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 ability 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 substantially larger impact 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 tools 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 an extensive debate about whether more educated workers earn higher wages due to formal education or due to their unobservable characteristics, such as higher cognitive ability. 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. In this work we add to this literature by examining the changing roles of formal education and cognitive ability in wage determination between the 1980s and 2000s. We show that returns to formal education grew substantially during the entire period and did not slow down in the nineties. On the other hand, returns to cognitive ability have decreased over time.

A number of studies examine the trend in the return to cognitive ability as measured by scores on standardized tests. Blackburn and Neumark (1993) report that the rise in return to education is concentrated among those with both high education and high ability, but they argue that there is no trend in the return to ability.[1] They estimate the model using the 1979 National Longitudinal Survey of Youth (NLSY79), gathering information for the 1979 - 1987 period, for a single experience group, using only entry wages. Grogger and Eide (1995) employ two longitudinal surveys that follow the same individuals: National Longitudinal Study of the High School Class of 1972 (NLS72) and the High School and Beyond (HSB), using late 1970s and mid 1980s data.[2]

[1] In their study cognitive ability is measured by an average of three subtests of the Armed Services Vocational Aptitude Battery (ASVAB) test scores.

[2] Ability is 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.

They assume linear experience effects and no age effects and find that standardized test scores and high school grades had no effect on the change in college wage premium for men, but returns to math ability rose considerably for women. They also find that the rise in economic return to education is concentrated among the most able. Bishop (1991) uses NLSY79 for the 1981 - 1986 period, assuming linear time and age effects, he finds that the time trend of returns to ability is not statistically significant for either men or women.

These studies attempt to decompose the increasing return to schooling using data that follow the same individuals or using repeated cross-section samples of the same cohorts over time. When following the same individuals or cohort over time, the identification of age, cohort and time effects, is merely possible since we do not observe two individuals of similar age who were born in different periods. Therefore, it is difficult to infer whether the rise in return to ability is due to changes in the value of cognitive skills, or because ability becomes more valuable with work experience (see Cawley, Heckman, Lochner and Vytlacil 1998, for further discussion).

Murnane, Willett and Levy (1995) implement an alternative econometric approach and identify both time and age effects. They use the NLS72 and the HSB datasets to compare wages in 1978 with wages in 1986. They estimate the contribution of ability, measured by scores in a math test, to the rise in the return to education measured at the age of 24 in 1978 and 1986. They conclude that 38% of the rise in the return to education during this period can be attributed to a rise in the return to ability.

Several studies evaluate returns to unobservable skills by examining the changing patterns of wage distribution. In recent decades there were two important changes in the wage distribution: an increase in the college/high school wage gap, and a substantial rise in the variance of wage residuals both within and between groups. The second change is typically attributed to an increase in the demand for unobserved skill, as for example argued by Juhn, Murphy and Pierce (1993). Chay and Lee (2000) and Taber (2001) examine the changing distributional patterns between the 1980s and early 1990s to evaluate returns to schooling and ability. Chay and Lee find evidence of an increase in the return to skill, but argue that it cannot be large enough to account for the full increase in the return to schooling. Their results are in contrast to Taber's findings, which suggest that an increase in the demand for unobserved ability could play a major role in the growing college premium.

This work provides new evidence on the relationships between formal education, ability and wages. We evaluate to what extent cognitive skills captured by the Armed Services Vocational Aptitude Battery (ASVAB) tests affect wages of young adults and how this relationship has changed over time.[3] Existing research mainly focuses on developments in the 1980s, here we examine the determinants of wages in 1980s and 2000s using the 1980 - 1991 waves in NLSY79 and the 1999 - 2008 waves in NLSY97, and analyze the 18 - 28 age group in both datasets. By examining how the ability-wage relationship differs between the two cohorts, we evaluate how the returns to cognitive skills and schooling have changed over the last 20 years.

The key finding is that cognitive skills were substantially more important in the 1980s than in the 2000s. We show that returns to cognitive ability have decreased by 20% - 50% between the 1980s and 2000s for men and women. We also show that the slowing down in the increase of returns to education during this period is less pronounced when controlling for ability. These changes in returns are persistent across education groups, hold for various ability measures and are robust in various specifications. We show that our findings are in line with technological changes and reforms in education system that took place between the 1980s and 2000s. The results also point out that the increase in wage inequality or in residual wage inequality over the recent decades, (see for example Heathcote, Perri and Violante, 2010), cannot be attributed to an increase in returns to unobserved cognitive skills.

