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The Changing Roles of Education and Ability in Wage Determination*

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Abstract

This study examines changes in returns to formal education and cognitive skills over the last 20 years using the 1979 and 1997 waves of the National Longitudinal Survey of Youth. We show that cognitive skills had a 30%-50% larger effect on wages in the 1980s than in the 2000s. Returns to education were higher in the 2000s. These developments are not explained by changing distributions of workers' observable characteristics or by changing labor market structure. We show that the decline in returns to ability can be attributed to differences in the growth rate of technology between the 1980s and 2000s.

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1 Introduction

Families and policy makers implement various strategies to enhance an individual's capacity to succeed in the labor market. Investment in an individual's human capital is one of the most important channels to achieve this goal. A large literature documents that workers with higher educational attainment have higher earnings and that this wage differential has been increasing over time. The standard estimates obtained using the least-squares method show that between the 1980s and 2000s there was an increase in returns to education in the range of 20% - 50% (see, for example, Goldin and Katz 2007, among others). Many studies argue that this growth was more rapid in the first half of the 1980s. There is also some debate about the interpretation of the rising return to schooling: whether it is due to an increase in return to formal education or a rising return to cognitive ability. This debate focuses on developments in the 1980s and concludes that the increase in return to cognitive ability explains much of the increase in return to education in the 1980s (see, for example, Cawley, Heckman, Lochner and Vytlacil 1998). In this study, we examine changes in wage structure between the 1980s and 2000s and show that the return to cognitive skills has declined substantially over this period while the return to schooling has increased.

Using data from the 1979 and 1997 National Longitudinal Surveys of Youth (NLSY79 and NLSY97, respectively) we evaluate to what extent schooling and cognitive skills, captured by Armed Services Vocational Aptitude Battery (ASVAB) tests, affect wages of 18 - 28 years old men and women and how this relationship has changed between the 1980s and 2000s.[1,2] We show that during these two decades the return to cognitive ability has declined by 30% - 50% for men and women. We also show that the slowdown in increase in return to education after the 1990s is less pronounced when controlling for ability. These changes in returns are persistent across various population groups, hold for different ability measures and robust in various specifications.

We consider various channels that could lead to such large decline in the ability premium in the 2000s. First, we examine changing distributions of characteristics and skills and assess

[1] ASVAB scores are extensively used in the literature as a measure of cognitive achievement, aptitude and intelligence. See for example Carneiro and Heckman (2002) and Belley and Lochner (2007).

[2] The data are from 1980 - 1991 waves in NLSY79 and the 1999 - 2008 waves in NLSY97.

how the returns to education and cognitive skills would have changed if the observable population characteristics remained constant between the 1980s and 2000s. The NLSY97 respondents are younger on average than the NLSY79 respondents even if constraining for the same age group. The cohorts also have different distributions of family background characteristics: the respondents of the 1997 cohort have more educated parents and are more likely to live in single-parent households. We reweight the samples applying methodology proposed by DiNardo, Fortin and Lemieux (1996) to match NLSY79 and NLSY97 age and family background distributions, and use reweighted data in estimations. Changing distributions of various observed characteristics cannot explain the decrease in return to cognitive ability. Second, we examine whether changing labor market structure can explain the decline in return to cognitive skills. We perform a similar reweighting procedure to match the distributions of occupations and industries across surveys, and show that these adjustments do not affect the results. Third, we examine the role of measurement errors in test scores and show that these cannot explain our findings.

To further study changes in skill prices between the 1980s and 2000s, we examine developments in wage dynamics. In the 1980s estimations, returns to education decline with experience and returns to ability increase with experience. These relationships are weaker in the 2000s. Incorporating dynamics into the model results in no significant difference between returns to cognitive skills at entry wages in the 1980s and 2000s, suggesting that changing wage dynamics explain the overall decline in returns to cognitive skills, for men and women. We explain these outcomes within two frameworks, human capital accumulation theory, as in Ben-Porath (1967), and employer-learning model, (see, for example, Farber and Gibbons, 1996; Altonji and Pierret, 2001). Within the human capital accumulation framework, changing coefficients of the dynamic wage equation reflect effects of changing technology and structural labor market changes on investment and depreciation of human capital. Using this framework, we examine the Nelson-Phelps hypothesis, which posits that skills are most valuable when workers are adapting to a changing environment but as the rate of technological change slows down, formal education becomes relatively more important for labor market outcomes. Within the employer-learning framework, changing wage dynamics reflect changes in signaling, screening and learning mechanisms, associated with reforms in education system following technological innovations. Both explanations are consistent with a changing state of workplace technology. We construct technology growth indexes employing Cummins and Violante (2002) methodology and show that there was a slowdown in growth starting in the late 1990s, (in line with finding in other studies, see, for example, Greenwood and Yorokoglu, 1997 and Katz, 2000). We also argue that changing technology has led to reforms in schooling system resulting in a more relevant and merit-oriented education.

Previous studies that examine changes in returns to cognitive skills focus on developments in the 1980s and find an increasing or weakly increasing trend. For example, Blackburn and Neumark (1993) use 1979 - 1987 waves of the NLSY79 and report that the rise in return to education during that period was concentrated among those with both high education and high ability.[3] Grogger and Eide (1995) using 1970s - 1980s data, find that controlling for ability reduces the rising return to schooling.[4] Bishop (1991), using the 1981 - 1986 waves of NLSY79, finds that the return to cognitive skills rose in cross-section results but finds mixed results using panel data. These studies decompose the increasing return to schooling using panel data or repeated cross-section samples of same cohorts over time. Given the data structure, the identification of age, cohort and time effects, is merely possible and therefore further parametric assumptions are required to conclude whether the estimated increase in return to ability is due to changes in the value of cognitive skills or because ability becomes more valuable with work experience. Heckman and Vytlacil (2001) provide an extensive study using a large number of specifications and demonstrate the sensitivity of the results to the posed assumptions.

Murnane, Willett and Levy (1995) solve the identification problem by examining two different cohorts. They draw from the National Longitudinal Study of the High School Class of 1972 (NLS72) and the High School and Beyond (HSB) data to compare wages of 24 year old males in 1978 and 1986. They conclude that 38% of the rise in return to education during this period can be

[3]Blackburn and Neumark (1993) measure cognitive ability using an average score of three subtests in the ASVAB.

[4]Grogger and Eide (1995) use the National Longitudinal Study of the High School Class of 1972 (NLS72) and the High School and Beyond (HSB). Cognitive skills are measured by standardized test scores and high school grades. They use a math test, a vocabulary test, and a "mosaic" test that measures perceptual speed and accuracy.

attributed to a rise in return to ability, measured by scores in a math test. There is still a question whether their results are unique to the age they choose and the two years they analyze.

An alternative to estimating the trend in the return to cognitive ability as measured by scores on standardized tests is to examine patterns of wage dispersion. For example, Juhn, Murphy and Pierce (1993) attribute the increasing variance of wage residuals in the 1980s to an increase in the demand for unobserved skill. Chay and Lee (2000) examine the changing distributional patterns and show that the return to unobserved skills were increasing, but argue that it cannot be large enough to account for the full increase in the return to schooling. Taber (2001) finds that an increase in the demand for unobserved ability could play a major role in the growing college premium.

Our study extends the previous work by using cross-decade comparisons of returns to schooling and cognitive ability, measured by standardized test scores. Using two NLSY cohorts allows to identify age, cohort and time effects. Previous studies focused on developments in the 1980s and early 1990s. We examine the 1980s - 2000s period and document a large decline in returns to cognitive skills and an increase in return to schooling.

The paper proceeds as follows. Section 2 describes the datasets in detail. Our main empirical results are reported in Section 3. In this section we examine the changing roles of cognitive skills and formal education in wage determination. We also perform sensitivity analyses to evaluate whether differences in skills distributions and test-taking conditions can explain the outcomes. Section 4 explores the dynamics of wages and evaluates findings within the human capital and employer-learning theories. Here we also document the developments in the state of technology over the 20 years. Section 5 concludes the paper.

2 Data

For the analysis, we draw data from the 1979 and 1997 waves of the National Longitudinal Survey of Youth (NLSY). NLSY79 provides a nationally representative sample of 12686 young men and women who were aged 14 - 22 in 1979, and NLSY97 samples 8984 individuals who were aged

12-16 in 1997. We employ both cross-sectional and supplemental samples (excluding the military supplement) and use the base year weights provided by the Bureau of Labor Statistics (BLS) to achieve representativeness of the population.[5] We pool observations for 1980 - 1991 for NLSY79 and for 1999 - 2008 for NLSY97.

The data contain detailed information on individuals, including measures of cognitive ability, education, labor market activity and other family and personal characteristics. Many of these variables are compatible across the 1979 and 1997 cohorts, but some require further adjustments to facilitate comparison across samples. Altonji, Bharadwaj and Lange (2012) provide a detailed analysis of each dataset and suggest methods to achieve compatibility. We follow their methodology where applicable.[6]

Individuals enrolled in school and in military service are excluded from the analysis. We consider individuals who have achieved their highest degree, work at least 20 hours per week and earn real hourly wages within the range of 3 to 100 dollars (in 2007 prices, deflated using the CPI). We exclude individuals with missing information on key variables. Since the oldest individual in the NLSY97 turned 28 in the 2008 wave of data, we limit our analysis to the 18 - 28 age group.[7] The final samples of men contain 21062 observations in the 1979 cohort and 12442 in the 1997 cohort. The number of individuals in each cohort is 4635 and 3030, respectively. For women we use 17227 observations in NLSY79 and 10889 observations in NLSY97, pooling information on 4438 and 2943 respondents respectively.

Table 1 summarizes the variables used from NLSY97 and NLSY79. The statistics are calculated using the standard BLS weights and also using constructed weights to match the age distribution of NLSY97 to that of NLSY79.[8]

Comparison of the age statistics in NLSY79 and NLSY97 samples shows the main effect of the

[5]For some estimations we construct alternative sets of weights to evaluate effects of changing distributions of skills on labor market outcomes. Next section describes this procedure in detail.

[6]Some studies have raised a concern regarding the representativeness of the NLSY97. These issues are discussed in detail by Altonji et al. (2012), and we adopt their assumption that by using the survey weights, the available data are representative of the 1997 and 1979 populations. Attrition patterns are also addressed by Altonji et al., who argue that it does not constrain the analysis.

[7]A very small number of respondents were age 29 at the time of the 2008 wave of the NLSY97.

[8]The reweighting procedure is discussed in detail in subsection 3.1.

age-reweighting procedure. The mean age is lower in NLSY97 when using the standard weights, due to a higher concentration of younger workers. The age statistics are practically identical when adjusting the NLSY97 sample to have the age distribution of NLSY79. Other variables that are sensitive to the choice of weights are hourly wage, work experience and education. The means of these variables increase when the age-reweighted NLSY97 sample is used.

Both data sources contain comparable measures of ability, captured by the ASVAB, which is a sequence of tests that cover basic math, verbal, and manual skills. Math skills are measured by scores on the Arithmetic Reasoning, Numerical Operations and Mathematics Knowledge sections of the ASVAB. Verbal skills are measured by the scores on the Word Knowledge and Paragraph Comprehension sections of the ASVAB. We construct the Armed Forces Qualifications Test (AFQT) score using the definition from NLSY79, which is based on scores from Arithmetic Reasoning, Numerical Operations, Word Knowledge and Paragraph Comprehension tests. We also define Math and Verbal measures using the relevant tests in ASVAB. "Math" is defined as an average of the Arithmetic Reasoning, Mathematics Knowledge and Numerical Operations sections. "Verbal" ability is measured by averaging the scores on the Word Knowledge and Paragraph Comprehension sections of the ASVAB.

We address two important compatibility issues which arise due to differences in survey and test methodologies between the NLSY79 and NLSY97. First, participants in the NLSY79 took the ASVAB exam in the summer of 1980 when they were 15-23 years old. For the NLSY97 cohort, the test was administered when individuals were between 12 and 17 years old. Second, the NLSY79 cohort was administered a pencil and paper (P&P) version of the ASVAB while the NLSY97 participants took a computer assisted test (CAT) format. For NLSY97 we use ASVAB scores provided by Daniel Segall, who develops a mapping that assigns scores to equalize percentiles on the various subtests of the P&P and the CAT. The mapping procedure is described in detail in Segall (1997). To adjust scores by age we follow a procedure described in Altonji et al. (2012).[9]

Altonji et al. exploit the overlap in the test-taking age across both cohorts by applying an

[9] We thank Joseph Altonji, Prashant Bharadwaj and Fabian Lange for help with the ASVAB data.

equipercentile procedure on each cohort with the population of test takers who were 16 year old when taking the test. In our estimations we use age- and format-adjusted test scores.

Figure 1 shows the distributions of ability measures for each cohort. Table 1 provides means and standard deviations of the measures. The AFQT score can take values between 70 and 280 but actual scores fall within 80 - 220 range. Math and Verbal test scores can range within 20 and 80, with actual scores falling within the 20 - 70 interval. We use normalized test scores in estimations, such that the relevant sample mean is zero and the standard deviation is one.

The ASVAB scores are widely used in the literature as a measure of cognitive achievement, aptitude and intelligence. Some studies argue that human capital investments affect AFQT scores which may constrain the identification of education and ability effects on earnings, see for example Neal and Johnson (1996) or Cascio and Lewis (2006). To break the link between schooling and AFQT scores we test the robustness of our results for a subgroup of individuals who took the test when they were 16 years old (the youngest overlap age in the two samples) and attended the 9th grade. Another concern is that individuals with higher AFQT scores are more likely to complete higher education levels and that this selection into schooling could be changing over time. We find that the correlation between the AFQT scores and years of schooling is fairly stable, 0.55 in NLSY79 and 0.53 in NLSY97 for males and 0.50 vs. 0.56 for females, (using the age reweighted sample), which allows to compare returns to cognitive skills and education across cohorts.

In our main estimations we use indicators of schooling levels. There is an increase in overall education levels which is more pronounced if using the age-reweighted NLSY97 sample. For example, for male workers, the proportion of individuals with a bachelor's degree is similar, 12% and 13% respectively. If using reweighted sample, the average college graduation rate is higher in the NLSY97 sample, and stands at 16%. For women, the college graduation rates increases from 16% to 19%. After the age adjustment the graduation rate increases to 21% for the later cohort.

Years of schooling are not used in main estimations since, on average, it takes longer for the later cohort to complete their degrees. For example, a 25 year old individual (male or female) with a bachelor's degree has 15.9 years of schooling on average in NLSY79, but 16.5 years in NLSY97.

In the entire NLSY79 sample the mean value of years of schooling is 12.4 for males and 12.8 for females. In the 1997 sample, the average years of education are 12.5 for males and 13.1 for females. In the age-reweighted sample, mean years of schooling are 12.7 and 13.3 for men and women, respectively.

