Principal Components

PRINCIPAL COMPONENT	BLACK FEMALES	BLACK MALES	HISPANIC FEMALES	HISPANIC MALES	WHITE FEMALES	WHITE MALES
First (g)	0.552	0.637	0.650	0.706	0.579	0.639
Second	0.096	0.085	0.079	0.081	0.108	0.114
Third	0.070	0.060	0.054	0.052	0.068	0.059
Fourth	0.063	0.050	0.043	0.037	0.058	0.046
Fifth	0.060	0.035	0.039	0.028	0.043	0.031
Sixth	0.047	0.032	0.036	0.023	0.039	0.030
Seventh	0.033	0.030	0.031	0.021	0.033	0.025
Eighth	0.031	0.028	0.026	0.020	0.031	0.023
Ninth	0.028	0.026	0.024	0.017	0.022	0.017
Tenth	0.019	0.016	0.017	0.014	0.018	0.016

Table 3GA
Cognitive Ability as a Determinant of Wages
ASVAB Std. By Age, Cohort; Principal Components Std by Cohort

Variable	Black Females	Black Males	Hispanic Females	Hispanic Males	White Females	White Males
1st Principal Component	0.1952 (0.0088) p = 0.0000	0.1647 (0.0086) p = 0.0000	0.1823 (0.0117) p = 0.0000	0.1531 (0.0120) p = 0.0000	0.1965 (0.0062) p = 0.0000	0.1535 (0.0058) p = 0.0000
2nd Principal Component	-0.0403 (0.0083) p = 0.0000	0.0225 (0.0085) p = 0.0081	0.0285 (0.0110) p = 0.0095	0.0360 (0.0108) p = 0.0008	0.0660 (0.0054) p = 0.0000	0.0595 (0.0052) p = 0.0000
3rd Principal Component	0.0102 (0.0086) p = 0.2350	-0.0198 (0.0086) p = 0.0221	-0.0451 (0.0107) p = 0.0000	0.0481 (0.0113) p = 0.0000	-0.0389 (0.0052) p = 0.0000	-0.0010 (0.0051) p = 0.8447
4th Principal Component	-0.0308 (0.0082) p = 0.0002	-0.0008 (0.0080) p = 0.9249	-0.0098 (0.0104) p = 0.3444	0.0082 (0.0113) p = 0.4710	0.0072 (0.0057) p = 0.2041	0.0279 (0.0050) p = 0.0000
5th Principal Component	-0.0057 (0.0078) p = 0.4712	0.0144 (0.0075) p = 0.0541	-0.0023 (0.0111) p = 0.8341	0.0181 (0.0112) p = 0.1053	-0.0058 (0.0051) p = 0.2598	0.0328 (0.0051) p = 0.0000
6th Principal Component	-0.0163 (0.0083) p = 0.0484	0.0135 (0.0082) p = 0.0990	-0.0323 (0.0116) p = 0.0053	0.0088 (0.0114) p = 0.4430	-0.0329 (0.0052) p = 0.0000	-0.0036 (0.0050) p = 0.4648
7th Principal Component	-0.0109 (0.0084) p = 0.1918	-0.0080 (0.0079) p = 0.3131	0.0003 (0.0102) p = 0.9728	-0.0009 (0.0117) p = 0.9370	-0.0053 (0.0051) p = 0.2973	-0.0043 (0.0050) p = 0.3841
8th Principal Component	-0.0013 (0.0081) p = 0.8718	-0.0125 (0.0076) p = 0.1013	0.0104 (0.0101) p = 0.3045	0.0082 (0.0115) p = 0.4732	0.0087 (0.0052) p = 0.0937	0.0089 (0.0052) p = 0.0840
9th Principal Component	0.0096 (0.0076) p = 0.2066	0.0163 (0.0084) p = 0.0508	0.0155 (0.0108) p = 0.1507	0.0055 (0.0113) p = 0.6256	-0.0116 (0.0053) p = 0.0296	0.0199 (0.0052) p = 0.0001
10th Principal Component	0.0040 (0.0086) p = 0.6403	0.0016 (0.0079) p = 0.8366	-0.0159 (0.0111) p = 0.1524	0.0246 (0.0122) p = 0.0438	0.0266 (0.0054) p = 0.0000	0.0045 (0.0052) p = 0.3802
R-squared	$R^2 = 0.1416$	$R^2 = 0.1022$	$R^2 = 0.1157$	$R^2 = 0.0934$	$R^2 = 0.1230$	$R^2 = 0.0947$
Number of Observations	10979	12477	7072	8338	26783	27958
F[50, 93591]=19.32						

Sample includes all valid employed out-of-school person-year observations.
OLS regression used with stacked person-year observations.
Dependent variable is the log of the hourly wage reported for each year in 1990 dollars.
Regressions run separately for race-sex groups based on rejection of the hypothesis that coefficients are equal across groups.
Reported standard errors are Eicker-White robust standard errors generalized for panel data.
Background model includes only human capital measures and time dummies.
NLSY sample weights are used.

Table 3GB
Cognitive Ability as a Determinant of Wages
ASVAB Std. By Age, Cohort Principal Components Std by Cohort

Variable	Black Females	Black Males	Hispanic Females	Hispanic Males	White Females	White Males
1st Principal Component	0.1235 (0.0093) p = 0.0000	0.1045 (0.0084) p = 0.0000	0.0904 (0.0140) p = 0.0000	0.1084 (0.0124) p = 0.0000	0.0903 (0.0066) p = 0.0000	0.0828 (0.0066) p = 0.0000
2nd Principal Component	-0.0190 (0.0073) p = 0.0092	0.0005 (0.0076) p = 0.9435	0.0071 (0.0095) p = 0.4542	0.0212 (0.0098) p = 0.0313	0.0403 (0.0048) p = 0.0000	0.0237 (0.0050) p = 0.0000
3rd Principal Component	0.0068 (0.0075) p = 0.3592	-0.0062 (0.0078) p = 0.4210	-0.0358 (0.0093) p = 0.0001	0.0447 (0.0102) p = 0.0000	-0.0095 (0.0047) p = 0.0423	0.0247 (0.0050) p = 0.0000
4th Principal Component	-0.0130 (0.0075) p = 0.0835	0.0025 (0.0072) p = 0.7344	-0.0066 (0.0093) p = 0.4749	0.0119 (0.0107) p = 0.2678	0.0183 (0.0051) p = 0.0003	0.0160 (0.0047) p = 0.0006
5th Principal Component	-0.0064 (0.0070) p = 0.3569	0.0120 (0.0070) p = 0.0878	-0.0039 (0.0094) p = 0.6771	0.0204 (0.0102) p = 0.0451	-0.0036 (0.0044) p = 0.4222	0.0369 (0.0047) p = 0.0000
6th Principal Component	-0.0116 (0.0073) p = 0.1096	0.0105 (0.0073) p = 0.1502	-0.0194 (0.0102) p = 0.0582	0.0091 (0.0103) p = 0.3817	-0.0199 (0.0045) p = 0.0000	0.0030 (0.0046) p = 0.5069
7th Principal Component	-0.0107 (0.0070) p = 0.1233	-0.0081 (0.0072) p = 0.2631	0.0053 (0.0091) p = 0.5599	0.0069 (0.0105) p = 0.5134	0.0067 (0.0045) p = 0.1334	-0.0028 (0.0045) p = 0.5338
8th Principal Component	-0.0023 (0.0071) p = 0.7399	0.0006 (0.0070) p = 0.9322	0.0110 (0.0090) p = 0.2208	0.0068 (0.0102) p = 0.5091	0.0055 (0.0046) p = 0.2313	0.0092 (0.0048) p = 0.0543
9th Principal Component	0.0010 (0.0068) p = 0.8769	0.0105 (0.0071) p = 0.1411	0.0065 (0.0097) p = 0.5023	0.0062 (0.0104) p = 0.5508	-0.0122 (0.0047) p = 0.0090	0.0053 (0.0048) p = 0.2683
10th Principal Component	-0.0032 (0.0073) p = 0.6558	0.0047 (0.0072) p = 0.5177	-0.0087 (0.0101) p = 0.3863	0.0229 (0.0112) p = 0.0407	0.0064 (0.0047) p = 0.1749	0.0017 (0.0047) p = 0.7196
Grades Completed	0.0721 (0.0058) p = 0.0000	0.0625 (0.0048) p = 0.0000	0.0463 (0.0066) p = 0.0000	0.0561 (0.0062) p = 0.0000	0.0772 (0.0033) p = 0.0000	0.0716 (0.0032) p = 0.0000
Potential Experience	0.0370 (0.0047) p = 0.0000	0.0450 (0.0048) p = 0.0000	0.0219 (0.0054) p = 0.0000	0.0754 (0.0081) p = 0.0000	0.0312 (0.0030) p = 0.0000	0.0678 (0.0028) p = 0.0000
$(\text{Potential Experience})^2$	-0.0010 (0.0002) p = 0.0001	-0.0015 (0.0002) p = 0.0000	-0.0008 (0.0003) p = 0.0009	-0.0019 (0.0004) p = 0.0000	-0.0012 (0.0002) p = 0.0000	-0.0020 (0.0001) p = 0.0000
Job Tenure	0.0019 (0.0001) p = 0.0000	0.0015 (0.0001) p = 0.0000	0.0017 (0.0001) p = 0.0000	0.0014 (0.0001) p = 0.0000	0.0017 (0.0001) p = 0.0000	0.0013 (0.0001) p = 0.0000
$(\text{Job Tenure})^2$	-0.0000 (0.0000) p = 0.0000	-0.0000 (0.0000) p = 0.0000	-0.0000 (0.0000) p = 0.0000	-0.0000 (0.0000) p = 0.0000	-0.0000 (0.0000) p = 0.0000	-0.0000 (0.0000) p = 0.0000
National Unemployment Rate	-0.0011 (0.0016) p = 0.4815	-0.0006 (0.0016) p = 0.7207	-0.0044 (0.0022) p = 0.0443	-0.0014 (0.0020) p = 0.4823	-0.0042 (0.0010) p = 0.0000	-0.0030 (0.0009) p = 0.0008
Local Unemployment Rate<6%	0.0605 (0.0102) p = 0.0000	0.0643 (0.0093) p = 0.0000	0.0570 (0.0167) p = 0.0006	0.0849 (0.0158) p = 0.0000	0.0917 (0.0070) p = 0.0000	0.0674 (0.0063) p = 0.0000
Local Unemployment Rate>=9%	-0.0454 (0.0135) p = 0.0008	-0.0313 (0.0130) p = 0.0160	-0.0906 (0.0183) p = 0.0000	-0.1123 (0.0176) p = 0.0000	-0.0609 (0.0077) p = 0.0000	-0.0903 (0.0081) p = 0.0000
Linear Time	-0.0125 (0.0010) p = 0.0000	-0.0117 (0.0008) p = 0.0000	0.0038 (0.0010) p = 0.0002	-0.0215 (0.0010) p = 0.0000	-0.0004 (0.0006) p = 0.4689	-0.0150 (0.0005) p = 0.0000
R-squared	$R^2 = 0.2851$	$R^2 = 0.2210$	$R^2 = 0.2355$	$R^2 = 0.2304$	$R^2 = 0.2667$	$R^2 = 0.2409$
Number of Observations	10802	12298	6923	8216	26462	27552
F[95, 92228]=9.28						

Sample includes all valid employed out-of-school person-year observations.
OLS regression used with stacked person-year observations.
Dependent variable is the log of the hourly wage reported for each year in 1990 dollars.
Regressions run separately for race-sex groups based on rejection of the hypothesis that coefficients are equal across groups.
Reported standard errors are Bicker-White robust standard errors generalized for panel data.
Background model includes only human capital measures and time dummies.
NLSY sample weights are used.