We consider various factors that could generate such a dramatic decline in the ability premium in the 2000s. First, we examine changing distributions of skills and assess how the returns to education and cognitive ability would have changed if the observable population characteristics remained constant between the 1980s and 2000s. One difference between the two samples is in

[3] Although the ASVAB scores are noisy measures of ability, they are widely 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).

the age distribution of the respondents. The age range is similar in both datasets but, due to differences in sampling methodologies, NLSY97 respondents are younger on average than NLSY79 respondents. The cohorts also have different distributions of family background measures: the respondents of the 1997 cohort have more educated parents and are more likely to live in single-parent households. To minimize these differences, we follow the density reweighting procedure described in DiNardo, Fortin and Lemieux (1996). We re-estimate wage equations for the NLSY97 cohort applying population weights to match NLSY79 distributions. Changing distributions of various observed characteristics cannot explain the decrease in returns to cognitive ability. Second, we examine whether changing labor market structure can explain the decreasing return to cognitive skills. We perform a similar reweighting procedure to adjust the distributions of occupations and industries across surveys, and show that these adjustments do not change the results. Third, we assess whether changes in test-taking conditions and incentives could affect the outcomes through a measurement error in test scores. Measurement errors do not explain much of the decline in returns to cognitive skills.

To further study the changes in skill prices between the 1980s and 2000s, we examine developments in wage dynamics over the 20 years. In the 1980s higher ability was associated with higher wage growth; wage growth in 2000s is not affected by ability. We evaluate these findings within the Ben-Porath (1967) human capital framework. We argue that these changes in wage dynamics, and therefore the overall decline in returns to ability, can be attributed to the changing pace of technological progress between the two periods. More rapid technological growth raises the importance of on-the-job training and therefore raises returns to experience, with a larger increase for more able workers if these workers are more trainable. Many studies suggest that technological progress has slowed down in late 1990s, see for example, Greenwood and Yorokoglu (1997) and Katz (2000). We demonstrate this trend using constructed technological change indexes. These developments could decrease the importance of post-schooling training and therefore narrow the role of ability in wage determination. We also address the changes in wage dynamics within the employer-learning theory, which uses a similar empirical specification (see for example, Altonji and Pierret 2001). Within this framework, the results suggest that there were advances in signaling about unobserved skills between 1980s and 2000s.

This paper proceeds as follows. Section 2 describes the datasets in detail. Our main empirical results are reported in Section 3. We examine the changing roles of cognitive skills and formal education in the wage function. We also perform a sensitivity analysis to evaluate whether differences in skills distributions and changing test-taking conditions can explain the outcomes. Section 4 explores the dynamics of wages and evaluates findings within the human capital and asymmetric employer-learning theories. 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 12687 young men and women who were ages 14 - 22 in 1979, and NLSY97 samples 8985 individuals who were ages 12-16 in 1997. We pool observations for the years 1980 - 1991 for NLSY79, and 1999 - 2008 for NLSY97. We employ both cross-sectional and supplemental samples (excluding the military supplement) in NLSY79 and 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 (2008) provide a detailed analysis of each dataset and suggest methods to achieve compatibility. We follow their methodology where applicable.[4]

Individuals enrolled in school and military service are excluded from the analysis. Only workers with at least 20 hours per week and real hourly wages within the range of 3 to 100 dollars (in

[4]Some studies have raised a concern regarding the representativeness of the NLSY97. These issues are discussed in detail by Altonji et al. (2008), 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.

2007 prices, deflated using the CPI) are considered. 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.[5] The final samples of men contain 23792 observations in the 1979 cohort and 12621 in the 1997 cohort. The number of individuals in each cohort is 4635 and 3030, respectively. For women we use 19409 observations in NLSY79 and 11177 observations in NLSY97, pooling information on 4438 and 2943 respondents respectively. We pool observations for years 1980-1991 for the NLSY79, and 1999-2008 for the NLSY97. We use weights provided by the Bureau of Labor Statistics (BLS) to achieve representativeness of the population.[6]

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.[7]

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

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

[6] 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.