Work experience is defined as age minus schooling minus six. There are differences across cohorts, but these are smaller if reweighting the samples by age. Hours of work are decreasing over time for men and women. We use hourly real wages in 2007 prices for both cohorts. The unemployment rate is used to summarize macroeconomic conditions. Finally, the proportion of black workers is higher in the NLSY97 sample. This is partially due to sampling methodology and partially because of a higher attrition of black workers in the earlier waves of the survey. This issue is discussed in more detail in Altonji et al. (2012).

Table 1 also summarizes information on the family background of the respondents: parental education, intact family and family income. NLSY79 and NLSY97 record family income in early survey years, we use average family income when participants were aged 16-17, excluding those not living with their parents at that time.[10] Family income is denominated in 2007 dollars, using the CPI. Mean family income is fairly constant over time but its dispersion has increased. Family structure information is provided by an indicator variable for whether both parents were living with the child when he/she was 14 years old in the NLSY79, and in 1997 (i.e., ages 13-17) in the NLSY97. There are more single-parent households in the later cohort. Finally, Table 1 shows statistics on parental years of schooling, which are higher in the 2000s.

3 Estimation

The analysis focuses on estimating wage functions using NLSY79 and NLSY97, treating men and women separately. Tables summarize selected output results, full tables are provided in Appendix A. To evaluate the changes in effects of schooling and cognitive skills on earnings, we employ

[10]Family income measure is only available to the younger cohorts of NLSY79, those born between 1961 and 1964. When income is available only for age 16 or age 17 and not both, we use the available measure.

identical estimation specifications for each cohort. The following equation is estimated,

$$\ln wage_{it} = EDUC_i\beta_1^T + \beta_2^T ABILITY_i + \beta_3^T EXP_{it} + \beta_4^T EXP_{it}^2 + X_{it}\beta_5^T + \varepsilon_{it}, \qquad (1)$$

where $wage_{it}$ is the real hourly wage rate paid to an individual i at time t, $EDUC_i$ is a vector of education dummy variables, $ABILITY_i$ measures cognitive skills measured by either the AFQT score, the average Math score or the average Verbal score, EXP_{it} corresponds to labor market experience, X_{it} is a vector of personal characteristics and family background variables, upper scripts on the coefficients denote the cohort used in estimation, $T \in \{NLSY79, NLSY97\}$. The term ε_i is a vector of unobserved skills and all other unobserved factors that determine wages. We assume that the distribution of ε_i, conditional on observed variables, does not change over time. Thus, the changing distributions of education, ability or X account for any changes in the marginal distribution of ε.[11] The datasets pool information for individuals over time. Therefore, the coefficients of education and ability may reflect not only prices of these skills, but also the effects of human capital depreciation and on-the-job training or learning-by-doing. We discuss the interpretation of the coefficients in the next section, where we estimate the returns to formal schooling and test scores in a dynamic wage model.

The results are reported in Table 2. Columns (1) and (2) report effects of education on wages without controlling for test scores. Returns to education in this specification display modest increases over time for men and women, confirming patterns described in other studies. Columns (3) - (8) display estimation results that include ability measures. We document a significant decline in return to ability, β_2, over the 20 years. The differences between the coefficients on ability measures are statistically significant at a 1% confidence level in all specifications, for men and women. For men, an increase in the AFQT score by one standard deviation is associated with a 8.5% increase in hourly wage for the 1979 cohort, but only with a 3.4% increase for the 1997 cohort. For women,

[11]To increase quality of this assumption we include a detailed vector of controls in all estimations. We also provide results by education, race and test taking motivation to further evaluate the importance of unobserved characteristics.

the effect of one standard deviation increase in AFQT score on the real wage rate drops from 10.3% to 6.4%. Similar large declines in returns to cognitive skills are documented when using alternative measures, the coefficient of Math (Verbal) score has declined by 54% (64%) for men and by 34% (32%) for women.

When controlling for test scores, the increase in returns to education is more pronounced at all levels for men and women. For instance, the return to bachelor's degree (compared to high school dropouts) in the 1980s is 55% for men and 63% for women in the specification that excludes the ability measure (column 1 in Table 2). These returns are 61% and 69%, for men and women, in the 2000s (column 2 in Table 2). Estimates obtained from the model that includes the AFQT score are 40% and 48%, for men and women, in the 1980s, increasing to 56% and 60% in the 2000s. Thus, for men, the return to bachelor's degree is 11% higher in the 2000s if AFQT is not included, and it is 38% higher if controlling for AFQT in Equation (1). (For women, these changes are 10% and 27%, respectively). These outcomes also imply that the ability bias is larger when estimating the wage equation for the 1980s.[12]

Table 3 reports estimation results of the wage equation controlling for additional characteristics, as well as by education level and by race. Including family background controls (Model 1, Panel A): family income, parental education and intact family indicator, reduces the coefficients of AFQT score. Adding occupation and industry indicators (Model 2, Panel A) reduces the coefficients of AFQT further. However, the proportional decline in the AFQT coefficient does not change much when including additional controls, and the differences in returns to cognitive skills between the 1980s and 2000s are statistically significant for men and women.

Returns to ability measures by education are reported in Panel B of Table 3. These results show that the decrease in returns to ability occurred within and between different education levels for men and women. The differences in ability coefficients across cohorts are statistically significant at a 1% - 5% level in all specifications. The same pattern is observed in Panel C, Table 3, which records estimation results by race. The returns to ability decrease for white and black men and

[12] Returns to experience do not change significantly when controlling for AFQT scores, for both cohorts. See Table A.1, Appendix A.

women, although the magnitude of the decline is higher for white workers. The differences are significant at a 1% level for men and at a 5% - 10% for women.

Equation (1) is also estimated using the alternative definition of the schooling variable. Columns (1), (2) and (5), (6) in Table 8 report estimation results using years of schooling (highest grade completed) for men and women. In these specifications, AFQT coefficient drops from 0.0731 to 0.0305 for men, and from 0.0934 to 0.0687 for women.

3.1 Robustness/ Sensitivity Analysis

This section provides additional robustness tests. First, we check whether measurement errors in test scores can explain the outcomes.[13] Second, NLSY97 respondents differ from NLSY79 respondents in age distribution. Individuals in NLSY97 are younger on average than those in NLSY79, (age statistics are reported in Table 1). We construct weights to adjust age distributions and estimate equation (1). Third, we adjust distributions of other observable variables and match labor market characteristics.

Measurement errors Section 2 describes the procedure to obtain comparable test score distributions across samples. We also estimate equation (1) for respondents who took the ASVAB test when they were 16 years old, which is the overlapping age to take the test across NLSY cohorts. To perform these estimations we use scores reweighted only using the mapping to obtain comparable distributions of P&P and CAT formats, described in Segall (1997). The results, reported in Table 4, show a significant decline in returns to ability over the 20 years, in all specifications, for men and women. The differences are statistically significant at a 5% level for men and at a 1% level for women.[14]

To further examine the role of potential measurement errors, we perform TSLS estimations

[13] In addition to format differences and age differences at the time of test, there are differences in the monetary award for participating in the ASVAB. Respondents in NLSY79 were paid $50 (equivalent to $97 in 1997) and respondents in NLSY97 were paid $75. Higher compensation in 1979 than in 1997 may have lead to higher measurement errors in test scores in NLSY97.

[14] Further constraining the sample to include only respondents who were 16 years old and completed the 9th grade at the time of the test, delivers very similar estimates, reported in Table A.8, Appendix A.

using SAT score to instrument for the AFQT score.[15] The TSLS results, along with the OLS results for the sample with valid SAT scores, are reported in Table 5. First stage results show strong correlation between the SAT and AFQT scores which did not change much over time. Second stage results show larger effects of AFQT on earnings than the OLS results, suggesting that measurement errors might be important. On the other hand, the proportional decline between the coefficients for NLSY79 and NLSY97 cohorts remains above 50% and is statistically significant.

The amount of financial compensation to participate in ASVAB was lower for the later cohort and could affect test performance through incentives and motivation. The respondents in the NLSY97 survey were asked about the reason they took the ASVAB test, and there were 7 possible responses: (1) Because it's an important study; (2) To see what it's like to take a test on a computer; (3) To see how well I could do on the test; (4) To learn more about my interests; (5) Family member wanted me to take it; (6) To get the money; or (7) I had nothing else to do today. We split the 2000s sample into two groups, "motivated" - with responses from (1) to (4), and "non-motivated" - for responses (5) to (7).[16]

The estimation results for men and women, for each subgroup, are reported in Table 6. Higher motivated respondents have a higher test score coefficient than the less-motivated respondents. We partly attribute this difference to measurement errors in test scores. Test scores are likely to be less informative about the true cognitive ability of a respondent who puts lower effort into the test. This result may also suggest that there is a correlation between unobservable personal characteristics that affect wages and the reason to take the test, but including the motivation indicator as a control in equation (1) does not affect the estimated returns to schooling and cognitive skills, (Table A.12, Appendix A). The return to cognitive ability estimated for the 1980s is two to four times larger than the estimated return in 2000s, for each subgroup. The differences are statistically significant

[15]The SAT is a standardized test for college admissions in the United States. In the NLSY79, SAT score is collected in 1980, 1981 and 1983, in the high school transcript survey, and available for 950 respondents, majority of these individuals were expected to graduate high school in the survey year. In NLSY97, SAT scores are also available in transcript surveys of 1999-2000 and 2004 waves, for 1407 respondents who graduated high school or had reached 18 and were no longer enrolled.

[16]The results are not very sensitive to the division of individuals into subgroups. For example, estimating equation (1) using only individuals who chose answer (4) vs. those who chose (7), provides very similar estimates.

at a 1% level. There is no statistically significant difference in returns to schooling between the "motivated" and "non-motivated" samples, (see Table A.11, Appendix A).

Estimation of Propensity Scores and Reweighting We reweight both samples to generate similar distributions of observable characteristics. To construct the weights, we follow the methodology developed by DiNardo, Fortin and Lemieux (1996). First, we pool data from both surveys and use Probit models to estimate the probability that an observation is in the NLSY79, conditional on variables of interest. These probability estimations use sampling weights provided by the BLS to achieve population representative samples. Second, we construct the weights using the following weight function, $\psi(Z) = \frac{P(d1979|Z)}{1-P(d1979|Z)}$. Here $d1979 \in \{0,1\}$ is an indicator that a given observation is taken from NLSY79, and $P(d1979|Z)$ is the conditional probability of appearing in NLSY79, conditional on observable characteristics Z. When estimating the propensity scores we consider various sets of characteristics. Weight function, $\psi(Z)$, is used to reweight the observations in NLSY97 to obtain nearly equal distributions of variables of interest across the two surveys. Reweighted data are used to estimate the wage equation controlling for changing distributions of observable characteristics and labor market structure.

Age Both samples are constructed to have the same age range, 18 - 28 years old, but age distributions are not similar. The NLSY97 sample is younger, on average, than the NLSY79 sample. We construct weights for the NLSY97 sample to match the age distributions. First, we pool data from NLSY79 and NLSY97, and use a Probit model to estimate the propensity score $P(d1979|age, age^2, age^3)$, where $d1979 \in \{0,1\}$ using sampling weights provided by BLS for NLSY79 and NLSY97. These propensity scores are used to construct weights to statistically adjust the samples. We apply the following weighting function, $\psi(age, age^2, age^3) = \frac{P(d1979|age,age^2,age^3)}{1-P(d1979|age,age^2,age^3)}$. These weights are used to reweight the NLSY97 observations. Age summary statistics before and after the reweighting, and the effects of reweighting on other variables of interest, are given in Table 1. Age adjustment affects not only the age distribution of the NLSY97 sample but also average schooling, experience and wages, which increase on average, and ability scores, which decrease on average.

Estimation results using the age-adjusted data are in columns (1) and (2) of Table 7. The age-reweighted returns to ability in the 2000s are slightly higher than those obtained using the standard weights but significantly lower than the 1980s returns.[17]

Family Background Summary statistics of family background variables, in Table 1, show several important developments over the 20 years. Parental education and proportion of single-parent families are higher in the 2000s. Family background determines skill development and economic decision-making, therefore we want to match distributions of these variables when estimating returns to skills. We construct a new set of weights using a model that includes age variables, mother's and father's education, family income, intact family indicator, number of siblings and indicator of Hispanic origin. Family income variable is only available for a subset of respondents, therefore, we construct two sets of weights, including and excluding the family income, and report two sets of estimates.

Using more flexible forms of propensity models also leads to obtaining extreme values for the propensity weights. These are generated because some combinations of characteristics are much more likely in NLSY79, which leads to very high corresponding weights; and some combinations are much more likely in NLSY97, in which case the weights are very low. To limit the influence of observations with extreme weights we focus on 99% of the sample, excluding the 99th percentile.[18]

We reweight the NLSY97 sample using constructed weights and report results in Table 7, columns (3) - (6).[19] The results suggest that changing distributions of family characteristics do not explain the decline in returns to cognitive skills.

[17] We reweight the NLSY97 sample to make its age distribution look like that of the NLSY79. The choice of base distribution does not change our conclusions about returns to education and ability.

[18] To examine the sensitivity of results to trimming extreme weights, we confirmed that using 99.5% of the sample has almost no effect on the results.

[19] The estimates and sample sizes of the NLSY79 cohorts are slightly different from those in Table 2 since we limit the sample to individuals with no missing values in variables used in propensity score estimations.

Occupational and Industrial Shifts We also examine whether the change in return to cognitive skills can be attributed to changes in labor market structure. Many studies document and examine the causes and consequences of structural change in the labor market, for example, Acemoglu (2002) argues that technical change over the past sixty years has been skill-biased. We test how the returns to cognitive ability and schooling would have changed if there were no shift in the distributions of industries and occupations over time. We use age variables, family background variables, occupations and industries indicators, to construct another set of weights for NLSY97. Estimation results obtained using these weights are reported in columns (7) and (8) of Table 7. The effect of structural change on the estimates is relatively small for both men and women.

4 Wage Dynamics and Returns to Cognitive Skills

We estimate equation (1) and show that the return to cognitive skills has declined substantially and the return to formal education has increased between the 1980s and 2000s. Here we estimate a dynamic wage specification, allowing for variation in education and ability differentials by work experience. For each cohort, $T \in \{NLSY79, NLSY97\}$, we estimate the following equation,

$$\begin{aligned} \ln wage_{it} =& \eta_1^T EDUC_i + \eta_2^T ABILITY_i + \eta_3^T EXP_{it} \times EDUC_i + \\ & \eta_4^T EXP_{it} \times ABILITY_i + \eta_5^T EXP_{it} + \eta_6^T EXP_{it}^2 + X_{it}\eta_7^T + \omega_{it}. \end{aligned} \quad (2)$$

Table 8 reports key estimation results of equation (2). In these estimations NLSY79 sample is weighted using sampling weights provided by the BLS and NLSY97 sample is weighted using constructed weights to match age distributions in NLSY79. Columns (1), (2), (5) and (6) report results obtained using equation (1) including a continuous schooling variable. These results are quite similar to those reported in Table 2, and show significant declines in returns to cognitive skills over the 20 years and higher returns to education in the 2000s.