Table 3NA
Cognitive Ability as a Determinant of Wages
ASVAB Residualized on Age by Cohort, Std. by Cohort

Variable	Black Females	Black Males	Hispanic Females	Hispanic Males	White Females	White Males
1st Principal Component	0.1951 (0.0000) p = 0.0000	0.1643 (0.0000) p = 0.0000	0.1899 (0.0000) p = 0.0000	0.1505 (0.0000) p = 0.0000	0.1968 (0.0000) p = 0.0000	0.1543 (0.0000) p = 0.0000
2nd Principal Component	-0.0397 (0.0000) p = 0.0000	0.0230 (0.0000) p = 0.0000	0.0261 (0.0000) p = 0.0000	0.0366 (0.0000) p = 0.0000	0.0666 (0.0000) p = 0.0000	0.0593 (0.0000) p = 0.0000
3rd Principal Component	0.0123 (0.0000) p = 0.0000	-0.0218 (0.0000) p = 0.0000	-0.0483 (0.0000) p = 0.0000	0.0479 (0.0000) p = 0.0000	-0.0393 (0.0000) p = 0.0000	-0.0024 (0.0000) p = 0.0000
4th Principal Component	-0.0304 (0.0000) p = 0.0000	0.0002 (0.0000) p = 0.0000	-0.0118 (0.0000) p = 0.0000	0.0102 (0.0000) p = 0.0000	0.0067 (0.0000) p = 0.0000	0.0262 (0.0000) p = 0.0000
5th Principal Component	-0.0073 (0.0000) p = 0.0000	-0.0134 (0.0000) p = 0.0000	-0.0212 (0.0000) p = 0.0000	0.0150 (0.0000) p = 0.0000	-0.0064 (0.0000) p = 0.0000	0.0309 (0.0000) p = 0.0000
6th Principal Component	-0.0167 (0.0000) p = 0.0000	0.0135 (0.0000) p = 0.0000	-0.0260 (0.0000) p = 0.0000	0.0050 (0.0000) p = 0.0000	-0.0335 (0.0000) p = 0.0000	-0.0091 (0.0000) p = 0.0000
7th Principal Component	-0.0103 (0.0000) p = 0.0000	-0.0076 (0.0000) p = 0.0000	0.0009 (0.0000) p = 0.0000	0.0001 (0.0000) p = 0.0000	-0.0056 (0.0000) p = 0.0000	-0.0035 (0.0000) p = 0.0000
8th Principal Component	0.0018 (0.0000) p = 0.0000	-0.0124 (0.0000) p = 0.0000	0.0090 (0.0000) p = 0.0000	0.0143 (0.0000) p = 0.0000	0.0083 (0.0000) p = 0.0000	0.0071 (0.0000) p = 0.0000
9th Principal Component	0.0104 (0.0000) p = 0.0000	0.0150 (0.0000) p = 0.0000	0.0118 (0.0000) p = 0.0000	0.0035 (0.0000) p = 0.0000	-0.0111 (0.0000) p = 0.0000	0.0187 (0.0000) p = 0.0000
10th Principal Component	0.0024 (0.0000) p = 0.0000	0.0005 (0.0000) p = 0.0000	-0.0180 (0.0000) p = 0.0000	0.0225 (0.0000) p = 0.0000	0.0273 (0.0000) p = 0.0000	0.0051 (0.0000) p = 0.0000
R-squared	$R^2 = 0.1430$	$R^2 = 0.1035$	$R^2 = 0.1236$	$R^2 = 0.0926$	$R^2 = 0.1236$	$R^2 = 0.0947$
Number of Observations	10979	12477	7072	8338	26783	27958
F[50, 93591]=18.87						

Sample includes all valid employed out-of-school person-year observations.
OLS regression used with stacked person-year observations.
Dependent variable is the log of the hourly wage reported for each year in 1990 dollars.
Regressions run separately for race-sex groups based on rejection of the hypothesis that coefficients are equal across groups.
Reported standard errors are Eicker-White robust standard errors generalized for panel data.
Background model includes only human capital measures and time dummies.
NLSY sample weights are used.

Table 3NB
Cognitive Ability as a Determinant of Wages
ASVAB Residualized on Age, by Cohort; Std. by Cohort

Variable	Black Females	Black Males	Hispanic Females	Hispanic Males	White Females	White Males
1st Principal Component	0.1233 (0.0093) p = 0.0000	0.1056 (0.0083) p = 0.0000	0.0995 (0.0145) p = 0.0000	0.1038 (0.0122) p = 0.0000	0.0911 (0.0066) p = 0.0000	0.0839 (0.0067) p = 0.0000
2nd Principal Component	-0.0187 (0.0073) p = 0.0101	0.0009 (0.0075) p = 0.9024	0.0065 (0.0094) p = 0.4912	0.0210 (0.0098) p = 0.0328	0.0410 (0.0048) p = 0.0000	0.0233 (0.0050) p = 0.0000
3rd Principal Component	0.0085 (0.0074) p = 0.2500	-0.0081 (0.0077) p = 0.2898	-0.0383 (0.0096) p = 0.0001	0.0447 (0.0105) p = 0.0000	-0.0089 (0.0047) p = 0.0569	0.0239 (0.0050) p = 0.0000
4th Principal Component	-0.0123 (0.0075) p = 0.1027	0.0033 (0.0072) p = 0.6441	-0.0086 (0.0095) p = 0.3630	0.0131 (0.0106) p = 0.2187	0.0172 (0.0051) p = 0.0007	0.0152 (0.0046) p = 0.0011
5th Principal Component	-0.0077 (0.0069) p = 0.2629	-0.0134 (0.0071) p = 0.0583	-0.0144 (0.0089) p = 0.1079	0.0179 (0.0102) p = 0.0795	-0.0044 (0.0044) p = 0.3274	0.0364 (0.0047) p = 0.0000
6th Principal Component	-0.0117 (0.0073) p = 0.1076	0.0099 (0.0073) p = 0.1743	-0.0149 (0.0104) p = 0.1521	0.0039 (0.0104) p = 0.7056	-0.0203 (0.0046) p = 0.0000	-0.0032 (0.0046) p = 0.4800
7th Principal Component	-0.0105 (0.0072) p = 0.1432	-0.0081 (0.0071) p = 0.2533	0.0063 (0.0091) p = 0.4831	0.0078 (0.0106) p = 0.4606	0.0066 (0.0045) p = 0.1406	-0.0020 (0.0045) p = 0.6495
8th Principal Component	0.0010 (0.0070) p = 0.8840	0.0005 (0.0071) p = 0.9394	0.0112 (0.0090) p = 0.2166	0.0123 (0.0100) p = 0.2210	0.0051 (0.0046) p = 0.2659	0.0085 (0.0048) p = 0.0752
9th Principal Component	0.0026 (0.0068) p = 0.7040	0.0100 (0.0072) p = 0.1637	0.0056 (0.0097) p = 0.5647	0.0037 (0.0104) p = 0.7205	-0.0122 (0.0047) p = 0.0090	0.0050 (0.0047) p = 0.2944
10th Principal Component	-0.0045 (0.0073) p = 0.5419	0.0049 (0.0072) p = 0.4966	-0.0101 (0.0100) p = 0.3145	0.0208 (0.0114) p = 0.0677	0.0075 (0.0047) p = 0.1136	0.0018 (0.0047) p = 0.7062
Grades Completed	0.0715 (0.0059) p = 0.0000	0.0621 (0.0048) p = 0.0000	0.0430 (0.0067) p = 0.0000	0.0564 (0.0061) p = 0.0000	0.0769 (0.0032) p = 0.0000	0.0715 (0.0032) p = 0.0000
Potential Experience	0.0363 (0.0047) p = 0.0000	0.0445 (0.0048) p = 0.0000	0.0216 (0.0054) p = 0.0001	0.0731 (0.0081) p = 0.0000	0.0308 (0.0030) p = 0.0000	0.0679 (0.0028) p = 0.0000
$(\text{Potential Experience})^2$	-0.0009 (0.0002) p = 0.0001	-0.0015 (0.0002) p = 0.0000	-0.0008 (0.0003) p = 0.0010	-0.0018 (0.0004) p = 0.0001	-0.0012 (0.0002) p = 0.0000	-0.0020 (0.0001) p = 0.0000
Job Tenure	0.0019 (0.0001) p = 0.0000	0.0015 (0.0001) p = 0.0000	0.0017 (0.0001) p = 0.0000	0.0014 (0.0001) p = 0.0000	0.0017 (0.0001) p = 0.0000	0.0013 (0.0001) p = 0.0000
$(\text{Job Tenure})^2$	-0.0000 (0.0000) p = 0.0000	-0.0000 (0.0000) p = 0.0000	-0.0000 (0.0000) p = 0.0000	-0.0000 (0.0000) p = 0.0000	-0.0000 (0.0000) p = 0.0000	-0.0000 (0.0000) p = 0.0000
National Unemployment Rate	-0.0010 (0.0016) p = 0.5181	-0.0005 (0.0016) p = 0.7518	-0.0044 (0.0022) p = 0.0451	-0.0013 (0.0020) p = 0.5215	-0.0041 (0.0010) p = 0.0000	-0.0029 (0.0009) p = 0.0010
Local Unemployment Rate<6%	0.0609 (0.0102) p = 0.0000	0.0643 (0.0093) p = 0.0000	0.0571 (0.0167) p = 0.0006	0.0843 (0.0159) p = 0.0000	0.0918 (0.0070) p = 0.0000	0.0676 (0.0063) p = 0.0000
Local Unemployment Rate>=9%	-0.0449 (0.0135) p = 0.0009	-0.0313 (0.0129) p = 0.0157	-0.0893 (0.0183) p = 0.0000	-0.1125 (0.0176) p = 0.0000	-0.0608 (0.0077) p = 0.0000	-0.0899 (0.0081) p = 0.0000
Linear Time	-0.0123 (0.0010) p = 0.0000	-0.0117 (0.0008) p = 0.0000	0.0044 (0.0010) p = 0.0000	-0.0208 (0.0010) p = 0.0000	-0.0003 (0.0006) p = 0.5655	-0.0151 (0.0005) p = 0.0000
R-squared	$R^2 = 0.2852$	$R^2 = 0.2223$	$R^2 = 0.2379$	$R^2 = 0.2286$	$R^2 = 0.2669$	$R^2 = 0.2408$
Number of Observations	10802	12298	6923	8216	26462	27552
F[95, 92228]=9.41						

Sample includes all valid employed out-of-school person-year observations.
OLS regression used with stacked person-year observations.
Dependent variable is the log of the hourly wage reported for each year in 1990 dollars.
Regressions run separately for race-sex groups based on rejection of the hypothesis that coefficients are equal across groups.
Reported standard errors are Eicker-White robust standard errors generalized for panel data.
Background model includes only human capital measures and time dummies.
NLSY sample weighus are used.