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

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.[8]

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. (2008).[9]

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

The ASVAB scores are widely used in the literature as a measure of cognitive achievement, aptitude and intelligence. Some studies suggest 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

[8]We interpret each measure as a proxy for cognitive ability and avoid using more than one measure in estimations due to their high correlations. For instance, the correlation between Math and Verbal scores is 0.75.

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

when they were 16 years old (the youngest overlap age in the two samples) and attended 8th or 9th grade. Another concern is that students can choose different levels of schooling after taking the AFQT. Individuals with higher scores on the AFQT are more likely to complete higher education grades, 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). Given that the correlation between ability and schooling does not vary much over time we are able to compare returns to ability 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 observations, the average college graduation rate is larger, and stands at 16%. For women, the college graduation rates increases from 16% to 21%. After the age adjustment the graduation rates increases in the second cohort to 22%.

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. Limiting the observations to 25 year old individuals we obtain 12.6 and 13.1 years of education for males and females, respectively. 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. In the 25 years old subsample of NLSY97 data, these numbers are 13.1 and 13.9 respectively.[10]

To construct work experience we count the number of years after completing the most recent degree. 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

[10]The statistics for 25 year old individuals are not reported and are available upon request.

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. (2008).

Table 1 also summarizes information on the family background of the respondents: parental education, intact family and family income. NLSY79 contains measures of family income reported in early survey years, NLSY97 contains a measures family income in 1997. For the 1979 cohort, we use average family income when participants are aged 16-17, excluding those not living with their parents at these ages. This limits the sample to the younger cohorts of the NLSY79, those born between 1961 and 1964.[11] The NLSY97 analysis is based on family income in 1997, dropping individuals not living with their parents in that year. We denominate the family income measure in 2007 dollars, using the CPI. Mean family income remained fairly constant over time but its dispersion 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 centers on estimating wage functions using NLSY79 and NLSY97, treating men and women separately. To evaluate the changes in effects of schooling and cognitive ability on earnings, we employ identical estimation specifications for each cohort. For simplicity of interpretation and to facilitate comparison with other studies, we use the standard Mincer framework:

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

[11] When income is available only for age 16 or age 17 and not both, we use the available measure.

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, $ABILITY_i$ is cognitive ability 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 with $T \in \{NLSY79, NLSY97\}$. 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 propose a dynamic model to estimate returns to formal schooling and ability.[12]

The results are reported in Tables 2 and 3, for men and women respectively. Columns (1) and (2) report effects of education on wages when ability is not controlled for. Returns to education in this specification display modest increases over time for men and women, confirming patterns described in other studies. Returns to experience are lower for the NLSY97 cohort than for the NLSY79 cohort. The remaining columns display estimation results that include ability measures. The most striking outcome is the significant decline in 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 male workers, an increase in the AFQT score by 10 points is associated with a 2.6% increase in hourly wage for the 1979 cohort, but only with a 1.1% increase for the 1997 cohort. For female workers, the effect of a 10 point increase in AFQT score on the real wage rate drops from 3.5% to 2.2%.[13] Similar large declines in returns to ability are documented when using alternative measures. A 10 point increase in Math (Verbal) score is associated with an increase of 1.2% (0.6%) in the wage rate in the 1980s and with 0.5% (0.2%) increase in the 2000s.[14]

[12]All estimations use age and format adjusted scores. It should be noted that our qualitative findings do not change if we adjust scores only by age.

[13]It should be noted that the standard deviation of the AFQT score for men is around 30 points in both samples (Table 1). Thus, an increase by one standard deviation in the AFQT score is associated with around a 7.8% increase in hourly wage for the 1979 cohort, and a 3.3% increase for the 1997 cohort.

[14]The standard deviation of the Math score for men is 8.1 in NLSY79 and 8.9 in NLSY97. The standard deviation of the Verbal score is around 10 points (Table 1).

When controlling for ability, the increase in returns to education is more pronounced at all levels for both men and women. For instance, the returns to a bachelor's degree in the 1980s are 5.5% for men and 6.3% for women in the specification that excludes the ability measure (column 1 in Tables 2 and 3). In a similar specification, these returns are 6% and 6.9% in the 2000s (column 2 in Tables 2 and 3). Estimates obtained from the model that includes the AFQT score to measure ability gives 4% and 4.8% for men and women in the 1980s, and 5.5% and 6% in the 2000s. These outcomes imply that the returns to education are much higher in the 2000s and the ability bias is larger when estimating the wage equation for the 1980s. In both periods, returns to experience do not change significantly when controlling for AFQT scores.