Columns (3) and (4) report estimation results of equation (2) for men. The coefficients of experience-ability and experience-education interactions are lower (in absolute value) and not significantly different from zero in NLSY97. Incorporating dynamics into the model reduces the coefficient of AFQT for NLSY79, η_2^{79}, and results in no significant difference between returns to ability at entry wages in the 1980s and 2000s. Results for women are reported in columns (7) and (8). There is a decline in returns to ability with experience, measured by η_4^{79} and η_4^{97}. The decline in returns to education with experience is more substantial in the 2000s. Introducing wage dynamics into the model yields very similar returns to AFQT at entry wages across cohorts. The results suggest that changing wage dynamics explain the overall decline in returns to cognitive skills for men and women.

We interpret these findings within two alternative frameworks which use similar empirical specifications, human capital accumulation theory and employer-learning theory. The human capital hypothesis, as in Ben-Porath (1967), suggests that ability may affect post-schooling investments in human capital, and that formal education may become obsolete over time. Within this theory, changing coefficients of the dynamic wage equation reflect changing technology, structural changes and their effects on human capital accumulation process. The employer-learning theory argues that wages are determined by the expected value of the worker's productivity conditional on observable characteristics and past performance. In this framework, employee's education is an important initial signal to the employer about his or her potential unobserved productivity. As the worker accumulates experience in the labor market, the employer obtains more information on actual productivity, returns to schooling decrease and returns to unobserved ability increase. Within this framework, changing dynamic equation estimates reflect changes in signaling and learning mechanisms between the 1980s and 2000s.

In a conventional model of human capital accumulation, potential earnings increase with acquired skills, and individuals allocate their time between work and on-the-job training. We rely on empirical findings by Veum (1993) and assume that cognitive ability makes workers more trainable and more able workers receive more training.[20] We also assume that technological change

[20] Rubinstein and Tsiddon (2004) also show that in times of rapid technological change, individuals invest more on the job. They also show that during such transitions innate ability contributes more to the wage growth within each

may affect investments in training. For example, Bartel and Sicherman (1998) use the NLSY79 data from 1987 through 1992 and find that production workers in manufacturing industries with higher rates of technological change are more likely to receive formal company training. Gashi, Pugh and Adnett (2008) reach a similar conclusion using an administrative German dataset.

To add formality to the discussion, assume in any period t, the stock of human capital, H_t, is given by: $H_t = Q_t + (1 - \delta)H_{t-1}$, where Q_t denotes human capital produced in the current period t (investment) and δ is the depreciation rate. Formal schooling is denoted by H_0, which is the level of human capital upon entry to the labor market. A higher depreciation rate implies a faster depletion of formal and acquired on-the-job human capital. Human capital produced in current period, Q_t, is assumed to positively depend on personal ability level, the current stock of human capital and technology.

Using this human capital framework, the coefficient of interaction between education and experience in equation (2), η_3^T, picks up the depreciation of schooling as the worker gets older and may also capture the complementarity between schooling and experience. Human capital investment and on-the-job training processes are reflected in coefficients of experience, η_5^T and η_6^T, and the interaction between ability and experience, η_4^T. Results are reported in Table 8 show a weaker relationship between returns to cognitive skills and experience in the 2000s relatively to 1980s, for men and women, suggesting a decreasing importance of on-the-job training. The results for men also show no decline in returns to formal education with experience in the 2000s, the interaction coefficient is not different from zero, compared to -0.0049 in 1980s, suggesting a decreasing depreciation rate of formal schooling or increasing complementarity between schooling and experience over time. The increase in EXP^2 coefficient is also consistent with a declining depreciation rate in the 2000s or with a faster accumulation of human capital in the 1980s. The results for women also show a weaker relationship between returns to ability and work experience in the 2000s but do not show an overall decline in the role of on-the-job training. On the other hand, female labor market and labor force participation went through many changes not captured

education group than during times of a low rate of technological progress.

by the simple specification of equation (2). We attribute the differences between male and female outcomes to the developments in the labor market.[21]

We also examine the empirical findings in Table 8 within the employer-learning theory. This theory argues that when a worker enters the labor market, employers might be able to infer only partial information about the worker's productivity. In this framework, employee's education is an important signal to the employer about his or her potential productivity. With labor market experience, as the employer gradually obtains more accurate information on the productivity of an employee, the return to schooling decreases and the return to unobserved ability increases.[22] Equation (2) is similar to the empirical strategy developed in Altonji and Pierret (2001). Our estimation results are quite similar to those derived in their study when using the 1979 cohort, returns to ability increase with experience and returns to education decrease with experience. The results for the 1997 cohort show a weaker evidence of employer's learning about worker's ability in the 2000s. Within the employer-learning theory, these outcomes suggest that there were advances in signaling about ability between the 1980s and 2000s: employers obtain more information about employees' productivity from observing their formal education in the 2000s.

Within the human capital accumulation framework, the estimates are consistent with Nelson-Phelps (1966) hypothesis, which posits that skills are most valuable when workers are adapting to a changing environment but as the rate of technological change slows down, the relative productivity of formal education increases. Rapidly changing technological environment also implies a higher depreciation rate of human capital.[23] Within the employer-learning framework, the results are consistent with changing signaling and screening mechanism associated with reforms in education system following technological innovations.

[21] Among many others, Blundell, Bozio and Laroque (2011) document the over time changes in labor market participation for men and women. For example, labor force participation of 27 year-old men in the US was around 87% in 1977 and in 2007. For women these rates are around 55% and 70%, respectively.

[22] This theory was empirically tested by Farber and Gibbons (1996) and Altonji and Pierret (2001) using the NLSY79 data. Both studies argue that an employer's learning about worker's ability plays an important role in wage dynamics.

[23] This interpretation is also consistent with findings reported in Panel B of Table 3. Those with a bachelor degree have 4%-5% higher return to AFQT than high school graduates in the 1980s but there is no difference in the 2000s. The drop in the difference in return to AFQT can be explained by the decline in training required to adapt to the changing work environment, given that those with a college degree are more likely to receive such training.

Was technological change more rapid in the 1980s than in the 2000s? To obtain a measure of technological change, we follow methodology that was proposed in Cummins and Violante (2002) and implemented in many following studies. Cummins and Violante (2002) measure the speed of technical change for each capital good in equipment and software category (E&S) as a difference between the growth rate of constant-quality consumption and the growth rate of the good's quality-adjusted price. We use two measures of real equipment prices, National Income and Product Accounts (NIPA) official price index of E&S and the price of computers and peripheral (C&P) equipment.[24] Figure 2 shows a substantial decline in the technical change in the 2000s. Average annual growth rates in the overall E&S indexes are 5-7% in the 1980s and 1990s and drop to 1% in the 2000s. The C&P index grows by 19-21% on average in the 1980s and 1990s and by 10% in the 2000s.

Prices reflect both consumption- and investment-specific shocks as well as changing competitive conditions and therefore only partially measure technological innovations. For example, Aizcorbe, Oliner, and Sichel (2008) decompose detailed semiconductor price indexes and show that swings in price-cost markups account for a considerable part of the price dynamics over the past fifteen years.[25] However, their findings are weaker when using aggregate semiconductor prices and they do not examine relative aggregate equipment and software prices or relative aggregate computer prices. We infer that relative aggregate price indexes are less susceptible to shocks associated with changing markups.

Existing literature offers more evidence on the changing pace of technological progress. For example, Goldin and Katz (2007) show that relative demand growth for college workers was more rapid particularly in the 1980s, but it has slowed down since the 1990s and conclude that technology has been racing ahead of education, especially in the 1980s.[26] Katz (2000) suggests that the

[24]The former is not fully quality adjusted although a significant effort has been made by the Bureau of Economic Analysis (BEA) to reduce the quality bias. The latter is a reliable constant-quality price index. We retrieve data from Table 5.3.4. of the NIPA series. For further discussion on NIPA and BEA indexes, see BEA (2003) and Cummins and Violante (2002).

[25]In contrast, Pillai (forthcoming) uses growth of microprocessor performance (instead of semiconductor prices) and shows that it increased during the 1990-2000 and decreased subsequently.

[26]Using National Science Foundation (NSF) data we document a similar trend in the proportion of R&D scientists and engineers in manufacturing companies. This proportion had increased by 72% during the 1981-1991 period and

maturing of computer revolution lead to the slowdown in growth of relative demand for skill since the late 1980s. Greenwood and Yorokoglu (1997) argue that technological changes were more pronounced at the beginning of the 1980s. Hornstein, Krusell and Violante (2002) show that at times of technological acceleration the average age of capital declines: firms scrap their machines earlier in response to a faster obsolescence rate. Following their methodology and using data from the BEA, Table 2.10, we find that the average age of capital has increased from 8.5 years in the 1980s to more than 10 years in 2000s, consistent with a slowdown in the rate of technological growth.

Changing technological environment leads not only to changes in training policies but also affects productivity signaling, screening and monitoring mechanisms. Technological change was followed by reforms in the education system, in terms of fields of study, implementation and development of new teaching approaches and access to education. For example, McPherson and Schapiro (1998) document a positive trend in merit-oriented student aid policies which provided higher skilled individuals with opportunities to achieve more and higher quality education. Kinsler and Pavan (2011) show that for higher ability students the effect of family income on the probability of attending a top quartile school decreased significantly across the two waves of the NLSY. Castex (2010) and Lovenheim and Reynolds (2011) show that college non-attendance decreased substantially over time, particularly for high ability students. Goldin and Katz (2007) argue that the increasing relevance of educational institutions to market needs starting in the later 1990s, could have provided young workers with better skills for the jobs. Such adjustments in the education system should improve the screening process, i.e. schooling degrees and grades immediately provide more accurate information on the true productivity of an individual in the 2000s than in the 1980s.

5 Conclusion

Returns to cognitive skills have declined by 30% - 50% for men and women between the 1980s and the 2000s while returns to formal education have increased. These changes in returns are

by 22% during 1997-2007.

persistent across education groups, hold for different ability measures and are robust in various specifications. Changing distributions of various observed characteristics (age and family background) and changing labor market structure cannot explain the decrease in returns to cognitive ability between the 1980s and 2000s. Additionally, we examine potential biases associated with measurement errors in test scores and conclude that they do not explain the declining coefficients.

We examine the changes in skill prices over the 20 years period in a dynamic wage model. We show that wage growth in the 1980s was positively associated with cognitive ability but we do not find such relationship in the 2000s. We analyze these outcomes within human capital accumulation and employer-learning frameworks. We show that these changes in wage dynamics and therefore the overall decline in returns to ability can be attributed to the changing work environment and adoption of new technologies. We argue that a more rapid technological growth in the 1980s raised the importance of on-the-job training and therefore raised returns to cognitive skills. In the 2000s, technological change has slowed down, leading to a more stable work environment. Within the employer-learning theory, we argue that advances in signaling and learning about workers' productivity between the 1980s and 2000s can explain the changing wage dynamics. In particular, we conclude that employers obtain more information about employees' productivity from observing their formal education in the 2000s than in the 1980s.

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Table 1: Summary statistics

	NLSY79		NLSY97				NLSY79		NLSY97			
	standard weights		standard weights		age-reweighted		standard weights		standard weights		age-reweighted	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
	men						**women**					
real wage rate	15.1	7.5	14.0	8.2	15.8	9.7	12.3	5.7	12.0	6.4	13.4	7.7
AFQT	161.5	31.0	161.7	32.2	158.7	33.3	167.3	26.8	164.9	28.9	160.7	31.0
math score	48.2	8.1	48.5	8.8	48.0	9.0	46.9	6.6	49.3	8.1	48.6	8.4
varbal score	45.3	9.8	45.2	10.2	44.1	10.6	47.9	8.5	46.6	9.3	45.1	10.1
hs	0.68	0.47	0.70	0.46	0.66	0.48	0.69	0.46	0.63	0.48	0.60	0.49
aa	0.05	0.21	0.04	0.20	0.04	0.20	0.07	0.26	0.05	0.23	0.06	0.24
ba	0.12	0.33	0.13	0.33	0.16	0.37	0.16	0.36	0.19	0.40	0.21	0.41
ma	0.01	0.11	0.01	0.09	0.02	0.12	0.02	0.12	0.02	0.13	0.03	0.18
years of school	12.4	2.0	12.5	2.3	12.7	2.5	12.8	1.9	13.0	2.4	13.3	2.6
age	24.8	2.4	22.7	2.3	24.8	2.4	24.7	2.4	22.8	2.3	24.8	2.3
experience	6.5	2.6	4.2	2.7	6.2	3.2	5.9	2.5	3.8	2.7	5.5	3.1
black	0.13	0.33	0.15	0.36	0.25	0.43	0.12	0.33	0.17	0.37	0.30	0.46
unemployment	0.08	0.01	0.05	0.00	0.05	0.00	0.08	0.01	0.05	0.00	0.05	0.00
N	21062		12442				17227		10889			
family intact	0.80	0.40	0.68	0.47	0.66	0.47	0.81	0.40	0.63	0.48	0.61	0.49
mom educ	11.6	2.4	12.8	2.6	12.7	2.8	11.6	2.4	12.8	2.6	12.6	2.8
dad educ	11.7	3.2	12.7	2.8	12.5	3.0	11.8	3.2	12.8	2.8	12.6	2.9
N	17036		10352				14417		8954			
ln(real family inc)	10.8	0.7	11.0	1.1	11.0	1.1	10.9	0.6	10.8	1.2	10.7	1.2
N	10028		10050				7509		8945			

Note: Hourly wages are inflation adjusted to 2007 using the CPI-U. AFQT score is adjusted using the Altonji et al. (2008) methodology. Education variables: hs=1 for high school graduates and 0 otherwise, aa=1 for individuals with an associate degree, ba=1 for a bachelor's degree holders and ma=1 for individuals with a master's degree or higher. The unemployment rate is measured by a 3-year moving average and is calculated using Current Population Surveys. Family background variables are observed only for a subset of individuals. Real family income is measured at ages 16 or 17. Family intact indicates family composition at 14 years old in the NLSY79, and in 1997 (i.e., ages 13-17) in the NLSY97. Parental education is measured in years of schooling.