Table 30A
Cognitive Ability as a Determinant of Wages
ASVAB Resid. on Age, Education, and Parents HGC by Cohort, Std. by Cohort

Variable	Black Females	Black Males	Hispanic Females	Hispanic Males	White Females	White Males
1st Principal Component	0.1228 (0.0107)	0.1045 (0.0109)	0.1088 (0.0153)	0.0521 (0.0128)	0.0865 (0.0066)	0.0739 (0.0068)
	p = 0.0000	p = 0.0000	p = 0.0000	p = 0.0000	p = 0.0000	p = 0.0000
2nd Principal Component	0.0228 (0.0100)	0.0034 (0.0113)	0.0208 (0.0125)	0.0427 (0.0131)	0.0507 (0.0061)	0.0541 (0.0056)
	p = 0.0232	p = 0.7669	p = 0.0971	p = 0.0011	p = 0.0000	p = 0.0000
3rd Principal Component	0.0225 (0.0106)	-0.0260 (0.0115)	-0.0430 (0.0133)	0.0487 (0.0144)	-0.0532 (0.0064)	-0.0062 (0.0059)
	p = 0.0337	p = 0.0239	p = 0.0013	p = 0.0007	p = 0.0000	p = 0.3004
4th Principal Component	-0.0295 (0.0106)	0.0129 (0.0102)	-0.0304 (0.0132)	0.0219 (0.0139)	0.0006 (0.0062)	0.0306 (0.0057)
	p = 0.0054	p = 0.2052	p = 0.0208	p = 0.1141	p = 0.9232	p = 0.0000
5th Principal Component	-0.0115 (0.0093)	-0.0212 (0.0102)	-0.0145 (0.0130)	0.0197 (0.0139)	-0.0136 (0.0057)	-0.0201 (0.0058)
	p = 0.2181	p = 0.0376	p = 0.2662	p = 0.1569	p = 0.0163	p = 0.0005
6th Principal Component	0.0010 (0.0097)	-0.0057 (0.0100)	0.0176 (0.0138)	0.0002 (0.0147)	-0.0283 (0.0061)	0.0190 (0.0057)
	p = 0.9203	p = 0.5666	p = 0.2029	p = 0.9892	p = 0.0000	p = 0.0008
7th Principal Component	-0.0043 (0.0105)	0.0049 (0.0091)	-0.0005 (0.0125)	0.0073 (0.0144)	-0.0006 (0.0060)	-0.0102 (0.0058)
	p = 0.6833	p = 0.5926	p = 0.9680	p = 0.6134	p = 0.9226	p = 0.0766
8th Principal Component	-0.0071 (0.0109)	-0.0056 (0.0098)	0.0034 (0.0123)	0.0020 (0.0146)	0.0131 (0.0060)	0.0122 (0.0058)
	p = 0.5171	p = 0.5642	p = 0.7803	p = 0.8919	p = 0.0285	p = 0.0351
9th Principal Component	0.0103 (0.0094)	0.0117 (0.0114)	0.0101 (0.0133)	0.0173 (0.0146)	-0.0045 (0.0061)	0.0158 (0.0061)
	p = 0.2735	p = 0.3064	p = 0.4455	p = 0.2356	p = 0.4672	p = 0.0092
10th Principal Component	0.0021 (0.0105)	0.0089 (0.0099)	-0.0139 (0.0131)	-0.0412 (0.0137)	0.0168 (0.0061)	0.0069 (0.0059)
	p = 0.8409	p = 0.3670	p = 0.2877	p = 0.0027	p = 0.0060	p = 0.2404
R-squared	$R^2 = 0.0633$	$R^2 = 0.0454$	$R^2 = 0.0467$	$R^2 = 0.0334$	$R^2 = 0.0434$	$R^2 = 0.0360$
Number of Observations	8068	8685	5669	6342	23994	24884
F[50, 93591]=12.06						

Sample includes all valid employed out-of-school person-year observations.
OLS regression used with stacked person-year observations.
Dependent variable is the log of the hourly wage reported for each year in 1990 dollars.
Regressions run separately for race-sex groups based on rejection of the hypothesis that coefficients are equal across groups.
Reported standard errors are Eicker-White robust standard errors generalized for panel data.
Background model includes only human capital measures and time dummies.
NLSY sample weights are used.

Table 3OB
Cognitive Ability as a Determinant of Wages
ASVAB Resid. on Age, Education, and Parents HGC by Cohort; Std. by Cohort

Variable	Black Females	Black Males	Hispanic Females	Hispanic Males	White Females	White Males
1st Principal Component	0.0875 (0.0084) p = 0.0000	0.0840 (0.0088) p = 0.0000	0.0734 (0.0122) p = 0.0000	0.0364 (0.0109) p = 0.0008	0.0510 (0.0054) p = 0.0000	0.0553 (0.0058) p = 0.0000
2nd Principal Component	0.0130 (0.0082) p = 0.1150	-0.0038 (0.0091) p = 0.6786	0.0182 (0.0101) p = 0.0726	0.0217 (0.0114) p = 0.0556	0.0414 (0.0050) p = 0.0000	0.0227 (0.0050) p = 0.0000
3rd Principal Component	0.0119 (0.0084) p = 0.1545	-0.0072 (0.0093) p = 0.4415	-0.0288 (0.0107) p = 0.0068	0.0467 (0.0123) p = 0.0001	-0.0196 (0.0051) p = 0.0001	0.0247 (0.0052) p = 0.0000
4th Principal Component	-0.0069 (0.0090) p = 0.4481	0.0178 (0.0088) p = 0.0420	-0.0242 (0.0107) p = 0.0243	0.0254 (0.0131) p = 0.0525	0.0141 (0.0052) p = 0.0067	0.0205 (0.0049) p = 0.0000
5th Principal Component	-0.0074 (0.0078) p = 0.3394	-0.0176 (0.0088) p = 0.0456	-0.0105 (0.0103) p = 0.3083	0.0200 (0.0121) p = 0.0978	-0.0030 (0.0045) p = 0.5098	-0.0243 (0.0051) p = 0.0000
6th Principal Component	-0.0052 (0.0079) p = 0.5063	-0.0116 (0.0082) p = 0.1567	0.0121 (0.0112) p = 0.2808	-0.0005 (0.0121) p = 0.9639	-0.0196 (0.0049) p = 0.0001	0.0246 (0.0048) p = 0.0000
7th Principal Component	-0.0037 (0.0082) p = 0.6563	0.0033 (0.0082) p = 0.6866	0.0091 (0.0099) p = 0.3570	0.0011 (0.0120) p = 0.9293	0.0077 (0.0048) p = 0.1124	-0.0034 (0.0048) p = 0.4862
8th Principal Component	-0.0038 (0.0087) p = 0.6641	0.0103 (0.0085) p = 0.2239	0.0029 (0.0102) p = 0.7802	0.0077 (0.0124) p = 0.5363	0.0035 (0.0048) p = 0.4752	0.0165 (0.0049) p = 0.0008
9th Principal Component	-0.0007 (0.0079) p = 0.9339	0.0090 (0.0089) p = 0.3140	0.0004 (0.0108) p = 0.9688	0.0209 (0.0130) p = 0.1074	-0.0102 (0.0049) p = 0.0351	0.0066 (0.0050) p = 0.1832
10th Principal Component	-0.0026 (0.0082) p = 0.7545	0.0065 (0.0082) p = 0.4266	-0.0019 (0.0107) p = 0.8607	-0.0364 (0.0123) p = 0.0030	0.0063 (0.0049) p = 0.1923	0.0013 (0.0050) p = 0.7997
Grades Completed	0.0924 (0.0054) p = 0.0000	0.0879 (0.0052) p = 0.0000	0.0700 (0.0060) p = 0.0000	0.0809 (0.0060) p = 0.0000	0.0946 (0.0030) p = 0.0000	0.0876 (0.0027) p = 0.0000
Potential Experience	0.0352 (0.0056) p = 0.0000	0.0436 (0.0058) p = 0.0000	0.0282 (0.0065) p = 0.0000	0.0685 (0.0074) p = 0.0000	0.0294 (0.0030) p = 0.0000	0.0683 (0.0029) p = 0.0000
(Potential Experience)^2	-0.0012 (0.0003) p = 0.0001	-0.0016 (0.0003) p = 0.0000	-0.0012 (0.0003) p = 0.0004	-0.0014 (0.0004) p = 0.0005	-0.0014 (0.0002) p = 0.0000	-0.0022 (0.0001) p = 0.0000
Job Tenure	0.0019 (0.0001) p = 0.0000	0.0014 (0.0001) p = 0.0000	0.0017 (0.0001) p = 0.0000	0.0014 (0.0001) p = 0.0000	0.0017 (0.0001) p = 0.0000	0.0013 (0.0001) p = 0.0000
(Job Tenure)^2	-0.0000 (0.0000) p = 0.0000	-0.0000 (0.0000) p = 0.0000	-0.0000 (0.0000) p = 0.0000	-0.0000 (0.0000) p = 0.0000	-0.0000 (0.0000) p = 0.0000	-0.0000 (0.0000) p = 0.0000
National Unemployment Rate	-0.0029 (0.0018) p = 0.1178	0.0006 (0.0018) p = 0.7379	-0.0045 (0.0024) p = 0.0644	0.0009 (0.0023) p = 0.6873	-0.0045 (0.0010) p = 0.0000	-0.0033 (0.0009) p = 0.0004
Local Unemployment Rate<6%	0.0633 (0.0116) p = 0.0000	0.0546 (0.0111) p = 0.0000	0.0419 (0.0190) p = 0.0277	0.0930 (0.0174) p = 0.0000	0.0967 (0.0073) p = 0.0000	0.0687 (0.0067) p = 0.0000
Local Unemployment Rate>=9%	-0.0368 (0.0158) p = 0.0201	-0.0241 (0.0152) p = 0.1142	-0.0895 (0.0203) p = 0.0000	-0.1077 (0.0210) p = 0.0000	-0.0591 (0.0081) p = 0.0000	-0.0943 (0.0087) p = 0.0000
Linear Time	-0.0096 (0.0010) p = 0.0000	-0.0099 (0.0009) p = 0.0000	0.0016 (0.0010) p = 0.0919	-0.0224 (0.0010) p = 0.0000	0.0029 (0.0005) p = 0.0000	-0.0134 (0.0005) p = 0.0000
R-squared	$R^2 = 0.2776$	$R^2 = 0.2313$	$R^2 = 0.2395$	$R^2 = 0.2131$	$R^2 = 0.2655$	$R^2 = 0.2362$
Number of Observations	7937	8565	5549	6253	23702	24540
F[95, 76521]=6.45						

Sample includes all valid employed out-of-school person-year observations.
OLS regression used with stacked person-year observations.
Dependent variable is the log of the hourly wage reported for each year in 1990 dollars.
Regressions run separately for race-sex groups based on rejection of the hypothesis that coefficients are equal across groups.
Reported standard errors are Eicker-White robust standard errors generalized for panel data.
Background model includes only human capital measures and time dummies.
NLSY sample weights are used.

Table 3PA
Cognitive Ability as a Determinant of Wages
ASVAB Residualized on Age and Education by Cohort, Std. by Cohort

Variable	Black Females	Black Males	Hispanic Females	Hispanic Males	White Females	White Males
1st Principal Component	0.1337 (0.0100) p = 0.0000	0.1022 (0.0089) p = 0.0000	0.1146 (0.0131) p = 0.0000	0.0805 (0.0111) p = 0.0000	0.1103 (0.0065) p = 0.0000	0.0888 (0.0063) p = 0.0000
2nd Principal Component	0.0226 (0.0089) p = 0.0106	0.0081 (0.0091) p = 0.3706	0.0135 (0.0117) p = 0.2478	0.0379 (0.0116) p = 0.0010	0.0496 (0.0057) p = 0.0000	0.0565 (0.0053) p = 0.0000
3rd Principal Component	0.0249 (0.0097) p = 0.0101	-0.0223 (0.0095) p = 0.0187	-0.0483 (0.0118) p = 0.0000	0.0443 (0.0126) p = 0.0004	-0.0523 (0.0059) p = 0.0000	-0.0094 (0.0056) p = 0.0912
4th Principal Component	-0.0317 (0.0094) p = 0.0007	0.0014 (0.0085) p = 0.8693	-0.0126 (0.0115) p = 0.2707	0.0106 (0.0121) p = 0.3832	-0.0041 (0.0059) p = 0.4894	0.0279 (0.0053) p = 0.0000
5th Principal Component	-0.0087 (0.0084) p = 0.2984	-0.0155 (0.0081) p = 0.0565	-0.0194 (0.0118) p = 0.1004	0.0190 (0.0122) p = 0.1195	0.0079 (0.0054) p = 0.1437	0.0285 (0.0054) p = 0.0000
6th Principal Component	-0.0065 (0.0088) p = 0.4628	0.0133 (0.0087) p = 0.1265	0.0193 (0.0126) p = 0.1264	-0.0011 (0.0129) p = 0.9337	-0.0274 (0.0058) p = 0.0000	-0.0016 (0.0054) p = 0.7646
7th Principal Component	-0.0065 (0.0089) p = 0.4627	-0.0023 (0.0082) p = 0.7797	0.0008 (0.0116) p = 0.9460	-0.0031 (0.0128) p = 0.8058	-0.0048 (0.0056) p = 0.3971	-0.0051 (0.0054) p = 0.3479
8th Principal Component	0.0047 (0.0091) p = 0.6028	-0.0093 (0.0081) p = 0.2518	0.0057 (0.0112) p = 0.6091	0.0120 (0.0126) p = 0.3414	0.0126 (0.0057) p = 0.0269	0.0102 (0.0055) p = 0.0650
9th Principal Component	0.0110 (0.0082) p = 0.1799	0.0086 (0.0092) p = 0.3482	0.0141 (0.0116) p = 0.2262	0.0037 (0.0124) p = 0.7649	-0.0096 (0.0058) p = 0.0976	0.0147 (0.0056) p = 0.0092
10th Principal Component	0.0006 (0.0094) p = 0.9516	0.0024 (0.0085) p = 0.7752	-0.0152 (0.0120) p = 0.2066	-0.0276 (0.0131) p = 0.0348	0.0162 (0.0058) p = 0.0049	-0.0027 (0.0056) p = 0.6255
R-squared	$R^2 = 0.0711$	$R^2 = 0.0413$	$R^2 = 0.0518$	$R^2 = 0.0384$	$R^2 = 0.0543$	$R^2 = 0.0435$
Number of Observations	10902	12389	6981	8189	26569	27617
F[50, 93591]=13.96						

Sample includes all valid employed out-of-school person-year observations.
OLS regression used with stacked person-year observations.
Dependent variable is the log of the hourly wage reported for each year in 1990 dollars.
Regressions run separately for race-sex groups based on rejection of the hypothesis that coefficients are equal across groups.
Reported standard errors are Eicker-White robust standard errors generalized for panel data.
Background model includes only human capital measures and time dummies.
NLSY sample weights are used.