Table 4 reports estimation results of the wage equation controlling for additional characteristics, family background and occupations and industries. Including family background controls reduces the coefficients of ability measures for males in NLSY79 but have a smaller effect on NLSY97 coefficients. For women, the effects of additional controls are small for both cohorts. Including occupation and industry indicators does not have much effect on the outcomes, suggesting that the decline in returns to cognitive skills is not driven by developments in specific sectors of the labor market. Overall, the differences in returns to cognitive skills between the 1980s and 2000s remain significant under all specifications, for men and women.

Returns to ability measures by education are reported in Table 5. These results show that the decrease in returns to ability occurred across different education levels for men and women. The differences in the ability coefficients across samples are statistically significant at a 1% - 10% level in all specifications except those for women with lower than high school education.

The same pattern is observed in Table 6, which records estimation results by race. The returns to ability decrease for white and black men and 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) - (6) in Tables 12 and 13 report estimation results using years of schooling (highest grade completed) for men and women. The decline in returns to cognitive ability is substantial in these specifications as well. For example, the AFQT coefficient drops from 2.3% for a 10-point increase in test score to 0.6% for men, and from 3.2% to 1.9% for women.

These estimation results document a significant decline in returns to cognitive ability between 1980s and 2000s. The estimations use a representative dataset but do not control for changing distributions of observable characteristics nor for potential measurement errors in test scores. We address these issues in the following Subsection.

3.1 Robustness/ Sensitivity Analysis

The results reported in Tables 2 - 6 are robust in various specifications, and the main findings do not change much when including additional control variables. Here we perform a few more tests to evaluate whether changes in test-taking incentives and conditions or changes in the distributions of individual characteristics can explain the main findings. First, we check whether changes in test-taking conditions and incentives could affect the outcomes.[15] Second, NLSY97 respondents differ from NLSY79 respondents in age distribution. Individuals in NLSY97 are younger on average than those in NLSY79, as evident from comparing the mean ages in columns (1) and (3) and (7) and (9) in Table 1. We construct weights to adjust age distributions and estimate equation (1). The respondents in each survey also differ in other dimensions: in additional estimations we control for changing distributions of workers' observable characteristics and for changing labor market structure.

Changes in test-taking conditions Section 2 described the procedure to obtain comparable test score distributions across samples. We also estimate equation (1) for the group of individuals who took the ASVAB test when they were 16 years old, which is an overlapping age to take the test across the NLSY cohorts. To perform these estimations we use scores reweighted only using the

[15] In addition to format differences and to age differences at the time of the test, there are differences in the monetary award for participating in the ASVAB. This compensation was significantly higher in 1979 than in 1997, which may suggest higher measurement errors in test scores in 1997.

mapping to obtain comparable distributions of P&P and CAT formats, described in Segall (1997). The results, reported in Tables 7 and 8, 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% - 10% level for men and at a 1% level for women.[16]

An additional difference in test-taking methodologies between the two samples is in the amount of financial compensation for participating in ASVAB, which was lower for the later cohort and could affect performance in the test 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).[17]

The estimation results for men and women, for each subgroup, are reported in Table 9. Individuals who are assumed to have higher motivation to take the test also 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 we do not find any correlation between the reason to take ASVAB and wages.[18]

The return to cognitive ability estimated for the 1980s is two to four times higher than the estimated return in 2000s, for each subgroup. The differences in AFQT and Math scores are statistically significant at a 1% level for men and women, and differences in Verbal scores are statistically significant at 10% for men and at 1% for women.

[16] Further constraining the sample to include respondents who were 16 years old and attended 8th or 9th grade at the time of the test deliver very similar estimates. These results are available from the authors.

[17] 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.

[18] These results are not reported and are available upon request.

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. The 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. The reweighted data are used to estimate the wage equation controlling for the changing distributions of observable characteristics and labor market structure.

Age The empirical analysis uses individuals between 18 and 28 years old. Both samples are constructed to have the same age range, but their age distributions are not similar. The NLSY97 sample is younger, on average, than the NLSY79 sample. We construct weights for the NLSY97 sample which equalize 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 the upper panels of Tables 10 and 11.