Table 2: Returns to schooling and cognitive skills, standard weights OLS

	AFQT80				Math		Verbal	
	NLSY79	NLSY97	NLSY79	NLSY97	NLSY79	NLSY97	NLSY79	NLSY97
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
					men			
test score			0.0852	0.0343	0.1035	0.0480	0.0577	0.0205
			(0.0094)	(0.0080)	(0.0088)	(0.0080)	(0.0090)	(0.0080)
hs	0.1926	0.1902	0.1185	0.1672	0.1075	0.1613	0.1441	0.1762
	(0.0183)	(0.0195)	(0.0199)	(0.0199)	(0.0194)	(0.0200)	(0.0199)	(0.0199)
aa	0.3722	0.4505	0.2649	0.4230	0.2540	0.4158	0.2996	0.4337
	(0.0314)	(0.0440)	(0.0339)	(0.0441)	(0.0332)	(0.0443)	(0.0336)	(0.0441)
ba	0.5493	0.6104	0.4048	0.5600	0.3900	0.5390	0.4576	0.5821
	(0.0245)	(0.0281)	(0.0291)	(0.0301)	(0.0276)	(0.0304)	(0.0285)	(0.0299)
ma	0.7449	0.9382	0.5746	0.8809	0.5457	0.8586	0.6407	0.9059
	(0.0534)	(0.0817)	(0.0560)	(0.0812)	(0.0550)	(0.0808)	(0.0556)	(0.0817)
R2 adj	0.1368	0.1533	0.1565	0.1573	0.1673	0.1610	0.1468	0.1548
N	21062	12442	21062	12442	21062	12442	21062	12442
					women			
test score			0.1026	0.0641	0.1016	0.0667	0.0759	0.0517
			(0.0079)	(0.0079)	(0.0078)	(0.0081)	(0.0076)	(0.0074)
hs	0.2117	0.2043	0.1393	0.1624	0.1495	0.1649	0.1575	0.1702
	(0.0207)	(0.0173)	(0.0211)	(0.0177)	(0.0208)	(0.0180)	(0.0212)	(0.0176)
aa	0.4328	0.4895	0.3203	0.4217	0.3326	0.4219	0.3541	0.4369
	(0.0310)	(0.0374)	(0.0312)	(0.0386)	(0.0308)	(0.0380)	(0.0315)	(0.0387)
ba	0.6293	0.6901	0.4761	0.6023	0.4888	0.5981	0.5235	0.6234
	(0.0262)	(0.0246)	(0.0286)	(0.0265)	(0.0277)	(0.0266)	(0.0286)	(0.0262)
ma	0.7643	1.0411	0.5995	0.9417	0.6150	0.9410	0.6537	0.9652
	(0.0593)	(0.0559)	(0.0588)	(0.0563)	(0.0584)	(0.0554)	(0.0594)	(0.0567)
R2 adj	0.1936	0.2658	0.2253	0.2797	0.2276	0.2810	0.2124	0.2754
N	17227	10889	17227	10889	17227	10889	17227	10889

Note: All statistics are weighted by the cross-sectional weights. Wages are inflation adjusted to 2007 using the CPI-U. Test scores are normalized to have zero mean and one standard deviation. Education variables: hs=1 for high school graduates and 0 otherwise, aa=1 for individuals with an associate degree, ba=1 for a bachelor's degree holders and ma=1 for individuals with a master's degree or higher. Other included controls - exp, exp2, black, unemployment, metro status. For full outputs, see Tables A.1 and A.2 in online appendix A. Coefficients and standard errors presented. Respondents are clustered at the primary sampling unit, robust standard errors are reported.

Table 3: Returns to AFQT, standard weigths, OLS, with additional controls, by education and by race

		men			women		
		AFQT	R2 adj	N	AFQT	R2 adj	N
				Panel A			
model 1	NLSY79	0.0644 (0.0131)	0.2252	8093	0.0972 (0.0138)	0.2581	6345
	NLSY97	0.0281 (0.0102)	0.1640	8424	0.0700 (0.0109)	0.2956	7473
model 2	NLSY79	0.0583 (0.0121)	0.2895	8064	0.0775 (0.0128)	0.3336	6335
	NLSY97	0.0255 (0.0090)	0.3093	8365	0.0499 (0.0094)	0.4232	7447
				Panel B: by education			
high school dropouts	NLSY79	0.1089 (0.0207)	0.0743	4096	0.0697 (0.0239)	0.0433	1529
	NLSY97	0.0200 (0.0176)	0.0485	1837	0.0479 (0.0197)	0.0261	1290
high school diploma	NLSY79	0.0804 (0.0113)	0.0826	13859	0.0974 (0.0091)	0.0795	12013
	NLSY97	0.0332 (0.0094)	0.0671	8497	0.0683 (0.0093)	0.0491	6847
ba	NLSY79	0.1351 (0.0281)	0.0645	1991	0.1383 (0.0257)	0.1133	2275
	NLSY97	0.0346 (0.0382)	0.0482	1065	0.0670 (0.0280)	0.0346	1371
				Panel C: by race			
white	NLSY79	0.0777 (0.0117)	0.1373	12285	0.1017 (0.0096)	0.2270	10498
	NLSY97	0.0285 (0.0105)	0.1418	6752	0.0581 (0.0110)	0.2831	5512
black	NLSY79	0.1152 (0.0163)	0.1317	5198	0.1363 (0.0146)	0.1852	4135
	NLSY97	0.0737 (0.0137)	0.1454	3126	0.1026 (0.0122)	0.2963	3143

Note: All statistics are weighted by the cross-sectional weights. Wages are inflation adjusted to 2007 using the CPI-U. Test scores are normalized to have zero mean and one standard deviation. Other controls - education dummies (see Table 2 note), exp, exp2, black, unemployment, metro status. Coefficients and standard errors presented. Model 1 specification includes family background variables. Model 2 specifications includes family background variables, industry and occupation dummies. For full outputs, see Tables A.3, A.4, A.5 and A.6 in online appendix A Respondents are clustered at the primary sampling unit, robust standard errors are reported.

Table 4: Returns to schooling and AFQT, standard weights, 16yo at time of test

	men				women			
	NLSY79	NLSY97	NLSY79	NLSY97	NLSY79	NLSY97	NLSY79	NLSY97
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
AFQT			0.0862	0.0363			0.1414	0.0500
			(0.0209)	(0.0193)			(0.0250)	(0.0174)
hs	0.1498	0.1951	0.0889	0.1719	0.2227	0.2385	0.1229	0.1998
	(0.0456)	(0.0445)	(0.0473)	(0.0466)	(0.0551)	(0.0279)	(0.0554)	(0.0298)
aa	0.4411	0.5531	0.3424	0.5235	0.4541	0.4774	0.3319	0.4135
	(0.0821)	(0.0928)	(0.0818)	(0.0940)	(0.0831)	(0.0613)	(0.0839)	(0.0674)
ba	0.5527	0.7158	0.4265	0.6634	0.6880	0.7111	0.4979	0.6397
	(0.0641)	(0.0582)	(0.0698)	(0.0628)	(0.0744)	(0.0451)	(0.0789)	(0.0517)
ma	0.6406	1.0856	0.4820	1.0307	0.4474	0.9956	0.2548	0.9181
	(0.1276)	(0.1708)	(0.1331)	(0.1684)	(0.2230)	(0.1024)	(0.2300)	(0.1040)
R2 adj	0.2165	0.2149	0.2393	0.2188	0.2275	0.2513	0.2737	0.2598
N	2620	2904	2620	2904	2072	2674	2072	2674

Note: All statistics are weighted by the cross-sectional weights. Wages are inflation adjusted to 2007 using the CPI-U. Test scores are normalized to have zero mean and one standard deviation. Education variables: hs=1 for high school graduates and 0 otherwise, aa=1 for individuals with an associate degree, ba=1 for a bachelor's degree holders and ma=1 for individuals with a master's degree or higher. Other included controls - exp, exp2, black, unemployment, metro status. For full outputs, see Table A.7 in online appendix A. Coefficients and standard errors presented. Respondents are clustered at the primary sampling unit, robust standard errors are reported.

Table 5: TSLS using SAT scores, workers with 12 or more years of schooling

	NLSY79	NLSY97	NLSY79	NLSY97
	men		women	
OLS	0.1518	0.0630	0.0693	0.0465
	(0.0456)	(0.0289)	(0.0316)	(0.0277)
TSLS	0.2145	0.1061	0.1770	0.0617
	(0.0592)	(0.0440)	(0.0461)	(0.0443)
First stage results:				
SAT	0.4500	0.5100	0.5172	0.5100
	(0.0162)	(0.0134)	(0.0139)	(0.0128)
N	1111	1455	1553	1604

Note: All statistics are weighted by the cross-sectional weights. Wages are inflation adjusted to 2007 using the CPI-U. Test scores are normalized to have zero mean and one standard deviation. Sampe includes individuals with 12 or more years of schooling and valid SAT scores. Other controls - education dummies (see Table 2 note), exp, exp2, black, unemployment, metro status. For full outputs, see Tables A.9 and A.10 in online appendix A. Coefficients and standard errors presented. Respondents are clustered at the primary sampling unit, robust standard errors are reported.

Table 6: Returns to AFQT, standard weights, OLS, by reason to take the test

	NLSY79	NLSY97		
	all	all	motivated	non-motivated
		Men		
AFQT	0.0852	0.0343	0.0483	0.0175
	(0.0094)	(0.0080)	(0.0105)	(0.0126)
R2 adj	0.1565	0.1573	0.1813	0.1373
N	21062	12442	6430	5743
		Women		
AFQT	0.1026	0.0641	0.0662	0.0586
	(0.0079)	(0.0079)	(0.0096)	(0.0140)
R2 adj	0.2253	0.2797	0.2921	0.2600
N	17227	10889	6508	4204

Note: All statistics are weighted by the cross-sectional weights. Wages are inflation adjusted to 2007 using the CPI-U. Test scores are normalized to have zero mean and one standard deviation. Other controls - education dummies (see Table 2 note), exp, exp2, black, unemployment, metro status. See Section 3.1 for definitions of "motivated" and "non-motivated" test-takers. For full outputs, see Table A.11 in online appendix A. Coefficients and standard errors presented. Respondents are clustered at the primary sampling unit, robust standard errors are reported.

Table 7: Returns to AFQT, NLSY97 reweighted using constructed weights

	reweighted by age		reweighted by age, family background (no fam inc)		reweighted by age, family background (with fam inc)		reweighted by age, ind and occs, family background (no fam inc)	
	NLSY79 (1)	NLSY97 (2)	NLSY79 (3)	NLSY97 (4)	NLSY79 (5)	NLSY97 (6)	NLSY79 (7)	NLSY97 (8)
				men				
AFQT	0.0852	0.0480	0.0840	0.0451	0.0810	0.0432	0.0841	0.0422
	(0.0094)	(0.0115)	(0.0105)	(0.0133)	(0.0126)	(0.0144)	(0.0105)	(0.0159)
R2 adj	0.1565	0.1659	0.1537	0.1517	0.2083	0.1480	0.1539	0.1612
N	21062	12442	16936	10254	8048	8342	16805	10182
				women				
AFQT	0.1026	0.0789	0.1076	0.0735	0.1031	0.0660	0.1081	0.0559
	(0.0079)	(0.0113)	(0.0087)	(0.0143)	(0.0134)	(0.0145)	(0.0087)	(0.0201)
R2 adj	0.2253	0.3184	0.2300	0.2893	0.2508	0.2918	0.2299	0.2277
N	17227	10889	14329	8867	6306	7402	14237	8834

Note: Statistics are weighted using specified weights. Wages are inflation adjusted to 2007 using the CPI-U. Test scores are normalized to have zero mean and one standard deviation. Other controls - education dummies (see Table 2 note), exp, exp2, black, unemployment, metro status. For full outputs, see Tables A.13 and A.14 in online appendix A. Coefficients and standard errors presented. Respondents are clustered at the primary sampling unit, robust standard errors are reported.

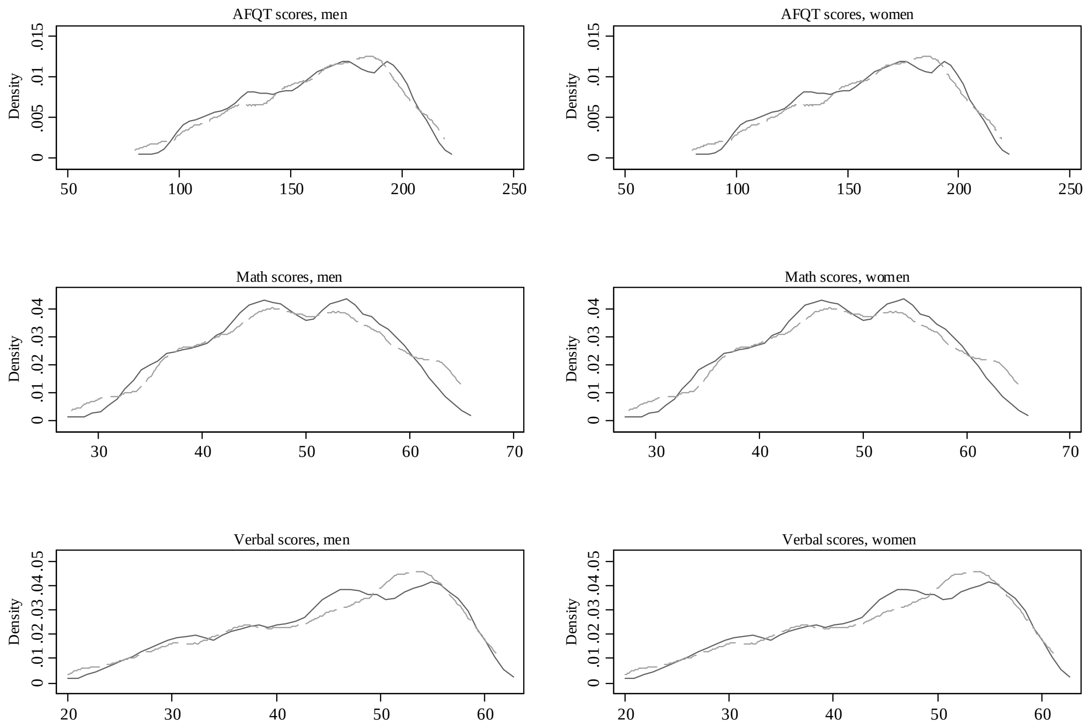
Table 8: Dynamic wage equation, OLS

	men				women			
	NLSY79	NLSY97	NLSY79	NLSY97	NLSY79	NLSY97	NLSY79	NLSY97
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
AFQT	0.0731	0.0305	0.0315	0.0257	0.0934	0.0687	0.0714	0.0659
	(0.0095)	(0.0116)	(0.0156)	(0.0234)	(0.0081)	(0.0109)	(0.0146)	(0.0171)
education	0.0699	0.0987	0.0972	0.0909	0.0806	0.1048	0.1080	0.1454
	(0.0040)	(0.0066)	(0.0079)	(0.0137)	(0.0039)	(0.0058)	(0.0082)	(0.0093)
AFQT*exp			0.0065	0.0007			0.0038	0.0007
			(0.0020)	(0.0041)			(0.0021)	(0.0029)
educ*exp			-0.0049	0.0016			-0.0055	-0.0092
			(0.0013)	(0.0024)			(0.0014)	(0.0018)
experience	0.0508	0.0651	0.1305	0.0334	0.0565	0.0369	0.1497	0.2073
	(0.0070)	(0.0123)	(0.0203)	(0.0425)	(0.0073)	(0.0081)	(0.0212)	(0.0317)
experience^2	-0.0010	-0.0008	-0.0026	0.0002	-0.0021	-0.0002	-0.0043	-0.0053
	(0.0005)	(0.0011)	(0.0006)	(0.0016)	(0.0006)	(0.0006)	(0.0006)	(0.0011)
R2 adj	0.1619	0.1900	0.1637	0.1902	0.2217	0.3219	0.2238	0.3305
N	21062	12442	21062	12442	17227	10889	17227	10889

Note: NLSY79 statistics are weighted by the cross-sectional weights. NLSY97 statistics are weighted using weights constructed to match age distributions. Wages are inflation adjusted to 2007 using the CPI-U. Test scores are normalized to have zero mean and one standard deviation. Education measures completed years of schooling. Other included controls - black, unemployment, metro status. For full outputs, see Table A.15 in online appendix A. Coefficients and standard errors presented. Respondents are clustered at the primary sampling unit, robust standard errors are reported.