Table 3PB
Cognitive Ability as a Determinant of Wages
ASVAB Residualized on Age and Education, by Cohort; Std. by Cohort

Variable	Black Females	Black Males	Hispanic Females	Hispanic Males	White Females	White Males
1st Principal Component	0.0954 (0.0082)	0.0818 (0.0071)	0.0775 (0.0105)	0.0620 (0.0093)	0.0674 (0.0053)	0.0636 (0.0056)
	p = 0.0000	p = 0.0000	p = 0.0000	p = 0.0000	p = 0.0000	p = 0.0000
2nd Principal Component	0.0170 (0.0073)	-0.0005 (0.0075)	0.0105 (0.0095)	0.0206 (0.0099)	0.0424 (0.0048)	0.0249 (0.0047)
	p = 0.0201	p = 0.9519	p = 0.2720	p = 0.0362	p = 0.0000	p = 0.0000
3rd Principal Component	0.0098 (0.0077)	-0.0063 (0.0078)	-0.0321 (0.0096)	0.0446 (0.0106)	-0.0176 (0.0048)	0.0223 (0.0049)
	p = 0.2041	p = 0.4165	p = 0.0008	p = 0.0000	p = 0.0002	p = 0.0000
4th Principal Component	-0.0072 (0.0079)	0.0046 (0.0073)	-0.0130 (0.0094)	0.0134 (0.0110)	0.0093 (0.0049)	0.0198 (0.0046)
	p = 0.3617	p = 0.5288	p = 0.1679	p = 0.2248	p = 0.0597	p = 0.0000
5th Principal Component	-0.0119 (0.0069)	-0.0155 (0.0071)	-0.0143 (0.0092)	0.0204 (0.0104)	-0.0009 (0.0044)	0.0369 (0.0047)
	p = 0.0851	p = 0.0303	p = 0.1211	p = 0.0495	p = 0.8387	p = 0.0000
6th Principal Component	-0.0110 (0.0072)	0.0102 (0.0074)	0.0144 (0.0103)	-0.0009 (0.0108)	-0.0178 (0.0046)	0.0025 (0.0046)
	p = 0.1233	p = 0.1673	p = 0.1625	p = 0.9311	p = 0.0001	p = 0.5822
7th Principal Component	-0.0078 (0.0074)	-0.0045 (0.0071)	0.0069 (0.0094)	0.0076 (0.0112)	0.0072 (0.0046)	0.0029 (0.0045)
	p = 0.2925	p = 0.5203	p = 0.4626	p = 0.4987	p = 0.1152	p = 0.5137
8th Principal Component	0.0037 (0.0070)	0.0022 (0.0071)	0.0078 (0.0093)	0.0081 (0.0100)	0.0039 (0.0046)	0.0108 (0.0048)
	p = 0.5917	p = 0.7513	p = 0.4014	p = 0.4203	p = 0.3917	p = 0.0257
9th Principal Component	0.0007 (0.0069)	0.0082 (0.0073)	0.0048 (0.0096)	0.0080 (0.0107)	-0.0134 (0.0047)	0.0046 (0.0048)
	p = 0.9161	p = 0.2598	p = 0.6203	p = 0.4586	p = 0.0042	p = 0.3337
10th Principal Component	-0.0056 (0.0074)	0.0058 (0.0072)	-0.0094 (0.0102)	-0.0252 (0.0114)	0.0054 (0.0047)	-0.0019 (0.0047)
	p = 0.4491	p = 0.4257	p = 0.3574	p = 0.0271	p = 0.2520	p = 0.6904
Grades Completed	0.0977 (0.0054)	0.0841 (0.0044)	0.0637 (0.0051)	0.0806 (0.0051)	0.0930 (0.0028)	0.0862 (0.0026)
	p = 0.0000	p = 0.0000	p = 0.0000	p = 0.0000	p = 0.0000	p = 0.0000
Potential Experience	0.0383 (0.0048)	0.0453 (0.0049)	0.0276 (0.0055)	0.0703 (0.0083)	0.0319 (0.0030)	0.0674 (0.0027)
	p = 0.0000	p = 0.0000	p = 0.0000	p = 0.0000	p = 0.0000	p = 0.0000
(Potential Experience)^2	-0.0012 (0.0003)	-0.0017 (0.0002)	-0.0011 (0.0003)	-0.0017 (0.0005)	-0.0014 (0.0002)	-0.0021 (0.0001)
	p = 0.0000	p = 0.0000	p = 0.0000	p = 0.0003	p = 0.0000	p = 0.0000
Job Tenure	0.0019 (0.0001)	0.0015 (0.0001)	0.0017 (0.0001)	0.0014 (0.0001)	0.0017 (0.0001)	0.0013 (0.0001)
	p = 0.0000	p = 0.0000	p = 0.0000	p = 0.0000	p = 0.0000	p = 0.0000
(Job Tenure)^2	-0.0000 (0.0000)	-0.0000 (0.0000)	-0.0000 (0.0000)	-0.0000 (0.0000)	-0.0000 (0.0000)	-0.0000 (0.0000)
	p = 0.0000	p = 0.0000	p = 0.0000	p = 0.0000	p = 0.0000	p = 0.0000
National Unemployment Rate	-0.0020 (0.0016)	-0.0008 (0.0016)	-0.0052 (0.0022)	-0.0011 (0.0020)	-0.0047 (0.0010)	-0.0032 (0.0009)
	p = 0.2258	p = 0.6180	p = 0.0192	p = 0.5885	p = 0.0000	p = 0.0003
Local Unemployment Rate<6%	0.0596 (0.0102)	0.0631 (0.0093)	0.0545 (0.0168)	0.0844 (0.0161)	0.0917 (0.0070)	0.0647 (0.0063)
	p = 0.0000	p = 0.0000	p = 0.0012	p = 0.0000	p = 0.0000	p = 0.0000
Local Unemployment Rate>=9%	-0.0482 (0.0136)	-0.0276 (0.0130)	-0.0893 (0.0186)	-0.1135 (0.0180)	-0.0609 (0.0077)	-0.0906 (0.0082)
	p = 0.0004	p = 0.0336	p = 0.0000	p = 0.0000	p = 0.0000	p = 0.0000
Linear Time	-0.0132 (0.0009)	-0.0110 (0.0008)	0.0014 (0.0008)	-0.0207 (0.0009)	0.0002 (0.0005)	-0.0130 (0.0005)
	p = 0.0000	p = 0.0000	p = 0.0874	p = 0.0000	p = 0.6967	p = 0.0000
R-squared	$R^2 = 0.2809$	$R^2 = 0.2179$	$R^2 = 0.2371$	$R^2 = 0.2215$	$R^2 = 0.2670$	$R^2 = 0.2402$
Number of Observations	10725	12211	6832	8070	26253	27228
F[95, 91294]=6.96						

Sample includes all valid employed out-of-school person-year observations.
OLS regression used with stacked person-year observations.
Dependent variable is the log of the hourly wage reported for each year in 1990 dollars.
Regressions run separately for race-sex groups based on rejection of the hypothesis that coefficients are equal across groups.
Reported standard errors are Eicker-White robust standard errors generalized for panel data.
Background model includes only human capital measures and time dummies.
NLSY sample weights are used.

Table 3QA
Cognitive Ability as a Determinant of Wages
Principal Components Unstandardized

Variable	Black Females	Black Males	Hispanic Females	Hispanic Males	White Females	White Males
1st Principal Component	0.2447 (0.0089) p = 0.0000	0.2075 (0.0085) p = 0.0000	0.1949 (0.0115) p = 0.0000	0.1573 (0.0114) p = 0.0000	0.2293 (0.0082) p = 0.0000	0.1841 (0.0054) p = 0.0000
2nd Principal Component	0.0651 (0.0086) p = 0.0000	0.0210 (0.0109) p = 0.0530	0.0798 (0.0124) p = 0.0000	0.0347 (0.0121) p = 0.0041	0.0810 (0.0059) p = 0.0000	0.0463 (0.0048) p = 0.0000
3rd Principal Component	-0.0349 (0.0099) p = 0.0004	-0.0256 (0.0098) p = 0.0086	-0.0460 (0.0120) p = 0.0001	0.0559 (0.0111) p = 0.0000	-0.0402 (0.0052) p = 0.0000	-0.0095 (0.0051) p = 0.0597
4th Principal Component	-0.0202 (0.0080) p = 0.0117	0.0091 (0.0083) p = 0.2710	-0.0164 (0.0104) p = 0.1148	0.0380 (0.0112) p = 0.0007	0.0178 (0.0055) p = 0.0011	0.0336 (0.0049) p = 0.0000
5th Principal Component	0.0020 (0.0079) p = 0.8012	-0.0133 (0.0079) p = 0.0911	0.0063 (0.0093) p = 0.4988	-0.0159 (0.0116) p = 0.1712	-0.0120 (0.0052) p = 0.0210	-0.0318 (0.0051) p = 0.0000
6th Principal Component	-0.0004 (0.0085) p = 0.9667	-0.0164 (0.0078) p = 0.0365	-0.0044 (0.0112) p = 0.6922	-0.0036 (0.0116) p = 0.7544	-0.0071 (0.0048) p = 0.1426	-0.0104 (0.0048) p = 0.0315
7th Principal Component	-0.0086 (0.0085) p = 0.3116	0.0072 (0.0073) p = 0.3255	-0.0218 (0.0107) p = 0.0406	0.0220 (0.0106) p = 0.0382	0.0094 (0.0054) p = 0.0831	0.0019 (0.0049) p = 0.7018
8th Principal Component	0.0023 (0.0080) p = 0.7759	0.0076 (0.0074) p = 0.3027	0.0069 (0.0106) p = 0.5155	-0.0126 (0.0106) p = 0.2337	0.0117 (0.0053) p = 0.0275	-0.0066 (0.0052) p = 0.2027
9th Principal Component	0.0043 (0.0083) p = 0.6059	0.0145 (0.0080) p = 0.0680	0.0046 (0.0106) p = 0.6640	-0.0018 (0.0115) p = 0.8726	0.0182 (0.0054) p = 0.0008	0.0143 (0.0050) p = 0.0046
10th Principal Component	-0.0006 (0.0083) p = 0.9398	0.0004 (0.0074) p = 0.9524	-0.0152 (0.0102) p = 0.1352	0.0162 (0.0113) p = 0.1529	-0.0215 (0.0055) p = 0.0001	-0.0023 (0.0053) p = 0.6671
R-squared	$R^2 = 0.1514$	$R^2 = 0.1115$	$R^2 = 0.1236$	$R^2 = 0.1092$	$R^2 = 0.1283$	$R^2 = 0.1127$
Number of Observations	10979	12477	7072	8338	26783	27958
F[50, 93591]=12.04						

Sample includes all valid employed out-of-school person-year observations.
OLS regression used with stacked person-year observations.
Dependent variable is the log of the hourly wage reported for each year in 1990 dollars.
Regressions run separately for race-sex groups based on rejection of the hypothesis that coefficients are equal across groups.
Reported standard errors are Eicker-White robust standard errors generalized for panel data.
Background model includes only human capital measures and time dummies.
NLSY sample weights are used.