The age-reweighted returns to ability in the 2000s are slightly higher than those obtained using the standard weights in all specifications but still significantly lower than the 1980s returns.[19]

Family Background The summary statistics of family background variables, in Table 1, show several important changes over the past 20 years. Parental education level and proportion of single-parent families increased in the 2000s. We construct a new set of weights by using a model that includes the age variables and mother's and father's education, family income, an intact family indicator, number of siblings and an indicator of Hispanic origin. These predetermined variables might be important for returns to skills estimations since they influence skill development and economic decision-making. Since the family income variable is only available for a subset of respondents we construct two sets of weights, including and excluding the family income variable, and report two set of returns to skill estimates.

Allowing for more flexible forms for the 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, so the corresponding weights are very high; 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. 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.[20] If we do not cap the weights the results are sensitive to propensity model specification and have large standard errors. Capping the weights produces results which are not sensitive to varying model specifications.

Estimation results of equation (1) using the reweighted data are reported in panels B and C of Tables 10 and 11, for men and women respectively.[21] Adding the family background variables to the propensity score model does not affect the coefficients on ability measures much. Results in panels B and C are very similar to those in panel A.

[19]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.

[20]These estimation results are available from the authors upon request.

[21]The estimates and sample sizes of the NLSY79 cohorts are slightly different from those in Tables 2 and 3 since we limit the sample to individuals with no missing values in variables used in propensity score estimations.

Occupational and Industrial Shift We also examine whether the change in return to cognitive ability can be attributed to changes in market structure. Many studies have documented and examined the effects 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, age^2, age^3, occupations and industries indicators to construct another set of weights. Estimation results based on samples with similar densities of occupations and industries (and age) are reported in panel D of Tables 10 and 11. The effect of structural change on the estimates is relatively small for both men and women. In panels E and F we estimate the coefficients using a propensity score model that includes age variables, occupations, industries and family background characteristics. These changes in the propensity model do not affect the estimation results.

4 Wage Dynamics and Returns to Cognitive Ability

We find that returns to cognitive ability have declined substantially and returns to formal education have increased between the 1980s and 2000s. These results were obtained using the standard Mincer equation given by (1). Here we estimate a dynamic wage specification, to allow for variation in education and ability differentials by work experience. For each cohort, $T \in \{NLSY79, NLSY97\}$, we estimate the following equation,

$$\ln wage_{it} = \eta_1^T EDUC_i + \eta_2^T ABILITY_i + \eta_3^T EXP_{it} * EDUC_i + \eta_4^T EXP_{it} * ABILITY_i + \eta_5^T EXP_{it} + \eta_6^T EXP_{it}^2 + X_{it}\eta_7^T + \omega_{it}. \tag{2}$$

Tables 12 and 13 provide estimation results of equation (2), for men and women, respectively. In these estimations the observations in the NLSY79 are weighted using sampling weights provided by the BLS. The observations in the NLSY97 are weighted using constructed weights to match age distributions in NLSY79. Columns (1) - (6) in Tables 12 and 13 report results obtained using equation (1) and do not include ability measures. These results are quite similar to those reported in Tables 2 and 3, and show significant declines in returns to cognitive ability over the 20 years and higher returns to education in the 2000s.

Columns (7) - (12) in Table 12 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 ability 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) - (12) in Table 13. There is a decline in returns to ability with experience, as measured by η_4^{79} and η_4^{97}. Returns to education decrease with experience more substantially in the 2000s. Including wage dynamics into the model yields very similar returns to ability at entry wages across cohorts, suggesting that changing wage dynamics explain the overall decline in returns to cognitive ability for 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 suggests that ability may affect post-schooling investments in human capital, and that formal education may become obsolete over time. Within this theory, adding dynamics to the model captures effects of technological and other structural changes on the human capital accumulation process. Within the employer-learning theory, as for example in Altonji and Pierret (2001), the dynamic equation estimates capture changes in signaling and monitoring mechanisms between the 1980s and 2000s.