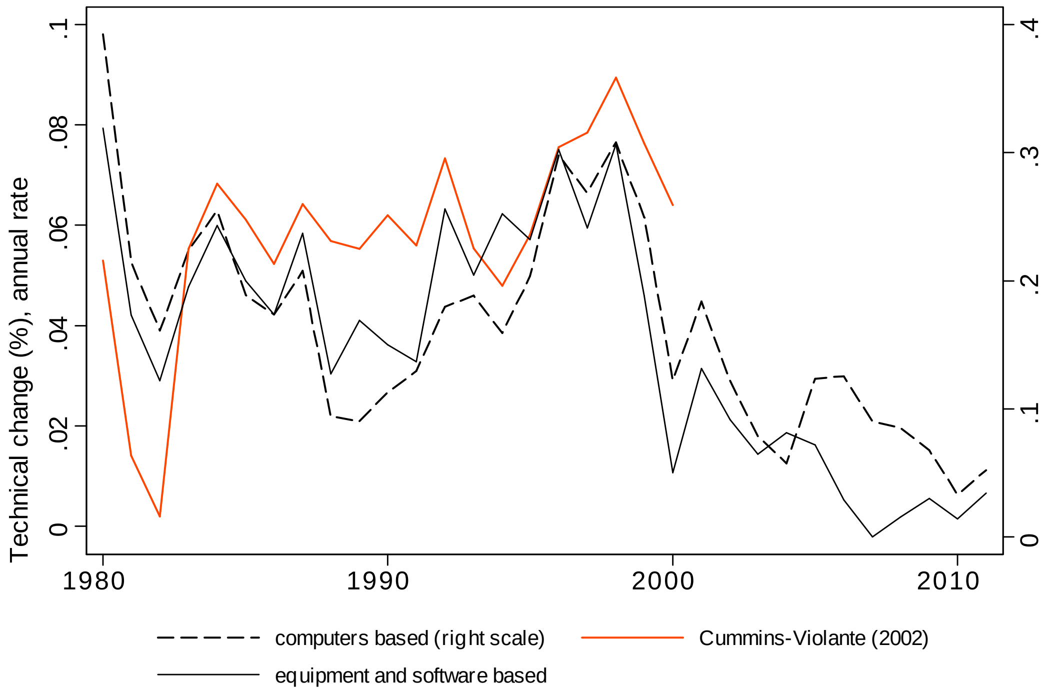
Figure 1

----------- NLSY79 -- -- -- -- NLSY97



Note: Both populations are weighted using the BLS weights.

Figure 2: Aggregate Measures of Investment-Specific Technical Change



Source: Cummins and Violante (2002), www.econ.nyu.edu/user/violante/Journals/CUMMINS-VIOLANTE-DATA.xls; NIPA.

Table A.1: Returns to schooling and cognitive skills, standard weights OLS, men

	AFQT80				Math		Verbal	
	NLSY79	NLSY97	NLSY79	NLSY97	NLSY79	NLSY97	NLSY79	NLSY97
test score			0.0852	0.0343	0.1035	0.0480	0.0577	0.0205
			(0.0094)	(0.0080)	(0.0088)	(0.0080)	(0.0090)	(0.0080)
hs	0.1926	0.1902	0.1185	0.1672	0.1075	0.1613	0.1441	0.1762
	(0.0183)	(0.0195)	(0.0199)	(0.0199)	(0.0194)	(0.0200)	(0.0199)	(0.0199)
aa	0.3722	0.4505	0.2649	0.4230	0.2540	0.4158	0.2996	0.4337
	(0.0314)	(0.0440)	(0.0339)	(0.0441)	(0.0332)	(0.0443)	(0.0336)	(0.0441)
ba	0.5493	0.6104	0.4048	0.5600	0.3900	0.5390	0.4576	0.5821
	(0.0245)	(0.0281)	(0.0291)	(0.0301)	(0.0276)	(0.0304)	(0.0285)	(0.0299)
ma	0.7449	0.9382	0.5746	0.8809	0.5457	0.8586	0.6407	0.9059
	(0.0534)	(0.0817)	(0.0560)	(0.0812)	(0.0550)	(0.0808)	(0.0556)	(0.0817)
experience	0.0724	0.0599	0.0714	0.0614	0.0718	0.0620	0.0714	0.0607
	(0.0067)	(0.0058)	(0.0066)	(0.0058)	(0.0066)	(0.0058)	(0.0066)	(0.0058)
experience^2	-0.0032	-0.0027	-0.0030	-0.0027	-0.0030	-0.0027	-0.0030	-0.0027
	(0.0005)	(0.0006)	(0.0005)	(0.0006)	(0.0005)	(0.0006)	(0.0005)	(0.0006)
black	-0.1777	-0.1542	-0.0948	-0.1339	-0.0713	-0.1322	-0.1227	-0.1419
	(0.0133)	(0.0145)	(0.0160)	(0.0151)	(0.0157)	(0.0147)	(0.0159)	(0.0154)
unempl rate	-1.9061	-2.4577	-1.8850	-2.3282	-1.9809	-2.2951	-1.8549	-2.3728
	(0.3934)	(0.8480)	(0.3882)	(0.8485)	(0.3857)	(0.8464)	(0.3910)	(0.8495)
metro status	0.0468	-0.0094	0.0398	-0.0125	0.0416	-0.0126	0.0429	-0.0114
	(0.0163)	(0.0142)	(0.0160)	(0.0142)	(0.0158)	(0.0141)	(0.0161)	(0.0142)
const	6.8128	6.8664	6.8852	6.8802	6.8962	6.8846	6.8574	6.8743
	(0.0456)	(0.0527)	(0.0459)	(0.0525)	(0.0454)	(0.0525)	(0.0459)	(0.0526)
R2 adj	0.1368	0.1533	0.1565	0.1573	0.1673	0.1610	0.1468	0.1548
N	21062	12442	21062	12442	21062	12442	21062	12442

Note: All statistics are weighted by the cross-sectional weights. Wages are inflation adjusted to 2007 using the CPI-U. Test scores are normalized to have zero mean and one standard deviation. Education variables: hs=1 for high school graduates and 0 otherwise, aa=1 for individuals with an associate degree, ba=1 for a bachelor's degree holders and ma=1 for individuals with a master's degree or higher. The unemployment rate is measured by a 3-year moving average and is calculated using Current Population Surveys. Coefficients and standard errors presented. Respondents are clustered at the primary sampling unit, robust standard errors are reported.

Table A.2: Returns to schooling and cognitive skills, standard weights OLS, women

	AFQT80				Math		Verbal	
	NLSY79	NLSY97	NLSY79	NLSY97	NLSY79	NLSY97	NLSY79	NLSY97
test score			0.1026	0.0641	0.1016	0.0667	0.0759	0.0517
			(0.0079)	(0.0079)	(0.0078)	(0.0081)	(0.0076)	(0.0074)
hs	0.2117	0.2043	0.1393	0.1624	0.1495	0.1649	0.1575	0.1702
	(0.0207)	(0.0173)	(0.0211)	(0.0177)	(0.0208)	(0.0180)	(0.0212)	(0.0176)
aa	0.4328	0.4895	0.3203	0.4217	0.3326	0.4219	0.3541	0.4369
	(0.0310)	(0.0374)	(0.0312)	(0.0386)	(0.0308)	(0.0380)	(0.0315)	(0.0387)
ba	0.6293	0.6901	0.4761	0.6023	0.4888	0.5981	0.5235	0.6234
	(0.0262)	(0.0246)	(0.0286)	(0.0265)	(0.0277)	(0.0266)	(0.0286)	(0.0262)
ma	0.7643	1.0411	0.5995	0.9417	0.6150	0.9410	0.6537	0.9652
	(0.0593)	(0.0559)	(0.0588)	(0.0563)	(0.0584)	(0.0554)	(0.0594)	(0.0567)
experience	0.0751	0.0396	0.0764	0.0429	0.0774	0.0426	0.0750	0.0422
	(0.0064)	(0.0055)	(0.0064)	(0.0055)	(0.0064)	(0.0055)	(0.0064)	(0.0055)
$experience^2$	-0.0043	-0.0025	-0.0040	-0.0025	-0.0041	-0.0024	-0.0040	-0.0025
	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0005)
black	-0.0845	-0.0471	0.0133	-0.0024	0.0078	-0.0147	-0.0137	-0.0090
	(0.0127)	(0.0139)	(0.0141)	(0.0140)	(0.0139)	(0.0137)	(0.0140)	(0.0141)
unempl rate	-2.5248	-5.3451	-2.2654	-5.1401	-2.1456	-5.2663	-2.3774	-5.1177
	(0.4095)	(0.8759)	(0.3997)	(0.8656)	(0.4007)	(0.8649)	(0.4038)	(0.8688)
metro status	0.0587	0.0448	0.0610	0.0377	0.0650	0.0381	0.0597	0.0394
	(0.0142)	(0.0138)	(0.0141)	(0.0137)	(0.0139)	(0.0136)	(0.0142)	(0.0137)
const	6.6280	6.8530	6.6555	6.8829	6.6319	6.8905	6.6546	6.8727
	(0.0458)	(0.0530)	(0.0446)	(0.0526)	(0.0446)	(0.0526)	(0.0452)	(0.0526)
R2 adj	0.1936	0.2658	0.2253	0.2797	0.2276	0.2810	0.2124	0.2754
N	17227	10889	17227	10889	17227	10889	17227	10889

Note: All statistics are weighted by the cross-sectional weights. Wages are inflation adjusted to 2007 using the CPI-U. Test scores are normalized to have zero mean and one standard deviation. Education variables: hs=1 for high school graduates and 0 otherwise, aa=1 for individuals with an associate degree, ba=1 for a bachelor's degree holders and ma=1 for individuals with a master's degree or higher. The unemployment rate is measured by a 3-year moving average and is calculated using Current Population Surveys. Coefficients and standard errors presented. Respondents are clustered at the primary sampling unit, robust standard errors are reported.

Table A.3: Returns to schooling and cognitive skills, standard weights, with additional controls, OLS, men

	AFQT				Math				Verbal			
	model 1		model 2		model 1		model 2		model 1		model 2	
	NLSY79	NLSY97	NLSY79	NLSY97	NLSY79	NLSY97	NLSY79	NLSY97	NLSY79	NLSY97	NLSY79	NLSY97
test score	0.0644	0.0281	0.0583	0.0255	0.0895	0.0425	0.0806	0.0363	0.0426	0.0116	0.0388	0.0126
	(0.0131)	(0.0102)	(0.0121)	(0.0090)	(0.0127)	(0.0099)	(0.0120)	(0.0087)	(0.0125)	(0.0103)	(0.0116)	(0.0090)
hs	0.0795	0.1396	0.0732	0.1009	0.0690	0.1337	0.0633	0.0971	0.0937	0.1491	0.0858	0.1080
	(0.0320)	(0.0260)	(0.0298)	(0.0225)	(0.0314)	(0.0262)	(0.0295)	(0.0225)	(0.0321)	(0.0261)	(0.0299)	(0.0226)
aa	0.2269	0.4051	0.2349	0.3050	0.2071	0.3978	0.2160	0.3006	0.2507	0.4153	0.2561	0.3121
	(0.0497)	(0.0514)	(0.0503)	(0.0431)	(0.0497)	(0.0517)	(0.0505)	(0.0432)	(0.0491)	(0.0512)	(0.0500)	(0.0429)
ba	0.3919	0.4962	0.3156	0.3448	0.3724	0.4768	0.2975	0.3319	0.4245	0.5163	0.3428	0.3592
	(0.0464)	(0.0370)	(0.0462)	(0.0349)	(0.0457)	(0.0376)	(0.0462)	(0.0350)	(0.0456)	(0.0367)	(0.0459)	(0.0347)
ma	0.4331	0.8673	0.3622	0.6827	0.4008	0.8468	0.3339	0.6691	0.4728	0.8897	0.3958	0.6988
	(0.0909)	(0.0973)	(0.0906)	(0.0933)	(0.0895)	(0.0970)	(0.0897)	(0.0930)	(0.0909)	(0.0978)	(0.0909)	(0.0938)
experience	0.0578	0.0590	0.0553	0.0440	0.0587	0.0597	0.0558	0.0445	0.0575	0.0584	0.0550	0.0435
	(0.0107)	(0.0069)	(0.0104)	(0.0066)	(0.0106)	(0.0069)	(0.0104)	(0.0066)	(0.0107)	(0.0069)	(0.0104)	(0.0066)
$experience^2$	-0.0027	-0.0024	-0.0028	-0.0016	-0.0027	-0.0024	-0.0027	-0.0016	-0.0027	-0.0024	-0.0028	-0.0016
	(0.0008)	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0008)	(0.0007)	(0.0007)	(0.0007)
black	-0.0163	-0.1053	-0.0082	-0.0890	0.0042	-0.1024	0.0090	-0.0875	-0.0328	-0.1138	-0.0228	-0.0957
	(0.0258)	(0.0213)	(0.0247)	(0.0181)	(0.0253)	(0.0207)	(0.0242)	(0.0177)	(0.0261)	(0.0216)	(0.0250)	(0.0182)
unempl rate	-4.5846	-1.4558	-4.1810	-2.4005	-4.5344	-1.3894	-4.1425	-2.3686	-4.6696	-1.5166	-4.2415	-2.4433
	(0.8623)	(1.0320)	(0.8118)	(0.9514)	(0.8548)	(1.0307)	(0.8044)	(0.9513)	(0.8659)	(1.0329)	(0.8150)	(0.9518)
metro status	0.0123	0.0094	0.0179	0.0201	0.0139	0.0090	0.0185	0.0199	0.0141	0.0105	0.0195	0.0208
	(0.0246)	(0.0175)	(0.0229)	(0.0151)	(0.0242)	(0.0175)	(0.0225)	(0.0150)	(0.0248)	(0.0176)	(0.0230)	(0.0151)
family background	+	+	+	+	+	+	+	+	+	+	+	+
inds, occs			+	+			+	+			+	+
const	6.2583	6.3613	6.1281	6.4486	6.3035	6.3783	6.1720	6.4527	6.2072	6.3350	6.0842	6.4340
	(0.2034)	(0.1278)	(0.1942)	(0.1478)	(0.1996)	(0.1274)	(0.1916)	(0.1488)	(0.2035)	(0.1277)	(0.1944)	(0.1474)
R2 adj	0.2252	0.1640	0.2895	0.3093	0.2355	0.1672	0.2977	0.3114	0.2200	0.1621	0.2854	0.3079
N	8093	8424	8064	8365	8093	8424	8064	8365	8093	8424	8064	8365

Note: All statistics are weighted by the cross-sectional weights. Wages are inflation adjusted to 2007 using the CPI-U. Test scores are normalized to have zero mean and one standard deviation. Education variables: hs=1 for high school graduates and 0 otherwise, aa=1 for individuals with an associate degree, ba=1 for a bachelor's degree holders and ma=1 for individuals with a master's degree or higher. The unemployment rate is measured by a 3-year moving average and is calculated using Current Population Surveys. Coefficients and standard errors presented. Respondents are clustered at the primary sampling unit, robust standard errors are reported.