Table 3QB
Cognitive Ability as a Determinant of Wages
Principal Components Unstandardized

Variable	Black Females	Black Males	Hispanic Females	Hispanic Males	White Females	White Males
1st Principal Component	0.1510 (0.0174) p = 0.0000	0.1301 (0.0108) p = 0.0000	0.1016 (0.0173) p = 0.0000	0.1019 (0.0125) p = 0.0000	0.1047 (0.0089) p = 0.0000	0.0942 (0.0075) p = 0.0000
2nd Principal Component	0.0342 (0.0119) p = 0.0042	-0.0046 (0.0102) p = 0.6526	0.0469 (0.0150) p = 0.0018	0.0204 (0.0131) p = 0.1215	0.0395 (0.0069) p = 0.0000	0.0168 (0.0058) p = 0.0035
3rd Principal Component	-0.0187 (0.0092) p = 0.0417	-0.0118 (0.0088) p = 0.1809	-0.0406 (0.0106) p = 0.0001	0.0445 (0.0103) p = 0.0000	-0.0095 (0.0047) p = 0.0426	0.0081 (0.0050) p = 0.1098
4th Principal Component	-0.0116 (0.0083) p = 0.1618	0.0076 (0.0075) p = 0.3149	-0.0086 (0.0104) p = 0.4119	0.0293 (0.0109) p = 0.0069	0.0269 (0.0056) p = 0.0000	0.0354 (0.0048) p = 0.0000
5th Principal Component	-0.0017 (0.0068) p = 0.8030	-0.0155 (0.0072) p = 0.0318	-0.0004 (0.0085) p = 0.9641	-0.0166 (0.0107) p = 0.1206	-0.0107 (0.0047) p = 0.0238	-0.0358 (0.0049) p = 0.0000
6th Principal Component	0.0040 (0.0077) p = 0.6047	-0.0092 (0.0071) p = 0.1938	-0.0063 (0.0100) p = 0.5315	0.0030 (0.0103) p = 0.7727	0.0024 (0.0043) p = 0.5740	-0.0008 (0.0046) p = 0.8699
7th Principal Component	-0.0097 (0.0075) p = 0.1957	0.0052 (0.0069) p = 0.4561	-0.0201 (0.0094) p = 0.0321	0.0144 (0.0096) p = 0.1331	0.0133 (0.0048) p = 0.0061	0.0067 (0.0047) p = 0.1480
8th Principal Component	-0.0024 (0.0072) p = 0.7425	-0.0003 (0.0070) p = 0.9616	0.0049 (0.0094) p = 0.6011	-0.0001 (0.0101) p = 0.9890	0.0032 (0.0046) p = 0.4872	-0.0045 (0.0049) p = 0.3613
9th Principal Component	0.0043 (0.0075) p = 0.5702	0.0090 (0.0070) p = 0.2019	0.0012 (0.0096) p = 0.8981	-0.0021 (0.0106) p = 0.8397	0.0040 (0.0048) p = 0.3981	0.0052 (0.0047) p = 0.2664
10th Principal Component	-0.0055 (0.0069) p = 0.4268	0.0036 (0.0068) p = 0.5956	-0.0083 (0.0094) p = 0.3727	0.0166 (0.0106) p = 0.1168	-0.0154 (0.0049) p = 0.0018	-0.0002 (0.0049) p = 0.9686
Grades Completed	0.0651 (0.0061) p = 0.0000	0.0533 (0.0049) p = 0.0000	0.0438 (0.0068) p = 0.0000	0.0456 (0.0063) p = 0.0000	0.0704 (0.0034) p = 0.0000	0.0587 (0.0033) p = 0.0000
Potential Experience	0.0299 (0.0047) p = 0.0000	0.0357 (0.0048) p = 0.0000	0.0224 (0.0054) p = 0.0000	0.0623 (0.0081) p = 0.0000	0.0242 (0.0030) p = 0.0000	0.0551 (0.0028) p = 0.0000
(Potential Experience)^2	-0.0009 (0.0002) p = 0.0001	-0.0015 (0.0002) p = 0.0000	-0.0008 (0.0003) p = 0.0010	-0.0018 (0.0004) p = 0.0001	-0.0012 (0.0002) p = 0.0000	-0.0020 (0.0001) p = 0.0000
Job Tenure	0.0019 (0.0001) p = 0.0000	0.0015 (0.0001) p = 0.0000	0.0017 (0.0001) p = 0.0000	0.0014 (0.0001) p = 0.0000	0.0017 (0.0001) p = 0.0000	0.0013 (0.0001) p = 0.0000
(Job Tenure)^2	-0.0000 (0.0000) p = 0.0000	-0.0000 (0.0000) p = 0.0000	-0.0000 (0.0000) p = 0.0000	-0.0000 (0.0000) p = 0.0000	-0.0000 (0.0000) p = 0.0000	-0.0000 (0.0000) p = 0.0000
National Unemployment Rate	-0.0010 (0.0016) p = 0.5197	-0.0005 (0.0016) p = 0.7526	-0.0044 (0.0022) p = 0.0448	-0.0013 (0.0020) p = 0.5228	-0.0041 (0.0010) p = 0.0000	-0.0029 (0.0009) p = 0.0011
Local Unemployment Rate<6%	0.0609 (0.0102) p = 0.0000	0.0643 (0.0093) p = 0.0000	0.0571 (0.0167) p = 0.0006	0.0843 (0.0159) p = 0.0000	0.0918 (0.0070) p = 0.0000	0.0676 (0.0063) p = 0.0000
Local Unemployment Rate>=9%	-0.0449 (0.0135) p = 0.0009	-0.0313 (0.0129) p = 0.0157	-0.0893 (0.0183) p = 0.0000	-0.1125 (0.0177) p = 0.0000	-0.0608 (0.0077) p = 0.0000	-0.0899 (0.0081) p = 0.0000
Linear Time	-0.0059 (0.0011) p = 0.0000	-0.0029 (0.0009) p = 0.0013	0.0036 (0.0011) p = 0.0015	-0.0100 (0.0011) p = 0.0000	0.0062 (0.0006) p = 0.0000	-0.0023 (0.0006) p = 0.0000
R-squared	$R^2 = 0.2852$	$R^2 = 0.2223$	$R^2 = 0.2379$	$R^2 = 0.2286$	$R^2 = 0.2669$	$R^2 = 0.2408$
Number of Observations	10802	12298	6923	8216	26462	27552
F[95, 92228]=7.47						

Sample includes all valid employed out-of-school person-year observations.
OLS regression used with stacked person-year observations.
Dependent variable is the log of the hourly wage reported for each year in 1990 dollars.
Regressions run separately for race-sex groups based on rejection of the hypothesis that coefficients are equal across groups.
Reported standard errors are Eicker-White robust standard errors generalized for panel data.
Background model includes only human capital measures and time dummies.
NLSY sample weights are used.

Table 3RA
Cognitive Ability as a Determinant of Wages
ASVAB Std. By Age, Principal Components Unstandardized

Variable	Black Females	Black Males	Hispanic Females	Hispanic Males	White Females	White Males
1st Principal Component	0.1943 (0.0090) p = 0.0000	0.1942 (0.0087) p = 0.0000	0.1770 (0.0115) p = 0.0000	0.1387 (0.0117) p = 0.0000	0.2109 (0.0081) p = 0.0000	0.1644 (0.0056) p = 0.0000
2nd Principal Component	0.0906 (0.0089) p = 0.0000	0.0216 (0.0113) p = 0.0569	0.0884 (0.0126) p = 0.0000	0.0370 (0.0124) p = 0.0029	0.0830 (0.0060) p = 0.0000	0.0517 (0.0049) p = 0.0000
3rd Principal Component	-0.0516 (0.0099) p = 0.0000	-0.0266 (0.0098) p = 0.0066	-0.0522 (0.0122) p = 0.0000	0.0523 (0.0115) p = 0.0000	-0.0433 (0.0055) p = 0.0000	-0.0156 (0.0051) p = 0.0021
4th Principal Component	-0.0237 (0.0085) p = 0.0051	0.0132 (0.0085) p = 0.1186	-0.0170 (0.0108) p = 0.1134	0.0388 (0.0114) p = 0.0007	0.0217 (0.0055) p = 0.0001	0.0384 (0.0050) p = 0.0000
5th Principal Component	0.0026 (0.0081) p = 0.7513	-0.0167 (0.0080) p = 0.0364	0.0069 (0.0095) p = 0.4678	-0.0180 (0.0115) p = 0.1199	-0.0116 (0.0053) p = 0.0272	-0.0335 (0.0052) p = 0.0000
6th Principal Component	0.0029 (0.0086) p = 0.7328	-0.0124 (0.0080) p = 0.1205	-0.0049 (0.0114) p = 0.6680	0.0013 (0.0118) p = 0.9127	-0.0067 (0.0049) p = 0.1698	-0.0045 (0.0050) p = 0.3678
7th Principal Component	-0.0031 (0.0085) p = 0.7182	0.0142 (0.0073) p = 0.0531	-0.0095 (0.0110) p = 0.3900	0.0046 (0.0107) p = 0.6676	0.0127 (0.0055) p = 0.0210	-0.0061 (0.0049) p = 0.2147
8th Principal Component	-0.0142 (0.0083) p = 0.0852	-0.0041 (0.0076) p = 0.5910	-0.0206 (0.0105) p = 0.0498	0.0222 (0.0110) p = 0.0435	-0.0022 (0.0054) p = 0.6822	0.0035 (0.0054) p = 0.5115
9th Principal Component	0.0110 (0.0086) p = 0.1999	0.0183 (0.0081) p = 0.0236	0.0110 (0.0107) p = 0.3035	0.0037 (0.0116) p = 0.7481	0.0179 (0.0055) p = 0.0011	0.0214 (0.0051) p = 0.0000
10th Principal Component	0.0021 (0.0083) p = 0.7992	0.0000 (0.0076) p = 0.9991	-0.0139 (0.0103) p = 0.1760	0.0217 (0.0114) p = 0.0575	-0.0208 (0.0056) p = 0.0002	0.0020 (0.0054) p = 0.7058
R-squared	$R^2 = 0.1336$	$R^2 = 0.0999$	$R^2 = 0.1147$	$R^2 = 0.0894$	$R^2 = 0.1202$	$R^2 = 0.0995$
Number of Observations	10979	12477	7072	8338	26783	27958
F[50, 93591]=14.9						

Sample includes all valid employed out-of-school person-year observations.
OLS regression used with stacked person-year observations.
Dependent variable is the log of the hourly wage reported for each year in 1990 dollars.
Regressions run separately for race-sex groups based on rejection of the hypothesis that coefficients are equal across groups.
Reported standard errors are Eicker-White robust standard errors generalized for panel data.
Background model includes only human capital measures and time dummies.
NLSY sample weights are used.

Table 3RB
Cognitive Ability as a Determinant of Wages
ASVAB Std. By Age, Principal Components Unstandardized

Variable	Black Females	Black Males	Hispanic Females	Hispanic Males	White Females	White Males
1st Principal Component	0.1473 (0.0154)	0.1281 (0.0105)	0.0987 (0.0161)	0.0971 (0.0122)	0.1023 (0.0086)	0.0916 (0.0075)
	p = 0.0000	p = 0.0000	p = 0.0000	p = 0.0000	p = 0.0000	p = 0.0000
2nd Principal Component	0.0341 (0.0116)	-0.0055 (0.0103)	0.0465 (0.0150)	0.0196 (0.0131)	0.0378 (0.0069)	0.0170 (0.0058)
	p = 0.0032	p = 0.5930	p = 0.0019	p = 0.1337	p = 0.0000	p = 0.0032
3rd Principal Component	-0.0183 (0.0092)	-0.0099 (0.0087)	-0.0402 (0.0106)	0.0478 (0.0104)	-0.0067 (0.0049)	0.0113 (0.0051)
	p = 0.0456	p = 0.2562	p = 0.0001	p = 0.0000	p = 0.1677	p = 0.0276
4th Principal Component	-0.0105 (0.0082)	0.0086 (0.0075)	-0.0049 (0.0104)	0.0253 (0.0107)	0.0290 (0.0056)	0.0348 (0.0048)
	p = 0.2025	p = 0.2519	p = 0.6397	p = 0.0184	p = 0.0000	p = 0.0000
5th Principal Component	-0.0026 (0.0068)	-0.0160 (0.0072)	-0.0000 (0.0086)	-0.0173 (0.0105)	-0.0105 (0.0047)	-0.0360 (0.0049)
	p = 0.7044	p = 0.0267	p = 0.9973	p = 0.0985	p = 0.0271	p = 0.0000
6th Principal Component	0.0043 (0.0076)	-0.0082 (0.0070)	-0.0073 (0.0100)	0.0046 (0.0103)	0.0034 (0.0043)	0.0015 (0.0046)
	p = 0.5725	p = 0.2412	p = 0.4646	p = 0.6559	p = 0.4229	p = 0.7498
7th Principal Component	-0.0079 (0.0073)	0.0045 (0.0069)	-0.0098 (0.0095)	0.0094 (0.0098)	0.0109 (0.0048)	0.0006 (0.0045)
	p = 0.2801	p = 0.5153	p = 0.3037	p = 0.3395	p = 0.0221	p = 0.8930
8th Principal Component	-0.0041 (0.0074)	0.0040 (0.0070)	-0.0177 (0.0091)	0.0109 (0.0097)	0.0069 (0.0047)	0.0065 (0.0050)
	p = 0.5811	p = 0.5671	p = 0.0509	p = 0.2630	p = 0.1409	p = 0.1937
9th Principal Component	0.0053 (0.0075)	0.0078 (0.0070)	0.0039 (0.0096)	-0.0028 (0.0106)	0.0041 (0.0048)	0.0051 (0.0046)
	p = 0.4800	p = 0.2631	p = 0.6833	p = 0.7903	p = 0.3868	p = 0.2700
10th Principal Component	-0.0048 (0.0069)	0.0028 (0.0068)	-0.0073 (0.0093)	0.0180 (0.0105)	-0.0151 (0.0049)	-0.0002 (0.0049)
	p = 0.4873	p = 0.6746	p = 0.4311	p = 0.0850	p = 0.0021	p = 0.9718
Grades Completed	0.0777 (0.0057)	0.0642 (0.0048)	0.0504 (0.0063)	0.0584 (0.0060)	0.0797 (0.0032)	0.0688 (0.0033)
	p = 0.0000	p = 0.0000	p = 0.0000	p = 0.0000	p = 0.0000	p = 0.0000
Potential Experience	0.0422 (0.0047)	0.0469 (0.0048)	0.0284 (0.0054)	0.0752 (0.0081)	0.0340 (0.0030)	0.0657 (0.0028)
	p = 0.0000	p = 0.0000	p = 0.0000	p = 0.0000	p = 0.0000	p = 0.0000
$(\text{Potential Experience})^2$	-0.0010 (0.0002)	-0.0015 (0.0002)	-0.0008 (0.0003)	-0.0018 (0.0004)	-0.0013 (0.0002)	-0.0020 (0.0001)
	p = 0.0001	p = 0.0000	p = 0.0009	p = 0.0000	p = 0.0000	p = 0.0000
Job Tenure	0.0019 (0.0001)	0.0015 (0.0001)	0.0017 (0.0001)	0.0014 (0.0001)	0.0017 (0.0001)	0.0013 (0.0001)
	p = 0.0000	p = 0.0000	p = 0.0000	p = 0.0000	p = 0.0000	p = 0.0000
$(\text{Job Tenure})^2$	-0.0000 (0.0000)	-0.0000 (0.0000)	-0.0000 (0.0000)	-0.0000 (0.0000)	-0.0000 (0.0000)	-0.0000 (0.0000)
	p = 0.0000	p = 0.0000	p = 0.0000	p = 0.0000	p = 0.0000	p = 0.0000
National Unemployment Rate	-0.0011 (0.0016)	-0.0005 (0.0016)	-0.0044 (0.0022)	-0.0013 (0.0020)	-0.0042 (0.0010)	-0.0030 (0.0009)
	p = 0.5075	p = 0.7511	p = 0.0443	p = 0.5081	p = 0.0000	p = 0.0009
Local Unemployment Rate<6%	0.0607 (0.0102)	0.0641 (0.0093)	0.0570 (0.0167)	0.0843 (0.0159)	0.0918 (0.0070)	0.0676 (0.0063)
	p = 0.0000	p = 0.0000	p = 0.0007	p = 0.0000	p = 0.0000	p = 0.0000
Local Unemployment Rate>=9%	-0.0451 (0.0135)	-0.0313 (0.0130)	-0.0897 (0.0183)	-0.1127 (0.0177)	-0.0607 (0.0077)	-0.0898 (0.0081)
	p = 0.0009	p = 0.0157	p = 0.0000	p = 0.0000	p = 0.0000	p = 0.0000
Linear Time	-0.0181 (0.0010)	-0.0138 (0.0008)	-0.0025 (0.0010)	-0.0224 (0.0010)	-0.0030 (0.0005)	-0.0125 (0.0006)
	p = 0.0000	p = 0.0000	p = 0.0156	p = 0.0000	p = 0.0000	p = 0.0000
R-squared	$R^2 = 0.2850$	$R^2 = 0.2225$	$R^2 = 0.2373$	$R^2 = 0.2288$	$R^2 = 0.2667$	$R^2 = 0.2407$
Number of Observations	10802	12298	6923	8216	26462	27552
F[95, 92228]=7.6						

Sample includes all valid employed out-of-school person-year observations.
OLS regression used with stacked person-year observations.
Dependent variable is the log of the hourly wage reported for each year in 1990 dollars.
Regressions run separately for race-sex groups based on rejection of the hypothesis that coefficients are equal across groups.
Reported standard errors are Eicker-White robust standard errors generalized for panel data.
Background model includes only human capital measures and time dummies.
NLSY sample weights are used.

Table 4: Proportion of Variance in Wage Residuals Attributable to Principal Components

Principal Component	Black Females	Black Males	Hispanic Females	Hispanic Males	White Females	White Males
First	0.496	0.489	0.439	0.481	0.419	0.541
Second	0.135	0.167	0.129	0.161	0.152	0.099
Third	0.106	0.085	0.111	0.090	0.073	0.057
Fourth	0.061	0.050	0.085	0.064	0.066	0.043
Fifth	0.048	0.040	0.055	0.050	0.049	0.038
Sixth	0.036	0.036	0.043	0.041	0.044	0.037
Seventh	0.032	0.031	0.041	0.029	0.039	0.031
Eighth	0.023	0.025	0.029	0.024	0.034	0.028
Ninth	0.017	0.021	0.022	0.018	0.030	0.026
Tenth	0.013	0.014	0.015	0.013	0.023	0.024
Eleventh	0.011	0.011	0.012	0.011	0.021	0.021
Twelfth	0.008	0.009	0.008	0.008	0.018	0.018
Thirteenth	0.005	0.009	0.005	0.005	0.017	0.013
Fourteenth	0.005	0.008	0.003	0.003	0.010	0.012
Fifteenth	0.003	0.005	0.001	0.003	0.006	0.010

Note: Residuals are from a regression of log hourly wages on education, tenure, tenure squared, experience, experience squared, and time dummies.

Table 5A
Contribution of Ability to Wage Determination
Modelled With and Without Human Capital
N: Resid. on Age; P: Resid. by Age and Educ.; Both Are Std. by Cohort

	Modelled With Background Variables Only		Modelled With Human Capital		Number
Group	N	P	N	P	of Obs.
Black Females	0.191 (-0.001) p = -0.028	0.129 (-0.001) p = -0.027	0.118 (-0.001) p = -0.046	0.094 (-0.002) p = -0.048	10725
Change in R^2 =	0.163	0.095	0.033	0.030	
Black Males	0.156 (0.001) p = -0.031	0.096 (0.001) p = -0.023	0.104 (-0.001) p = -0.030	0.082 (-0.001) p = -0.027	12211
Change in R^2 =	0.119	0.064	0.028	0.023	
Hispanic Females	0.180 (-0.002) p = -0.083	0.104 (-0.001) p = -0.075	0.092 (-0.005) p = -0.090	0.075 (-0.005) p = -0.089	6832
Change in R^2 =	0.149	0.083	0.015	0.016	
Hispanic Males	0.143 (0.001) p = -0.117	0.074 (0.002) p = -0.114	0.107 (-0.000) p = -0.110	0.064 (-0.001) p = -0.108	8070
Change in R^2 =	0.138	0.087	0.023	0.013	
White Females	0.185 (-0.003) p = -0.069	0.106 (-0.002) p = -0.072	0.083 (-0.004) p = -0.063	0.066 (-0.004) p = -0.063	26253
Change in R^2 =	0.150	0.095	0.012	0.011	
White Males	0.142 (-0.000) p = -0.093	0.084 (0.000) p = -0.097	0.085 (-0.003) p = -0.087	0.065 (-0.003) p = -0.086	27228
Change in R^2 =	0.139	0.101	0.015	0.013	

Sample includes all valid employed out-of-school observations.
OLS regression used with Eicker-White robust standard errors generalized for panel data.
Dependent variable is the log of the hourly wage reported for each year in 1990 dollars.
Background variables include local and national unemployment rates and a linear time variable. Human capital includes education, experience, and job tenure with quadratic terms.

Table 5B
Contribution of Ability to Wage Determination
Modelled With and Without Human Capital
P: Resid. on Age and Educ O: Resid. on Age, Educ, Parents HGC

	Modelled With Background Variables Only		Modelled With Human Capital		Number
Group	O	P	O	P	of Obs.
Black Females	0.120 (-0.001) p = -0.014	0.126 (-0.001) p = -0.014	0.087 (-0.003) p = -0.036	0.096 (-0.003) p = -0.036	7937
Change in R^2 =	0.094	0.100	0.026	0.032	
Black Males	0.099 (0.003) p = -0.018	0.107 (0.003) p = -0.016	0.085 (0.001) p = -0.024	0.091 (0.001) p = -0.022	8565
Change in R^2 =	0.068	0.075	0.026	0.030	
Hispanic Females	0.098 (-0.001) p = -0.071	0.115 (-0.001) p = -0.058	0.070 (-0.004) p = -0.091	0.082 (-0.004) p = -0.081	5549
Change in R^2 =	0.078	0.089	0.014	0.019	
Hispanic Males	0.050 (0.004) p = -0.110	0.061 (0.004) p = -0.104	0.040 (0.001) p = -0.103	0.055 (0.001) p = -0.098	6253
Change in R^2 =	0.079	0.084	0.005	0.010	
White Females	0.085 (-0.002) p = -0.074	0.102 (-0.002) p = -0.073	0.051 (-0.004) p = -0.061	0.064 (-0.004) p = -0.061	23702
Change in R^2 =	0.091	0.098	0.007	0.010	
White Males	0.074 (0.000) p = -0.099	0.082 (0.000) p = -0.098	0.057 (-0.003) p = -0.088	0.065 (-0.003) p = -0.088	24540
Change in R^2 =	0.096	0.100	0.010	0.012	

Sample includes all valid employed out-of-school observations.
OLS regression used with Eicker-White robust standard errors generalized for panel data.
Dependent variable is the log of the hourly wage reported for each year in 1990 dollars.
Background variables include local and national unemployment rates and a linear time variable. Human capital includes education, experience, and job tenure with quadratic terms.