Table A.4: Returns to schooling and cognitive skills, standard weights, with additional controls, OLS, women

	AFQT				Math				Verbal			
	model 1		model 2		model 1		mode l2		model 1		model 2	
	NLSY79	NLSY97	NLSY79	NLSY97	NLSY79	NLSY97	NLSY79	NLSY97	NLSY79	NLSY97	NLSY79	NLSY97
test score	0.0972	0.0700	0.0775	0.0499	0.0985	0.0728	0.0786	0.0538	0.0661	0.0545	0.0518	0.0375
	(0.0138)	(0.0109)	(0.0128)	(0.0094)	(0.0135)	(0.0105)	(0.0122)	(0.0093)	(0.0139)	(0.0100)	(0.0130)	(0.0087)
hs	0.0427	0.1475	0.0117	0.0733	0.0558	0.1501	0.0210	0.0744	0.0586	0.1559	0.0244	0.0794
	(0.0424)	(0.0235)	(0.0394)	(0.0206)	(0.0428)	(0.0234)	(0.0404)	(0.0206)	(0.0431)	(0.0235)	(0.0397)	(0.0205)
aa	0.2092	0.3964	0.1453	0.2762	0.2192	0.3943	0.1521	0.2738	0.2338	0.4128	0.1630	0.2879
	(0.0541)	(0.0489)	(0.0502)	(0.0435)	(0.0549)	(0.0478)	(0.0512)	(0.0426)	(0.0553)	(0.0491)	(0.0507)	(0.0438)
ba	0.3726	0.5647	0.2518	0.3824	0.3746	0.5562	0.2529	0.3755	0.4152	0.5869	0.2819	0.3978
	(0.0561)	(0.0332)	(0.0527)	(0.0308)	(0.0560)	(0.0329)	(0.0530)	(0.0308)	(0.0573)	(0.0330)	(0.0533)	(0.0306)
ma	0.4382	0.9724	0.2723	0.7381	0.4381	0.9706	0.2711	0.7370	0.4833	0.9943	0.3030	0.7531
	(0.0857)	(0.0611)	(0.0832)	(0.0628)	(0.0854)	(0.0591)	(0.0835)	(0.0614)	(0.0872)	(0.0623)	(0.0841)	(0.0637)
experience	0.0667	0.0404	0.0653	0.0347	0.0679	0.0404	0.0661	0.0347	0.0648	0.0397	0.0637	0.0342
	(0.0118)	(0.0068)	(0.0106)	(0.0063)	(0.0118)	(0.0067)	(0.0106)	(0.0062)	(0.0119)	(0.0068)	(0.0106)	(0.0063)
$experience^2$	-0.0040	-0.0020	-0.0039	-0.0016	-0.0041	-0.0020	-0.0039	-0.0016	-0.0040	-0.0021	-0.0038	-0.0017
	(0.0010)	(0.0007)	(0.0009)	(0.0006)	(0.0010)	(0.0007)	(0.0009)	(0.0006)	(0.0010)	(0.0007)	(0.0009)	(0.0006)
black	0.0165	0.0313	-0.0064	0.0125	0.0231	0.0184	-0.0010	0.0042	-0.0136	0.0246	-0.0307	0.0067
	(0.0280)	(0.0186)	(0.0253)	(0.0166)	(0.0279)	(0.0180)	(0.0252)	(0.0162)	(0.0276)	(0.0187)	(0.0249)	(0.0168)
unempl rate	-4.1139	-5.1548	-3.3448	-4.3425	-4.0889	-5.2999	-3.3304	-4.4483	-4.3455	-5.0916	-3.5150	-4.2942
	(0.9429)	(1.0279)	(0.8687)	(0.9070)	(0.9389)	(1.0269)	(0.8715)	(0.9051)	(0.9581)	(1.0319)	(0.8763)	(0.9104)
metro status	0.0754	0.0257	0.0710	0.0322	0.0764	0.0251	0.0712	0.0316	0.0731	0.0272	0.0690	0.0334
	(0.0247)	(0.0166)	(0.0222)	(0.0144)	(0.0245)	(0.0166)	(0.0222)	(0.0144)	(0.0250)	(0.0166)	(0.0224)	(0.0144)
family background	+	+	+	+	+	+	+	+	+	+	+	+
inds, occs			+	+			+	+			+	+
const	6.2206	6.5537	6.1906	6.6509	6.1612	6.5565	6.1491	6.6552	6.2020	6.5150	6.1916	6.6213
	(0.2382)	(0.1073)	(0.2208)	(0.1672)	(0.2379)	(0.1068)	(0.2209)	(0.1687)	(0.2395)	(0.1078)	(0.2206)	(0.1656)
R2 adj	0.2581	0.2956	0.3336	0.4232	0.2632	0.2983	0.3368	0.4252	0.2462	0.2908	0.3260	0.4205
N	6345	7473	6335	7447	6345	7473	6335	7447	6345	7473	6335	7447

Note: All statistics are weighted by the cross-sectional weights. Wages are inflation adjusted to 2007 using the CPI-U. Test scores are normalized to have zero mean and one standard deviation. Education variables: hs=1 for high school graduates and 0 otherwise, aa=1 for individuals with an associate degree, ba=1 for a bachelor's degree holders and ma=1 for individuals with a master's degree or higher. The unemployment rate is measured by a 3-year moving average and is calculated using Current Population Surveys. Coefficients and standard errors presented. Respondents are clustered at the primary sampling unit, robust standard errors are reported.

Table A.5: Returns to ability, standard weigths, OLS, by education

	high school dropouts		high school		ba	
	NLSY79	NLSY97	NLSY79	NLSY97	NLSY79	NLSY97
	Men					
AFQT score	0.1089	0.0200	0.0804	0.0332	0.1351	0.0346
	(0.0207)	(0.0176)	(0.0113)	(0.0094)	(0.0281)	(0.0382)
experience	0.0512	0.0112	0.0730	0.0639	0.0885	0.0634
	(0.0165)	(0.0217)	(0.0097)	(0.0081)	(0.0330)	(0.0371)
experience^2	-0.0019	0.0008	-0.0029	-0.0031	-0.0066	0.0031
	(0.0010)	(0.0016)	(0.0007)	(0.0008)	(0.0039)	(0.0061)
black	-0.0920	-0.1311	-0.1037	-0.1454	0.0263	-0.0624
	(0.0315)	(0.0308)	(0.0203)	(0.0184)	(0.0438)	(0.0583)
unempl rate	-2.6642	2.2612	-1.2419	-3.1252	-3.9853	2.8169
	(0.8585)	(2.2905)	(0.4683)	(1.0410)	(1.2686)	(4.7549)
metro status	-0.0125	-0.0602	0.0576	-0.0192	-0.0519	0.0637
	(0.0357)	(0.0341)	(0.0202)	(0.0171)	(0.0420)	(0.0450)
const	7.0960	6.7994	6.9295	7.0893	7.4700	7.0865
	(0.0963)	(0.1134)	(0.0482)	(0.0546)	(0.1317)	(0.2687)
R2 adj	0.0743	0.0485	0.0826	0.0671	0.0645	0.0482
N	4096	1837	13859	8497	1991	1065
	Women					
AFQT score	0.0697	0.0479	0.0974	0.0683	0.1383	0.0670
	(0.0239)	(0.0197)	(0.0091)	(0.0093)	(0.0257)	(0.0280)
experience	0.0189	-0.0035	0.0778	0.0465	0.1113	0.0683
	(0.0201)	(0.0198)	(0.0083)	(0.0077)	(0.0255)	(0.0399)
experience^2	-0.0005	0.0012	-0.0042	-0.0029	-0.0073	-0.0059
	(0.0012)	(0.0015)	(0.0007)	(0.0008)	(0.0029)	(0.0076)
black	-0.0405	-0.0137	0.0197	-0.0084	-0.0079	0.0022
	(0.0372)	(0.0293)	(0.0167)	(0.0170)	(0.0410)	(0.0435)
unempl rate	-1.5857	-1.1983	-1.6720	-3.7552	-5.1597	-10.2730
	(1.1047)	(2.1445)	(0.4770)	(1.0279)	(1.1482)	(4.8679)
metro status	0.0384	0.0175	0.0699	0.0456	0.0406	0.0336
	(0.0340)	(0.0308)	(0.0164)	(0.0169)	(0.0403)	(0.0361)
const	6.7988	6.7926	6.7386	6.9613	7.2531	7.7264
	(0.1130)	(0.1170)	(0.0450)	(0.0563)	(0.1130)	(0.2811)
R2 adj	0.0433	0.0261	0.0795	0.0491	0.1133	0.0346
N	1529	1290	12013	6847	2275	1371

Note: All statistics are weighted by the cross-sectional weights. Wages are inflation adjusted to 2007 using the CPI-U. Test scores are normalized to have zero mean and one standard deviation. The unemployment rate is measured by a 3-year moving average and is calculated using Current Population Surveys. Coefficients and standard errors presented. Respondents are clustered at the primary sampling unit, robust standard errors are reported.

Table A.6: Returns to ability, standard weights, OLS, by race

	Men				Women			
	white		black		white		black	
	NLSY79	NLSY97	NLSY79	NLSY97	NLSY79	NLSY97	NLSY79	NLSY97
AFQT score	0.0777	0.0285	0.1152	0.0737	0.1017	0.0581	0.1363	0.1026
	(0.0117)	(0.0105)	(0.0163)	(0.0137)	(0.0096)	(0.0110)	(0.0146)	(0.0122)
hs	0.1245	0.1882	0.0982	0.1146	0.1418	0.1689	0.1390	0.1247
	(0.0258)	(0.0284)	(0.0295)	(0.0272)	(0.0257)	(0.0248)	(0.0360)	(0.0272)
aa	0.2758	0.4525	0.1968	0.3599	0.3244	0.4394	0.3104	0.3789
	(0.0418)	(0.0533)	(0.0581)	(0.0645)	(0.0378)	(0.0501)	(0.0496)	(0.0609)
ba	0.4090	0.5785	0.3940	0.5451	0.4867	0.6215	0.3840	0.5447
	(0.0355)	(0.0384)	(0.0481)	(0.0511)	(0.0335)	(0.0334)	(0.0501)	(0.0499)
ma	0.6000	0.9262	0.6577	1.0762	0.6090	0.9566	0.4518	1.0315
	(0.0615)	(0.0888)	(0.0790)	(0.0714)	(0.0659)	(0.0627)	(0.0904)	(0.1486)
experience	0.0732	0.0639	0.0417	0.0436	0.0778	0.0434	0.0784	0.0391
	(0.0080)	(0.0074)	(0.0113)	(0.0107)	(0.0074)	(0.0072)	(0.0105)	(0.0085)
$experience^2$	-0.0030	-0.0027	-0.0016	-0.0017	-0.0041	-0.0026	-0.0044	-0.0021
	(0.0006)	(0.0008)	(0.0008)	(0.0010)	(0.0006)	(0.0007)	(0.0008)	(0.0008)
unempl rate	-1.8999	-1.6572	-2.1564	-3.4221	-2.3524	-5.0002	-1.2182	-5.2162
	(0.4614)	(1.1027)	(0.6504)	(1.5395)	(0.4717)	(1.1380)	(0.6273)	(1.3447)
metro status	0.0418	-0.0192	0.0099	0.0053	0.0588	0.0408	0.0379	0.0039
	(0.0184)	(0.0183)	(0.0253)	(0.0229)	(0.0162)	(0.0177)	(0.0216)	(0.0224)
const	6.8706	6.8201	7.0170	6.9164	6.6509	6.8555	6.6532	6.9787
	(0.0547)	(0.0707)	(0.0754)	(0.0857)	(0.0522)	(0.0694)	(0.0759)	(0.0830)
R2 adj	0.1373	0.1418	0.1317	0.1454	0.2270	0.2831	0.1852	0.2963
N	12285	6752	5198	3126	10498	5512	4135	3143

Note: All statistics are weighted by the cross-sectional weights. Wages are inflation adjusted to 2007 using the CPI-U. Test scores are normalized to have zero mean and one standard deviation. Education variables: hs=1 for high school graduates and 0 otherwise, aa=1 for individuals with an associate degree, ba=1 for a bachelor's degree holders and ma=1 for individuals with a master's degree or higher. The unemployment rate is measured by a 3-year moving average and is calculated using Current Population Surveys. Coefficients and standard errors presented. Respondents are clustered at the primary sampling unit, robust standard errors are reported.