Table 5C
Contribution of Ability to Wage Determination
Modelled With and Without Human Capital
Q: Unconditional; R: ASVAB Std. by Year of Birth

	Modelled With Background Variables Only		**Modelled With Human Capital**		Number
Group	Q	R	Q	R	of Obs.
Black Females	0.291 (0.000) p = -0.026	0.250 (-0.001) p = -0.028	0.174 (-0.001) p = -0.045	0.170 (-0.001) p = -0.045	10802
Change in R^2 =	0.179	0.147	0.034	0.034	
Black Males	0.196 (0.002) p = -0.028	0.178 (0.001) p = -0.032	0.125 (-0.000) p = -0.031	0.123 (-0.001) p = -0.031	12298
Change in R^2 =	0.131	0.115	0.028	0.028	
Hispanic Females	0.212 (-0.001) p = -0.081	0.192 (-0.002) p = -0.078	0.109 (-0.004) p = -0.089	0.104 (-0.004) p = -0.090	6923
Change in R^2 =	0.154	0.139	0.015	0.015	
Hispanic Males	0.155 (0.002) p = -0.114	0.133 (0.001) p = -0.116	0.106 (-0.001) p = -0.109	0.103 (-0.001) p = -0.108	8216
Change in R^2 =	0.147	0.127	0.022	0.021	
White Females	0.252 (-0.002) p = -0.066	0.230 (-0.003) p = -0.070	0.112 (-0.004) p = -0.063	0.109 (-0.004) p = -0.063	26462
Change in R^2 =	0.164	0.149	0.013	0.013	
White Males	0.181 (0.000) p = -0.088	0.159 (-0.000) p = -0.092	0.095 (-0.003) p = -0.086	0.092 (-0.003) p = -0.086	27552
Change in R^2 =	0.165	0.143	0.015	0.014	

Sample includes all valid employed out-of-school observations.
OLS regression used with Eicker-White robust standard errors generalized for panel data.
Dependent variable is the log of the hourly wage reported for each year in 1990 dollars.
Background variables include local and national unemployment rates and a linear time variable. Human capital includes education, experience, and job tenure with quadratic terms.

Table 5D
Contribution of Ability to Wage Determination
Modelled With and Without Human Capital
All Ability Measures Standardized by Age Cohort

	Modelled With Background Variables Only		Modelled With Human Capital		Number
Group	AFQT	g	AFQT	g	of Obs.
Black Females	0.011 (0.000) p = -0.028	0.191 (-0.000) p = -0.027	0.007 (-0.001) p = -0.046	0.119 (-0.001) p = -0.045	10802
Change in R^2 =	0.174	0.162	0.033	0.034	
Black Males	0.008 (0.002) p = -0.027	0.157 (0.001) p = -0.031	0.005 (-0.000) p = -0.030	0.103 (-0.001) p = -0.031	12298
Change in R^2 =	0.126	0.118	0.024	0.027	
Hispanic Females	0.009 (-0.001) p = -0.083	0.173 (-0.002) p = -0.081	0.005 (-0.004) p = -0.090	0.084 (-0.004) p = -0.091	6923
Change in R^2 =	0.155	0.143	0.017	0.013	
Hispanic Males	0.006 (0.002) p = -0.110	0.147 (0.001) p = -0.114	0.004 (-0.001) p = -0.106	0.111 (-0.001) p = -0.108	8216
Change in R^2 =	0.131	0.135	0.014	0.024	
White Females	0.010 (-0.002) p = -0.063	0.185 (-0.002) p = -0.070	0.004 (-0.004) p = -0.061	0.084 (-0.004) p = -0.063	26462
Change in R^2 =	0.165	0.150	0.012	0.012	
White Males	0.007 (0.000) p = -0.084	0.141 (-0.000) p = -0.093	0.004 (-0.003) p = -0.084	0.083 (-0.003) p = -0.086	27552
Change in R^2 =	0.157	0.138	0.011	0.014	

Sample includes all valid employed out-of-school observations.
OLS regression used with Eicker-White robust standard errors generalized for panel data.
Dependent variable is the log of the hourly wage reported for each year in 1990 dollars.
Background variables include local and national unemployment rates and a linear time variable. Human capital includes education, experience, and job tenure with quadratic terms.

TABLE 6: SIMULTANEOUS EQUATION MODEL
DETERMINANTS OF OCCUPATION CHOICE AND WAGES
OCCUPATION CHOICE: WHITE COLLAR VS. BLUE COLLAR

Random Effects Probit Equation Using Stacked, Person-Year Observations
1 Common Unobserved Factor Estimated Non-Parametrically
Dependent Variable: White Collar

Variable	Black Females	Black Males	Hispanic Females	Hispanic Males	White Females	White Males
Factor Loading	1.4400 (0.0348) p=0.0000	0.5961 (0.0393) p=0.0000	1.4669 (0.0462) p=0.0000	0.7932 (0.0331) p=0.0000	1.2626 (0.0202) p=0.0000	0.3163 (0.0136) p=0.0000
Wage White Collar - Wage Blue Collar	0.7031 (0.0736) p=0.0000	1.9452 (0.0930) p=0.0000	0.8667 (0.0890) p=0.0000	1.1529 (0.0988) p=0.0000	0.7155 (0.0463) p=0.0000	0.9792 (0.0483) p=0.0000
1st Principal Component	0.5619 (0.0239) p=0.0000	0.3798 (0.0299) p=0.0000	0.2807 (0.0325) p=0.0000	0.3106 (0.0319) p=0.0000	0.2495 (0.0139) p=0.0000	0.3264 (0.0128) p=0.0000
2nd Principal Component	-0.0889 (0.0183) p=0.0000	0.1817 (0.0233) p=0.0000	0.1484 (0.0279) p=0.0000	0.1421 (0.0200) p=0.0000	0.1782 (0.0103) p=0.0000	0.2033 (0.0089) p=0.0000
3rd Principal Component	-0.0040 (0.0170) p=0.8162	-0.0294 (0.0219) p=0.1792	-0.0620 (0.0228) p=0.0065	-0.1431 (0.0233) p=0.0000	-0.0381 (0.0115) p=0.0009	-0.0902 (0.0087) p=0.0000
4th Principal Component	0.0094 (0.0187) p=0.6137	-0.0760 (0.0230) p=0.0010	0.0716 (0.0247) p=0.0038	-0.1041 (0.0195) p=0.0000	-0.0040 (0.0101) p=0.6908	-0.0953 (0.0088) p=0.0000
5th Principal Component	-0.0480 (0.0154) p=0.0018	0.0155 (0.0224) p=0.4873	0.0218 (0.0234) p=0.3507	-0.0658 (0.0205) p=0.0013	-0.0444 (0.0101) p=0.0000	-0.0365 (0.0077) p=0.0000
6th Principal Component	-0.1182 (0.0169) p=0.0000	0.0327 (0.0228) p=0.1510	-0.0241 (0.0232) p=0.2998	-0.0371 (0.0195) p=0.0566	0.0069 (0.0100) p=0.4930	-0.0188 (0.0082) p=0.0214
7th Principal Component	0.0112 (0.0178) p=0.5296	0.0741 (0.0224) p=0.0010	-0.0659 (0.0232) p=0.0045	0.1305 (0.0205) p=0.0000	-0.0232 (0.0100) p=0.0204	-0.0657 (0.0079) p=0.0000
8th Principal Component	-0.0188 (0.0166) p=0.2573	0.0775 (0.0242) p=0.0014	-0.1282 (0.0243) p=0.0000	0.0430 (0.0207) p=0.0378	0.0227 (0.0100) p=0.0229	0.0423 (0.0081) p=0.0000
9th Principal Component	0.0307 (0.0167) p=0.0658	0.0283 (0.0238) p=0.2332	-0.0070 (0.0231) p=0.7604	0.0207 (0.0198) p=0.2955	-0.0645 (0.0100) p=0.0000	-0.0451 (0.0077) p=0.0000
10th Principal Component	0.0124 (0.0171) p=0.4677	-0.0672 (0.0225) p=0.0028	-0.0618 (0.0231) p=0.0076	-0.0223 (0.0195) p=0.2527	0.0264 (0.0094) p=0.0052	0.0294 (0.0075) p=0.0001
Grades Completed	0.1631 (0.0104) p=0.0000	0.2042 (0.0146) p=0.0000	0.1413 (0.0124) p=0.0000	0.1729 (0.0114) p=0.0000	0.2209 (0.0055) p=0.0000	0.1988 (0.0046) p=0.0000
Potential Experience	-0.0419 (0.0063) p=0.0000	-0.0101 (0.0081) p=0.2148	-0.0498 (0.0086) p=0.0000	-0.0121 (0.0074) p=0.1027	0.0043 (0.0036) p=0.2354	-0.0036 (0.0029) p=0.2268
Mother White Collar	0.2153 (0.0371) p=0.0000	0.1729 (0.0336) p=0.0000	-0.1024 (0.0600) p=0.0876	0.1169 (0.0347) p=0.0008	0.0614 (0.0160) p=0.0001	0.0689 (0.0112) p=0.0000
Father White Collar	0.1639 (0.0415) p=0.0001	0.2786 (0.0496) p=0.0000	0.2442 (0.0512) p=0.0000	-0.0518 (0.0348) p=0.1367	-0.0063 (0.0157) p=0.6857	0.2084 (0.0114) p=0.0000
Year	0.0502 (0.0070) p=0.0000	-0.0070 (0.0099) p=0.4774	0.0653 (0.0094) p=0.0000	0.0333 (0.0084) p=0.0001	0.0184 (0.0042) p=0.0000	0.0192 (0.0035) p=0.0000
Factor 1, Support Point 1 :	0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)
Factor 1, Prob. Mass for Point 1 :	0.5627 (0.0160)	0.5852 (0.0163)	0.5117 (0.0203)	0.5482 (0.0206)	0.5354 (0.0105)	0.5087 (0.0107)
Factor 1, Support Point 2 :	1.0000 (0.0000)	1.0000 (0.0000)	1.0000 (0.0000)	1.0000 (0.0000)	1.0000 (0.0000)	1.0000 (0.0000)
Factor 1, Prob. Mass for Point 2 :	0.4373 (0.0160)	0.4148 (0.0163)	0.4883 (0.0203)	0.4518 (0.0206)	0.4646 (0.0105)	0.4913 (0.0107)
Negative Log-Likelihood	13160.7813	14238.6719	8621.8594	10066.4063	35880.9375	36143.1563
Number of Respondents	1396	1451	884	881	3338	3368

1. Table updated on June 13, 1996
2. Sample includes all valid person-year observations who are both employed and not in school.
3. Principal Components standardized to have mean 0 and inter-quartile range 1.
4. Intercept and year included in model but not reported.
5. The probit was specified to have 1 common unobserved factor with 2 support points. The points were constrained to be at 0 and 1.
All coefficients for blue collar except for wages have been constrainted to equal zero. These normalizations are necessary for identification.
6. The reported coefficients are for the state index function for white collar. The only coefficient effecting the blue collar index function that has not been normalized to zero is blue collar wage

TABLE 7: SIMULTANEOUS EQUATION MODEL
DETERMINANTS OF OCCUPATION CHOICE AND WAGES
WAGE REGRESSIONS FOR BLUE COLLAR

Regression Using Stacked, Person-Year Observations
1 Common Unobserved Factor Estimated Non-Parametrically
Dependent Variable: Log Wages