Table A.7: Returns to schooling and AFQT, standard weights, 16yo at time of test

	men				women			
	NLSY79	NLSY97	NLSY79	NLSY97	NLSY79	NLSY97	NLSY79	NLSY97
AFQT score			0.0862	0.0363			0.1414	0.0500
			(0.0209)	(0.0193)			(0.0250)	(0.0174)
hs	0.1498	0.1951	0.0889	0.1719	0.2227	0.2385	0.1229	0.1998
	(0.0456)	(0.0445)	(0.0473)	(0.0466)	(0.0551)	(0.0279)	(0.0554)	(0.0298)
aa	0.4411	0.5531	0.3424	0.5235	0.4541	0.4774	0.3319	0.4135
	(0.0821)	(0.0928)	(0.0818)	(0.0940)	(0.0831)	(0.0613)	(0.0839)	(0.0674)
ba	0.5527	0.7158	0.4265	0.6634	0.6880	0.7111	0.4979	0.6397
	(0.0641)	(0.0582)	(0.0698)	(0.0628)	(0.0744)	(0.0451)	(0.0789)	(0.0517)
ma	0.6406	1.0856	0.4820	1.0307	0.4474	0.9956	0.2548	0.9181
	(0.1276)	(0.1708)	(0.1331)	(0.1684)	(0.2230)	(0.1024)	(0.2300)	(0.1040)
experience	0.0062	0.0805	0.0186	0.0819	0.0602	0.0404	0.0734	0.0431
	(0.0209)	(0.0112)	(0.0207)	(0.0110)	(0.0229)	(0.0113)	(0.0241)	(0.0113)
experience^2	0.0007	-0.0040	0.0001	-0.0040	-0.0029	-0.0022	-0.0033	-0.0021
	(0.0014)	(0.0010)	(0.0014)	(0.0010)	(0.0016)	(0.0010)	(0.0017)	(0.0010)
black	-0.1594	-0.1381	-0.0819	-0.1131	-0.1183	-0.0570	0.0106	-0.0236
	(0.0346)	(0.0326)	(0.0383)	(0.0367)	(0.0431)	(0.0273)	(0.0478)	(0.0272)
unempl rate	-6.7918	-5.1114	-5.9266	-5.1911	-3.2125	-2.7800	-2.0415	-2.8672
	(1.3862)	(1.6059)	(1.3456)	(1.5996)	(1.6047)	(1.6447)	(1.6320)	(1.6347)
metro status	0.0173	0.0120	0.0033	0.0091	0.0495	0.0556	0.0647	0.0459
	(0.0402)	(0.0330)	(0.0383)	(0.0331)	(0.0468)	(0.0299)	(0.0450)	(0.0302)
const	7.3561	6.9141	7.3336	6.9379	6.7179	6.6685	6.6474	6.7117
	(0.1695)	(0.0906)	(0.1658)	(0.0916)	(0.2000)	(0.0859)	(0.1995)	(0.0871)
R2 adj	0.2165	0.2149	0.2393	0.2188	0.2275	0.2513	0.2737	0.2598
N	2620	2904	2620	2904	2072	2674	2072	2674

Note: All statistics are weighted by the cross-sectional weights. Wages are inflation adjusted to 2007 using the CPI-U. Test scores are normalized to have zero mean and one standard deviation. Education variables: hs=1 for high school graduates and 0 otherwise, aa=1 for individuals with an associate degree, ba=1 for a bachelor's degree holders and ma=1 for individuals with a master's degree or higher. The unemployment rate is measured by a 3-year moving average and is calculated using Current Population Surveys. Coefficients and standard errors presented. Respondents are clustered at the primary sampling unit, robust standard errors are reported.

Table A.8: Returns to schooling and AFQT, standard weights, 16yo and 9th grade at time of test

	men				women			
	NLSY79	NLSY97	NLSY79	NLSY97	NLSY79	NLSY97	NLSY79	NLSY97
AFQT score			0.0765	0.0180			0.1285	0.0105
			(0.0242)	(0.0306)			(0.0321)	(0.0244)
hs	0.1645	0.2892	0.1141	0.2808	0.1916	0.2246	0.1161	0.2161
	(0.0669)	(0.0841)	(0.0654)	(0.0854)	(0.0714)	(0.0416)	(0.0725)	(0.0423)
aa	0.4445	0.4925	0.3531	0.4826	0.4295	0.4212	0.3229	0.4096
	(0.1013)	(0.1586)	(0.0964)	(0.1593)	(0.1005)	(0.0824)	(0.1008)	(0.0924)
ba	0.5411	0.8185	0.4443	0.7946	0.6743	0.6824	0.5183	0.6676
	(0.0808)	(0.0987)	(0.0833)	(0.1032)	(0.0851)	(0.0589)	(0.0935)	(0.0705)
ma	0.7420	1.3071	0.6056	1.2788	0.6579	0.7629	0.5093	0.7429
	(0.1424)	(0.3339)	(0.1469)	(0.3332)	(0.1585)	(0.1030)	(0.1636)	(0.1125)
experience	0.0521	0.0973	0.0546	0.0990	0.0689	0.0250	0.0804	0.0255
	(0.0252)	(0.0179)	(0.0248)	(0.0173)	(0.0274)	(0.0196)	(0.0271)	(0.0197)
experience^2	-0.0026	-0.0045	-0.0027	-0.0046	-0.0031	0.0004	-0.0037	0.0004
	(0.0018)	(0.0017)	(0.0018)	(0.0017)	(0.0022)	(0.0018)	(0.0021)	(0.0018)
black	-0.1649	-0.0894	-0.0790	-0.0789	-0.1278	-0.0753	-0.0014	-0.0699
	(0.0484)	(0.0529)	(0.0531)	(0.0594)	(0.0468)	(0.0421)	(0.0598)	(0.0411)
unempl rate	-6.0725	-4.6178	-5.7066	-4.7838	-2.3869	0.8731	-1.6338	0.8448
	(1.7152)	(2.6270)	(1.6840)	(2.6235)	(1.6438)	(2.4179)	(1.7305)	(2.4107)
metro status	-0.0032	-0.0273	-0.0105	-0.0291	0.0565	0.0864	0.0653	0.0852
	(0.0461)	(0.0492)	(0.0446)	(0.0493)	(0.0535)	(0.0420)	(0.0517)	(0.0426)
const	7.2142	6.7787	7.2242	6.7943	6.6627	6.4881	6.6058	6.4986
	(0.2103)	(0.1480)	(0.2036)	(0.1486)	(0.2119)	(0.1225)	(0.2121)	(0.1247)
R2 adj	0.2213	0.2099	0.2373	0.2103	0.2379	0.2124	0.2708	0.2123
N	1542	1362	1542	1362	1564	1206	1564	1206

Note: All statistics are weighted by the cross-sectional weights. There are 372 males and 423 females who were in 9th grade and 16 years old in 1980 in NLSY79. In NLSY97, in 1997, the corresponding numbers are 282 and 276. Wages are inflation adjusted to 2007 using the CPI-U. Test scores are normalized to have zero mean and one standard deviation. Education variables: hs=1 for high school graduates and 0 otherwise, aa=1 for individuals with an associate degree, ba=1 for a bachelor's degree holders and ma=1 for individuals with a master's degree or higher. The unemployment rate is measured by a 3-year moving average and is calculated using Current Population Surveys. Coefficients and standard errors presented. Respondents are clustered at the primary sampling unit, robust standard errors are reported.

Table A.9: TSLS using SAT scores, workers with 12 or more years of schooling

	NLSY79	NLSY97	NLSY79	NLSY97	NLSY79	NLSY97	NLSY79	NLSY97
	OLS		TSLS		OLS		TSLS	
	men				women			
AFQT score	0.1518	0.0630	0.2145	0.1061	0.0693	0.0465	0.1770	0.0617
	(0.0456)	(0.0289)	(0.0592)	(0.0440)	(0.0316)	(0.0277)	(0.0461)	(0.0443)
hs	-0.4041	-0.6541	-0.3640	-0.6309	-0.5039	-0.7180	-0.4497	-0.7082
	(0.1080)	(0.0808)	(0.1120)	(0.0823)	(0.0981)	(0.0769)	(0.0919)	(0.0805)
aa	-0.2814	-0.3685	-0.2379	-0.3389	-0.2564	-0.5786	-0.2270	-0.5726
	(0.1338)	(0.1063)	(0.1444)	(0.1085)	(0.1126)	(0.1234)	(0.1075)	(0.1239)
ba	-0.1382	-0.2559	-0.1237	-0.2494	-0.0813	-0.2842	-0.0790	-0.2806
	(0.0959)	(0.0782)	(0.0959)	(0.0767)	(0.0963)	(0.0747)	(0.0901)	(0.0754)
experience	0.0485	0.0947	0.0516	0.0961	0.1099	0.0658	0.1145	0.0660
	(0.0308)	(0.0191)	(0.0310)	(0.0192)	(0.0243)	(0.0163)	(0.0245)	(0.0163)
$experience^2$	-0.0002	-0.0036	-0.0004	-0.0036	-0.0072	-0.0032	-0.0075	-0.0032
	(0.0027)	(0.0026)	(0.0028)	(0.0026)	(0.0025)	(0.0020)	(0.0026)	(0.0020)
black	0.0269	-0.0838	0.0736	-0.0535	-0.0916	0.0218	0.0303	0.0291
	(0.0725)	(0.0397)	(0.0756)	(0.0426)	(0.0542)	(0.0379)	(0.0687)	(0.0410)
unempl rate	-5.4109	-1.7781	-5.2572	-1.9841	-4.5915	-8.8170	-4.5467	-8.8655
	(1.6178)	(2.8289)	(1.6389)	(2.8491)	(1.3360)	(3.0222)	(1.3393)	(3.0285)
metro status	0.0218	-0.0102	0.0241	-0.0192	0.0825	0.0641	0.0741	0.0642
	(0.0580)	(0.0413)	(0.0583)	(0.0416)	(0.0535)	(0.0361)	(0.0570)	(0.0361)
const	7.7174	7.6113	7.6143	7.5778	7.4228	7.9525	7.2996	7.9388
	(0.1805)	(0.1724)	(0.1939)	(0.1728)	(0.1720)	(0.1672)	(0.1704)	(0.1690)
R2 adj	0.2114	0.2118	0.2060	0.2092	0.3152	0.2567	0.2954	0.2563
N	1111	1455	1111	1455	1553	1604	1553	1604

Note: All statistics are weighted by the cross-sectional weights. SAT scores are obtained high school transcript questionnaire. SAT scores are available for 950 and 1407 respondents, in NLSY79 and NLSY97, respectively. Wages are inflation adjusted to 2007 using the CPI-U. Test scores are normalized to have zero mean and one standard deviation. Education variables: hs=1 for high school graduates and 0 otherwise, aa=1 for individuals with an associate degree, ba=1 for a bachelor's degree holders and ma=1 for individuals with a master's degree or higher. The unemployment rate is measured by a 3-year moving average and is calculated using Current Population Surveys. Coefficients and standard errors presented. Respondents are clustered at the primary sampling unit, robust standard errors are reported. First stage results are reported in Table A.10.

Table A.10: First stage: using SAT scores to instrument for AFQT scores, workers with 12 or more years of schooling

	NLSY79	NLSY97	NLSY79	NLSY97
	men		women	
SAT score	0.4500	0.5100	0.5172	0.5100
	(0.0162)	(0.0134)	(0.0139)	(0.0128)
hs	-0.0805	0.0142	-0.0085	-0.1702
	(0.0522)	(0.0608)	(0.0616)	(0.0461)
aa	-0.0366	-0.1298	0.0740	-0.0497
	(0.0800)	(0.0927)	(0.0684)	(0.0534)
ba	0.0794	0.0625	0.1283	-0.1505
	(0.0435)	(0.0576)	(0.0588)	(0.0415)
experience	-0.0099	0.0076	0.0062	-0.0008
	(0.0253)	(0.0143)	(0.0248)	(0.0143)
$experience^2$	0.0003	-0.0011	-0.0001	0.0012
	(0.0024)	(0.0019)	(0.0023)	(0.0020)
black	-0.3003	-0.2357	-0.5960	-0.1370
	(0.0438)	(0.0424)	(0.0376)	(0.0282)
unempl rate	-0.7678	3.3549	3.2323	3.2201
	(1.0496)	(2.5046)	(1.0223)	(2.6701)
metro status	-0.0365	0.1062	0.0330	-0.0719
	(0.0303)	(0.0243)	(0.0284)	(0.0230)
const	1.0155	0.4420	0.4362	0.6721
	(0.1051)	(0.1452)	(0.1249)	(0.1451)
R2 adj	0.6653	0.6513	0.7048	0.6207
N	1111	1455	1553	1604

Note: All statistics are weighted by the cross-sectional weights. SAT scores are obtained high school transcript questionnaire. SAT scores are available for 950 and 1407 respondents, in NLSY79 and NLSY97, respectively. Wages are inflation adjusted to 2007 using the CPI-U. Test scores are normalized to have zero mean and one standard deviation. Education variables: hs=1 for high school graduates and 0 otherwise, aa=1 for individuals with an associate degree, ba=1 for a bachelor's degree holders and ma=1 for individuals with a master's degree or higher. The unemployment rate is measured by a 3-year moving average and is calculated using Current Population Surveys. Coefficients and standard errors presented.

Table A.11: Returns to AFQT, standard weights, OLS, by reason to take the test

	men				women			
	NLSY79	NLSY97			NLSY79	NLSY97		
	all	all	motivated	non-motivated	all	all	motivated	non-motivated
AFQT score	0.0852	0.0343	0.0483	0.0175	0.1026	0.0641	0.0662	0.0586
	(0.0094)	(0.0080)	(0.0105)	(0.0126)	(0.0079)	(0.0079)	(0.0096)	(0.0140)
hs	0.1185	0.1672	0.1475	0.1916	0.1393	0.1624	0.1703	0.1411
	(0.0199)	(0.0199)	(0.0255)	(0.0315)	(0.0211)	(0.0177)	(0.0205)	(0.0345)
aa	0.2649	0.4230	0.4177	0.4326	0.3203	0.4217	0.4470	0.3855
	(0.0339)	(0.0441)	(0.0698)	(0.0600)	(0.0312)	(0.0386)	(0.0470)	(0.0644)
ba	0.4048	0.5600	0.5551	0.5706	0.4761	0.6023	0.6222	0.5692
	(0.0291)	(0.0301)	(0.0417)	(0.0443)	(0.0286)	(0.0265)	(0.0342)	(0.0447)
ma	0.5746	0.8809	0.8959	0.8542	0.5995	0.9417	0.9443	0.9551
	(0.0560)	(0.0812)	(0.1046)	(0.1212)	(0.0588)	(0.0563)	(0.0731)	(0.0845)
experience	0.0714	0.0614	0.0534	0.0676	0.0764	0.0429	0.0482	0.0357
	(0.0066)	(0.0058)	(0.0080)	(0.0084)	(0.0064)	(0.0055)	(0.0070)	(0.0091)
$experience^2$	-0.0030	-0.0027	-0.0018	-0.0035	-0.0040	-0.0025	-0.0030	-0.0018
	(0.0005)	(0.0006)	(0.0008)	(0.0008)	(0.0005)	(0.0005)	(0.0006)	(0.0009)
black	-0.0948	-0.1339	-0.0981	-0.1674	0.0133	-0.0024	-0.0147	0.0217
	(0.0160)	(0.0151)	(0.0205)	(0.0227)	(0.0141)	(0.0140)	(0.0169)	(0.0252)
unempl rate	-1.8850	-2.3282	-1.8615	-2.5458	-2.2654	-5.1401	-4.6066	-5.6816
	(0.3882)	(0.8485)	(1.1685)	(1.2611)	(0.3997)	(0.8656)	(1.1314)	(1.3733)
metro status	0.0398	-0.0125	-0.0048	-0.0255	0.0610	0.0377	0.0339	0.0499
	(0.0160)	(0.0142)	(0.0185)	(0.0217)	(0.0141)	(0.0137)	(0.0176)	(0.0222)
const	6.8852	6.8802	6.8545	6.8924	6.6555	6.8829	6.8488	6.9253
	(0.0459)	(0.0525)	(0.0719)	(0.0787)	(0.0446)	(0.0526)	(0.0683)	(0.0842)
R2 adj	0.1565	0.1573	0.1813	0.1373	0.2253	0.2797	0.2921	0.2600
N	21062	12442	6430	5743	17227	10889	6508	4204

Note: All statistics are weighted by the cross-sectional weights. Wages are inflation adjusted to 2007 using the CPI-U. Test scores are normalized to have zero mean and one standard deviation. See Section 3.1 for definitions of "motivated" and "non-motivated" test-takers. Education variables: hs=1 for high school graduates and 0 otherwise, aa=1 for individuals with an associate degree, ba=1 for a bachelor's degree holders and ma=1 for individuals with a master's degree or higher. The unemployment rate is measured by a 3-year moving average and is calculated using Current Population Surveys. Coefficients and standard errors presented. Respondents are clustered at the primary sampling unit, robust standard errors are reported.