Variable	Black Females	Black Males	Hispanic Females	Hispanic Males	White Females	White Males
Factor Loading	-0.1692 (0.0214) p=0.0000	0.3855 (0.0066) p=0.0000	-0.1953 (0.0335) p=0.0000	0.3430 (0.0091) p=0.0000	-0.0566 (0.0161) p=0.0004	0.4209 (0.0046) p=0.0000
Intercept	1.5740 (0.1910) p=0.0000	1.6228 (0.1322) p=0.0000	2.4589 (0.3015) p=0.0000	1.5435 (0.1653) p=0.0000	1.7175 (0.1531) p=0.0000	1.1581 (0.0886) p=0.0000
1st Principal Component	0.0660 (0.0088) p=0.0000	0.0471 (0.0061) p=0.0000	0.0144 (0.0140) p=0.3046	0.0897 (0.0087) p=0.0000	0.0293 (0.0061) p=0.0000	0.0378 (0.0039) p=0.0000
2nd Principal Component	-0.0120 (0.0061) p=0.0489	-0.0052 (0.0043) p=0.2228	-0.0237 (0.0113) p=0.0353	0.0096 (0.0050) p=0.0537	0.0392 (0.0049) p=0.0000	-0.0385 (0.0033) p=0.0000
3rd Principal Component	-0.0070 (0.0062) p=0.2613	0.0371 (0.0047) p=0.0000	0.0008 (0.0092) p=0.9336	0.1006 (0.0067) p=0.0000	0.0483 (0.0048) p=0.0000	0.0889 (0.0032) p=0.0000
4th Principal Component	0.0277 (0.0065) p=0.0000	0.0336 (0.0048) p=0.0000	-0.0053 (0.0108) p=0.6211	0.0459 (0.0051) p=0.0000	0.0493 (0.0041) p=0.0000	-0.0158 (0.0028) p=0.0000
5th Principal Component	-0.0156 (0.0059) p=0.0081	0.0348 (0.0045) p=0.0000	-0.0569 (0.0093) p=0.0000	0.0561 (0.0054) p=0.0000	-0.0201 (0.0043) p=0.0000	0.0642 (0.0028) p=0.0000
6th Principal Component	-0.0021 (0.0059) p=0.7269	-0.0114 (0.0045) p=0.0109	-0.0170 (0.0098) p=0.0821	0.0064 (0.0051) p=0.2089	-0.0266 (0.0045) p=0.0000	0.0084 (0.0029) p=0.0032
7th Principal Component	-0.0230 (0.0059) p=0.0001	-0.0008 (0.0044) p=0.8573	0.0106 (0.0102) p=0.3013	0.0578 (0.0056) p=0.0000	0.0259 (0.0044) p=0.0000	-0.0049 (0.0030) p=0.1025
8th Principal Component	-0.0202 (0.0060) p=0.0007	0.0397 (0.0045) p=0.0000	-0.0379 (0.0093) p=0.0001	0.0118 (0.0055) p=0.0320	-0.0084 (0.0043) p=0.0472	0.0074 (0.0028) p=0.0078
9th Principal Component	-0.0229 (0.0062) p=0.0002	-0.0054 (0.0048) p=0.2543	0.0113 (0.0096) p=0.2371	-0.0015 (0.0051) p=0.7727	-0.0056 (0.0041) p=0.1727	-0.0019 (0.0025) p=0.4481
10th Principal Component	0.0041 (0.0056) p=0.4570	-0.0025 (0.0043) p=0.5596	-0.0133 (0.0102) p=0.1918	0.0289 (0.0050) p=0.0000	-0.0067 (0.0043) p=0.1171	-0.0070 (0.0028) p=0.0132
Grades Completed	0.0434 (0.0037) p=0.0000	0.0544 (0.0028) p=0.0000	0.0325 (0.0056) p=0.0000	0.0479 (0.0030) p=0.0000	0.0452 (0.0031) p=0.0000	0.0501 (0.0017) p=0.0000
Potential Experience	0.0173 (0.0020) p=0.0000	0.0259 (0.0015) p=0.0000	0.0284 (0.0035) p=0.0000	0.0398 (0.0019) p=0.0000	0.0262 (0.0016) p=0.0000	0.0350 (0.0011) p=0.0000
Region of Residence: North Central	-0.0771 (0.0159) p=0.0000	-0.0495 (0.0097) p=0.0000	-0.1609 (0.0313) p=0.0000	-0.0817 (0.0164) p=0.0000	-0.1272 (0.0093) p=0.0000	-0.0838 (0.0063) p=0.0000
Region of Residence: South	-0.0874 (0.0134) p=0.0000	-0.0475 (0.0082) p=0.0000	-0.1469 (0.0268) p=0.0000	-0.1551 (0.0123) p=0.0000	-0.1121 (0.0096) p=0.0000	-0.0589 (0.0066) p=0.0000
Region of Residence: West	-0.0541 (0.0218) p=0.0131	0.0690 (0.0121) p=0.0000	0.0423 (0.0246) p=0.0860	-0.0082 (0.0112) p=0.4643	-0.0712 (0.0109) p=0.0000	0.0149 (0.0072) p=0.0388
Local Unemployment Rate: 6% - 9%	0.0008 (0.0147) p=0.9546	-0.0287 (0.0102) p=0.0048	-0.0218 (0.0253) p=0.3891	-0.0656 (0.0127) p=0.0000	-0.0391 (0.0110) p=0.0004	-0.0372 (0.0069) p=0.0000
Local Unemployment Rate: Over 9%	-0.0414 (0.0162) p=0.0108	-0.0380 (0.0120) p=0.0016	-0.0815 (0.0235) p=0.0005	-0.1420 (0.0121) p=0.0000	-0.0631 (0.0108) p=0.0000	-0.0749 (0.0068) p=0.0000
National Unemployment Rate: 6% - 9%	-0.0263 (0.0180) p=0.1449	-0.0305 (0.0116) p=0.0086	-0.0369 (0.0275) p=0.1798	-0.0087 (0.0149) p=0.5599	0.0046 (0.0131) p=0.7254	-0.0266 (0.0077) p=0.0006
National Unemployment Rate: Over 9%	-0.0358 (0.0276) p=0.1952	-0.0797 (0.0172) p=0.0000	-0.0380 (0.0423) p=0.3697	-0.0126 (0.0227) p=0.5801	0.0050 (0.0189) p=0.7926	-0.0358 (0.0107) p=0.0008
Year	-0.0061 (0.0025) p=0.0124	-0.0084 (0.0018) p=0.0000	-0.0162 (0.0040) p=0.0001	-0.0052 (0.0022) p=0.0184	-0.0092 (0.0020) p=0.0000	-0.0018 (0.0012) p=0.1357

1. Table updated on June 13, 1996
2. Excluded category for region of residence is northeast. Excluded category for local and national unemployment rate is less than 6%.

TABLE 8: SIMULTANEOUS EQUATION MODEL
DETERMINANTS OF OCCUPATION CHOICE AND WAGES
WAGE REGRESSIONS FOR WHITE COLLAR

Regression Using Stacked, Person-Year Observations
1 Common Unobserved Factor Estimated Non-Parametrically
Dependent Variable: Log Wages

Variable	Black Females	Black Males	Hispanic Females	Hispanic Males	White Females	White Males
Factor Loading	0.3667 (0.0104) p=0.0000	0.5607 (0.0156) p=0.0000	0.3558 (0.0116) p=0.0000	0.6107 (0.0194) p=0.0000	0.4277 (0.0061) p=0.0000	0.5188 (0.0071) p=0.0000
Intercept	0.0114 (0.1625) p=0.9441	-1.1524 (0.2733) p=0.0000	-1.1235 (0.1807) p=0.0000	-0.6300 (0.2991) p=0.0352	-1.1489 (0.0927) p=0.0000	-1.7993 (0.1322) p=0.0000
1st Principal Component	0.2169 (0.0059) p=0.0000	0.1955 (0.0120) p=0.0000	0.1505 (0.0067) p=0.0000	0.1888 (0.0159) p=0.0000	0.1221 (0.0044) p=0.0000	0.1189 (0.0080) p=0.0000
2nd Principal Component	-0.0455 (0.0042) p=0.0000	0.0416 (0.0098) p=0.0000	0.0512 (0.0065) p=0.0000	0.0776 (0.0104) p=0.0000	0.0661 (0.0029) p=0.0000	0.0399 (0.0049) p=0.0000
3rd Principal Component	0.0169 (0.0039) p=0.0000	0.0015 (0.0087) p=0.8603	0.0202 (0.0054) p=0.0002	0.0326 (0.0112) p=0.0036	-0.0330 (0.0033) p=0.0000	0.0625 (0.0052) p=0.0000
4th Principal Component	-0.0223 (0.0041) p=0.0000	0.0274 (0.0092) p=0.0028	0.0275 (0.0054) p=0.0000	-0.0082 (0.0110) p=0.4539	0.0055 (0.0028) p=0.0513	0.0086 (0.0050) p=0.0835
5th Principal Component	0.0067 (0.0046) p=0.1491	-0.0042 (0.0093) p=0.6534	-0.0041 (0.0051) p=0.4212	0.0021 (0.0115) p=0.8545	0.0008 (0.0029) p=0.7942	0.0375 (0.0042) p=0.0000
6th Principal Component	-0.0243 (0.0040) p=0.0000	-0.0169 (0.0092) p=0.0656	-0.0136 (0.0057) p=0.0168	0.0058 (0.0108) p=0.5918	-0.0091 (0.0027) p=0.0009	-0.0227 (0.0048) p=0.0000
7th Principal Component	0.0032 (0.0044) p=0.4676	-0.0305 (0.0098) p=0.0017	0.0344 (0.0053) p=0.0000	-0.0024 (0.0100) p=0.8134	-0.0065 (0.0030) p=0.0312	0.0004 (0.0044) p=0.9225
8th Principal Component	0.0169 (0.0044) p=0.0001	0.0242 (0.0102) p=0.0175	0.0020 (0.0055) p=0.7091	0.0177 (0.0099) p=0.0733	-0.0026 (0.0029) p=0.3712	0.0304 (0.0044) p=0.0000
9th Principal Component	0.0182 (0.0044) p=0.0000	0.0471 (0.0088) p=0.0000	-0.0179 (0.0050) p=0.0004	0.0333 (0.0107) p=0.0017	-0.0293 (0.0029) p=0.0000	0.0086 (0.0047) p=0.0656
10th Principal Component	-0.0067 (0.0039) p=0.0854	-0.0331 (0.0095) p=0.0005	0.0127 (0.0050) p=0.0107	0.0359 (0.0110) p=0.0011	0.0023 (0.0026) p=0.3598	-0.0047 (0.0042) p=0.2689
Grades Completed	0.0873 (0.0026) p=0.0000	0.1521 (0.0052) p=0.0000	0.0850 (0.0029) p=0.0000	0.1011 (0.0057) p=0.0000	0.0996 (0.0016) p=0.0000	0.1149 (0.0025) p=0.0000
Potential Experience	0.0295 (0.0016) p=0.0000	0.0264 (0.0036) p=0.0000	0.0147 (0.0020) p=0.0000	0.0424 (0.0036) p=0.0000	0.0197 (0.0011) p=0.0000	0.0333 (0.0015) p=0.0000
Region of Residence: North Central	-0.1688 (0.0115) p=0.0000	-0.2183 (0.0195) p=0.0000	-0.1679 (0.0180) p=0.0000	0.0401 (0.0301) p=0.1838	-0.1164 (0.0059) p=0.0000	-0.1149 (0.0086) p=0.0000
Region of Residence: South	-0.1886 (0.0093) p=0.0000	-0.2557 (0.0163) p=0.0000	-0.1809 (0.0134) p=0.0000	-0.1489 (0.0228) p=0.0000	-0.1596 (0.0057) p=0.0000	-0.0549 (0.0088) p=0.0000
Region of Residence: West	-0.0401 (0.0141) p=0.0044	-0.0142 (0.0250) p=0.5711	-0.1186 (0.0129) p=0.0000	-0.0428 (0.0233) p=0.0661	0.0032 (0.0067) p=0.6372	-0.0034 (0.0099) p=0.7290
Local Unemployment Rate: 6% - 9%	-0.0708 (0.0102) p=0.0000	-0.0977 (0.0177) p=0.0000	-0.0475 (0.0134) p=0.0004	-0.0288 (0.0240) p=0.2299	-0.0805 (0.0063) p=0.0000	-0.0582 (0.0087) p=0.0000
Local Unemployment Rate: Over 9%	-0.0988 (0.0125) p=0.0000	-0.1079 (0.0211) p=0.0000	-0.1285 (0.0129) p=0.0000	-0.1199 (0.0244) p=0.0000	-0.1272 (0.0072) p=0.0000	-0.1327 (0.0096) p=0.0000
National Unemployment Rate: 6% - 9%	-0.0149 (0.0126) p=0.2389	-0.0370 (0.0211) p=0.0795	-0.0301 (0.0151) p=0.0466	-0.0509 (0.0270) p=0.0597	-0.0282 (0.0074) p=0.0001	-0.0627 (0.0102) p=0.0000
National Unemployment Rate: Over 9%	-0.0224 (0.0195) p=0.2511	-0.1266 (0.0323) p=0.0001	-0.0386 (0.0271) p=0.1546	-0.0159 (0.0431) p=0.7127	-0.0227 (0.0120) p=0.0583	-0.0607 (0.0157) p=0.0001
Year	0.0041 (0.0021) p=0.0442	0.0064 (0.0037) p=0.0808	0.0204 (0.0023) p=0.0000	0.0068 (0.0040) p=0.0910	0.0174 (0.0012) p=0.0000	0.0219 (0.0017) p=0.0000

1. Table updated on June 13, 1996
2. Excluded category for region of residence is northeast. Excluded category for local and national unemployment rate is less than 6%.