Table A.12: Returns to AFQT, standard weights, OLS, controlling for test motivation, NLSY97

	men				women			
test score		0.0343		0.0354		0.0641		0.0627
		(0.0080)		(0.0081)		(0.0079)		(0.0080)
"motivated"			-0.0168	-0.0173			0.0262	0.0261
			(0.0144)	(0.0143)			(0.0139)	(0.0137)
hs	0.1902	0.1672	0.1910	0.1675	0.2043	0.1624	0.2021	0.1614
	(0.0195)	(0.0199)	(0.0199)	(0.0203)	(0.0173)	(0.0177)	(0.0175)	(0.0180)
aa	0.4505	0.4230	0.4520	0.4243	0.4895	0.4217	0.4875	0.4216
	(0.0440)	(0.0441)	(0.0455)	(0.0456)	(0.0374)	(0.0386)	(0.0374)	(0.0386)
ba	0.6104	0.5600	0.6113	0.5596	0.6901	0.6023	0.6873	0.6020
	(0.0281)	(0.0301)	(0.0284)	(0.0304)	(0.0246)	(0.0265)	(0.0249)	(0.0268)
ma	0.9382	0.8809	0.9448	0.8860	1.0411	0.9417	1.0550	0.9580
	(0.0817)	(0.0812)	(0.0830)	(0.0824)	(0.0559)	(0.0563)	(0.0566)	(0.0567)
experience	0.0599	0.0614	0.0591	0.0607	0.0396	0.0429	0.0401	0.0434
	(0.0058)	(0.0058)	(0.0058)	(0.0058)	(0.0055)	(0.0055)	(0.0056)	(0.0056)
$experience^2$	-0.0027	-0.0027	-0.0026	-0.0027	-0.0025	-0.0025	-0.0026	-0.0026
	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0005)	(0.0005)	(0.0005)	(0.0005)
black	-0.1542	-0.1339	-0.1517	-0.1312	-0.0471	-0.0024	-0.0457	-0.0027
	(0.0145)	(0.0151)	(0.0147)	(0.0153)	(0.0139)	(0.0140)	(0.0141)	(0.0142)
unempl rate	-2.4577	-2.3282	-2.3300	-2.1932	-5.3451	-5.1401	-5.2025	-5.0146
	(0.8480)	(0.8485)	(0.8592)	(0.8596)	(0.8759)	(0.8656)	(0.8838)	(0.8735)
metro status	-0.0094	-0.0125	-0.0127	-0.0162	0.0448	0.0377	0.0465	0.0399
	(0.0142)	(0.0142)	(0.0143)	(0.0143)	(0.0138)	(0.0137)	(0.0139)	(0.0138)
const	6.8664	6.8802	6.8666	6.8807	6.8530	6.8829	6.8352	6.8646
	(0.0527)	(0.0525)	(0.0538)	(0.0536)	(0.0530)	(0.0526)	(0.0544)	(0.0539)
R2 adj	0.1533	0.1573	0.1536	0.1579	0.2658	0.2797	0.2653	0.2785
N	12442	12442	12173	12173	10889	10889	10712	10712

Note: All statistics are weighted by the cross-sectional weights. Wages are inflation adjusted to 2007 using the CPI-U. Test scores are normalized to have zero mean and one standard deviation. See Section 3.1 for definition of "motivated" test-takers. Education variables: hs=1 for high school graduates and 0 otherwise, aa=1 for individuals with an associate degree, ba=1 for a bachelor's degree holders and ma=1 for individuals with a master's degree or higher. The unemployment rate is measured by a 3-year moving average and is calculated using Current Population Surveys. Coefficients and standard errors presented. Respondents are clustered at the primary sampling unit, robust standard errors are reported.

Table A.13: Returns to AFQT, NLSY97 reweighted using constructed weights, men

	reweighted by age		reweighted by age, family background (no fam inc)		reweighted by age, family background (with fam inc)		reweighted by age, ind and occs, family background (no fam inc)	
	NLSY79	NLSY97	NLSY79	NLSY97	NLSY79	NLSY97	NLSY79	NLSY97
AFQT score	0.0852	0.0480	0.0840	0.0451	0.0810	0.0432	0.0841	0.0422
	(0.0094)	(0.0115)	(0.0105)	(0.0133)	(0.0126)	(0.0144)	(0.0105)	(0.0159)
hs	0.1185	0.1630	0.1298	0.1498	0.1072	0.1377	0.1299	0.1535
	(0.0199)	(0.0350)	(0.0227)	(0.0334)	(0.0321)	(0.0383)	(0.0229)	(0.0355)
aa	0.2649	0.4122	0.2749	0.3513	0.2570	0.3500	0.2722	0.3375
	(0.0339)	(0.0543)	(0.0368)	(0.0631)	(0.0505)	(0.0697)	(0.0368)	(0.0683)
ba	0.4048	0.5172	0.4236	0.5096	0.4410	0.5029	0.4232	0.5427
	(0.0291)	(0.0492)	(0.0319)	(0.0567)	(0.0460)	(0.0573)	(0.0321)	(0.0561)
ma	0.5746	0.8077	0.5826	0.7398	0.4755	0.7476	0.5810	0.7764
	(0.0560)	(0.0779)	(0.0597)	(0.0955)	(0.0890)	(0.1145)	(0.0598)	(0.0980)
experience	0.0714	0.0599	0.0740	0.0777	0.0557	0.0766	0.0739	0.0619
	(0.0066)	(0.0122)	(0.0075)	(0.0114)	(0.0108)	(0.0120)	(0.0075)	(0.0120)
experience^2	-0.0030	-0.0023	-0.0031	-0.0048	-0.0026	-0.0044	-0.0031	-0.0032
	(0.0005)	(0.0011)	(0.0006)	(0.0009)	(0.0008)	(0.0011)	(0.0006)	(0.0010)
black	-0.0948	-0.1387	-0.0903	-0.1373	-0.0711	-0.1394	-0.0909	-0.1178
	(0.0160)	(0.0247)	(0.0182)	(0.0278)	(0.0233)	(0.0307)	(0.0183)	(0.0287)
unempl rate	-1.8850	-9.6212	-1.7630	-9.5642	-4.6662	-9.0346	-1.8418	-12.0799
	(0.3882)	(1.3862)	(0.4268)	(2.0779)	(0.8665)	(2.1623)	(0.4286)	(2.0801)
metro status	0.0398	0.0071	0.0462	-0.0060	0.0347	-0.0232	0.0474	-0.0068
	(0.0160)	(0.0217)	(0.0174)	(0.0246)	(0.0244)	(0.0274)	(0.0174)	(0.0255)
const	6.8852	7.2979	6.8547	7.3000	7.1432	7.2816	6.8608	7.4518
	(0.0459)	(0.0959)	(0.0507)	(0.1292)	(0.1014)	(0.1320)	(0.0513)	(0.1318)
R2 adj	0.1565	0.1659	0.1537	0.1517	0.2083	0.1480	0.1539	0.1612
N	21062	12442	16936	10254	8048	8342	16805	10182

Note: Statistics are weighted using specified weights. Wages are inflation adjusted to 2007 using the CPI-U. Test scores are normalized to have zero mean and one standard deviation. Education variables: hs=1 for high school graduates and 0 otherwise, aa=1 for individuals with an associate degree, ba=1 for a bachelor's degree holders and ma=1 for individuals with a master's degree or higher. The unemployment rate is measured by a 3-year moving average and is calculated using Current Population Surveys. Coefficients and standard errors presented. Respondents are clustered at the primary sampling unit, robust standard errors are reported.

Table A.14: Returns to AFQT, NLSY97 reweighted using constructed weights, women

	reweighted by age		reweighted by age, family background (no fam inc)		reweighted by age, family background (with fam inc)		reweighted by age, ind and occs, family background (no fam inc)	
	NLSY79	NLSY97	NLSY79	NLSY97	NLSY79	NLSY97	NLSY79	NLSY97
AFQT score	0.1026	0.0789	0.1076	0.0735	0.1031	0.0660	0.1081	0.0559
	(0.0079)	(0.0113)	(0.0087)	(0.0143)	(0.0134)	(0.0145)	(0.0087)	(0.0201)
hs	0.1393	0.1480	0.1167	0.1703	0.0596	0.1571	0.1148	0.1710
	(0.0211)	(0.0238)	(0.0249)	(0.0352)	(0.0427)	(0.0333)	(0.0251)	(0.0428)
aa	0.3203	0.3964	0.2993	0.3828	0.2284	0.3697	0.2974	0.3517
	(0.0312)	(0.0438)	(0.0343)	(0.0582)	(0.0554)	(0.0646)	(0.0345)	(0.0609)
ba	0.4761	0.5512	0.4492	0.5811	0.4010	0.5773	0.4455	0.5940
	(0.0286)	(0.0396)	(0.0320)	(0.0538)	(0.0566)	(0.0521)	(0.0322)	(0.0744)
ma	0.5995	0.9592	0.6097	0.8192	0.4665	0.9029	0.6053	0.9547
	(0.0588)	(0.0734)	(0.0541)	(0.0887)	(0.0866)	(0.0867)	(0.0542)	(0.1240)
experience	0.0764	0.0429	0.0831	0.0450	0.0698	0.0431	0.0832	0.0502
	(0.0064)	(0.0090)	(0.0071)	(0.0113)	(0.0113)	(0.0118)	(0.0071)	(0.0148)
experience^2	-0.0040	-0.0027	-0.0047	-0.0032	-0.0042	-0.0029	-0.0047	-0.0035
	(0.0005)	(0.0007)	(0.0006)	(0.0009)	(0.0009)	(0.0010)	(0.0006)	(0.0012)
black	0.0133	-0.0168	0.0281	-0.0182	-0.0125	-0.0121	0.0285	-0.0036
	(0.0141)	(0.0213)	(0.0160)	(0.0240)	(0.0244)	(0.0267)	(0.0161)	(0.0300)
unempl rate	-2.2654	-10.9144	-2.5334	-10.7131	-4.1317	-9.9491	-2.6035	-5.8074
	(0.3997)	(1.1159)	(0.4333)	(2.0287)	(0.9554)	(2.0214)	(0.4359)	(2.5280)
metro status	0.0610	0.0362	0.0595	0.0240	0.0840	0.0139	0.0597	0.0287
	(0.0141)	(0.0193)	(0.0152)	(0.0231)	(0.0243)	(0.0251)	(0.0152)	(0.0314)
const	6.6555	7.2576	6.6822	7.2284	6.8962	7.2017	6.6914	6.9161
	(0.0446)	(0.0776)	(0.0483)	(0.1387)	(0.1121)	(0.1363)	(0.0489)	(0.1665)
R2 adj	0.2253	0.3184	0.2300	0.2893	0.2508	0.2918	0.2299	0.2277
N	17227	10889	14329	8867	6306	7402	14237	8834

Note: Statistics are weighted using specified weights. Wages are inflation adjusted to 2007 using the CPI-U. Test scores are normalized to have zero mean and one standard deviation. Education variables: hs=1 for high school graduates and 0 otherwise, aa=1 for individuals with an associate degree, ba=1 for a bachelor's degree holders and ma=1 for individuals with a master's degree or higher. The unemployment rate is measured by a 3-year moving average and is calculated using Current Population Surveys. Coefficients and standard errors presented. Respondents are clustered at the primary sampling unit, robust standard errors are reported.

Table A.15: Dynamic wage equation, OLS

	men				women			
	NLSY79	NLSY97	NLSY79	NLSY97	NLSY79	NLSY97	NLSY79	NLSY97
AFQT	0.0731	0.0305	0.0315	0.0257	0.0934	0.0687	0.0714	0.0659
	(0.0095)	(0.0116)	(0.0156)	(0.0234)	(0.0081)	(0.0109)	(0.0146)	(0.0171)
education	0.0699	0.0987	0.0972	0.0909	0.0806	0.1048	0.1080	0.1454
	(0.0040)	(0.0066)	(0.0079)	(0.0137)	(0.0039)	(0.0058)	(0.0082)	(0.0093)
AFQT*exp			0.0065	0.0007			0.0038	0.0007
			(0.0020)	(0.0041)			(0.0021)	(0.0029)
educ*exp			-0.0049	0.0016			-0.0055	-0.0092
			(0.0013)	(0.0024)			(0.0014)	(0.0018)
experience	0.0508	0.0651	0.1305	0.0334	0.0565	0.0324	0.1497	0.2073
	(0.0070)	(0.0123)	(0.0203)	(0.0425)	(0.0073)	(0.0086)	(0.0212)	(0.0317)
experience^2	-0.0010	-0.0008	-0.0026	0.0002	-0.0021	0.0001	-0.0043	-0.0053
	(0.0005)	(0.0011)	(0.0006)	(0.0016)	(0.0006)	(0.0006)	(0.0006)	(0.0011)
black	-0.1090	-0.1520	-0.1070	-0.1520	-0.0195	-0.0453	-0.0158	-0.0394
	(0.0159)	(0.0231)	(0.0159)	(0.0231)	(0.0143)	(0.0205)	(0.0143)	(0.0202)
unempl rate	-1.3777	-1.0291	-1.5177	-0.7622	-1.8819	-4.4528	-2.0173	-6.0286
	(0.3927)	(1.1585)	(0.3985)	(1.2699)	(0.4024)	(1.0371)	(0.4079)	(1.1292)
metro status	0.0424	0.0061	0.0426	0.0067	0.0570	0.0471	0.0567	0.0437
	(0.0161)	(0.0215)	(0.0160)	(0.0215)	(0.0142)	(0.0192)	(0.0141)	(0.0190)
const	6.1683	5.7144	5.7858	5.8282	5.8421	5.7377	5.4478	5.1553
	(0.0705)	(0.1347)	(0.1146)	(0.1982)	(0.0655)	(0.1241)	(0.1133)	(0.1454)
R2 adj	0.1619	0.1900	0.1637	0.1902	0.2217	0.3219	0.2238	0.3305
N	21062	12442	21062	12442	17227	10889	17227	10889

Note: NLSY79 statistics are weighted by the cross-sectional weights. NLSY97 statistics are weighted using weights constructed to match age distributions. Wages are inflation adjusted to 2007 using the CPI-U. Test scores are normalized to have zero mean and one standard deviation. Education measures years of schooling. Unemployment rate is measured by a 3-year moving average and is calculated using Current Population Surveys. Coefficients and standard errors presented. Respondents are clustered at the primary sampling unit, robust standard errors are reported.