Human capital theory analysis is based on the standard Ben-Porath (1967) framework and distinguishes between formal schooling and on-the-job training. In the conventional model, human capital increases potential earnings, and individuals allocate their time between work and on-the-job training. We adopt several standard assumptions about the roles of cognitive ability and technological change in the human capital accumulation process. We rely on earlier findings by Veum (1993) and assume that cognitive ability makes workers more trainable and more able workers receive more training.[22] Additionally, we assume that technological change may affect investments in training. This assumption also relies on findings in previous research. 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 the following framework. In any period t, the stock of human capital is given by the human capital remaining from the preceding period and human capital produced in the current period. The law of motion of human capital accumulation is described as follows: $H_t = Q_t + (1-\delta)H_{t-1}$, where H_t is the stock of human capital in period t, Q_t denotes the human capital produced in the current period t (investment), and δ is the depreciation rate of human capital. Human capital stock at $t = 0$, the year the individual enters the labor market, is H_0, which denotes the level of formal schooling. 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, in equation (2) the coefficient of interaction between education and experience, 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 interaction between ability and experience, η_4^T. The results reported in Tables 12 and 13 show a weakening relationship between returns to ability and potential experience in the 2000s relatively to 1980s for men and women, suggesting a decreasing importance of on-the-job training. The results for men, in Table 12, also show a smaller decline of returns to formal education with experience in the 2000s compared to 1980s, suggesting a decreasing depreciation of formal school-

[22]Veum (1993) uses NLSY79 and proxies cognitive ability with AFQT scores.

ing or increasing complementarity between schooling and experience over time. The decrease 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, in Table 13, also show a weakening 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 developments not captured by the simple specification of equation (2). We attribute the differences between male and female outcomes to the developments in the labor market.[23]

Within the specified human capital accumulation framework, the estimates are consistent with a changing pace of technological growth. A slowing down technological change or more stable workplace environment should lower the importance of post-schooling training in the 2000s relatively to 1980s and therefore narrow the role of ability in wage determination for the younger cohort. More rapid technological change in the 1980s also implies a higher depreciation rate of human capital. Some evidence points in this direction. The adoption of computer-based technologies occurred mainly in the 1980s and the early 1990s, and the work environment in the 2000s was relatively stable. Introduction of innovations into the production process in the recent decade lead to significant efficiency improvements but imposed only moderate adjustments on workers in 2000s. 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. One of their conclusions is that technology has been racing ahead of education, especially in the 1980s. Katz (2000) interprets the slowdown in growth of relative demand for skill since the late 1980s, as reflecting a maturing of the computer revolution. Greenwood and Yorokoglu (1997), in a general equilibrium setup, argue that technological changes where more pronounced at the beginning of the 1980s.

To obtain a measure of technological change, we follow methodologies that were proposed in Cummins and Violante (2002) and implemented in many following studies. According to Cum-

[23] 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.

mins and Violante (2002), the speed of technical change for each capital good in equipment and software category (E&S) can be measured as the difference between the growth rate of constant-quality consumption and the growth rate of the good's quality-adjusted price. We use data from Cummins and Violante (2002) and also employ two additional 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. 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.[24] Figure 2 reports the three aggregate technological change measures. The indexes show that there was a substantial decline in technical change in 2000s. Average annual growth rates in the overall E&S technical change indexes are 5-7% in the 1980s and 1990s and drop to 1% in the 2000s. The C&P index grew by 19-21% on average in the 1980s and 1990s and by 10% in the 2000s.

We also examine the empirical findings in Tables 12 and 13 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. Returns to schooling decrease with labor market experience and increase with initially unobserved ability, since the employer gradually obtains better information on the productivity of an employee.[25] 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. Using the NLSY79 data we find that returns to ability increase with experience, and returns to education decrease with experience. The results are very different for the 1997 cohort. Results in Tables 12 and 13 suggest that there is a weaker evidence for employer's learning about worker's ability in 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 an

[24] 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] 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 growth.

employee's productivity from observing their formal education in the 2000s. This could be an outcome of the introduction of more merit-oriented policies in educational enrollment which benefited more able individuals.[26] Additionally, as suggested by Goldin and Katz (2007), 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.

5 Conclusion

Many studies have addressed the rising return to education over time, trying to assess to what extent this trend can be explained by changing returns to cognitive ability. Most studies focused on the 1980s and found either no trend in returns to ability or rising returns over time. Some of the studies that report an increase in the returns to cognitive ability during the 1980s suggest that skill-biased technological change was behind the rising price of ability in the new market. Here we find that the return to cognitive ability has decreased substantially between the 1980s and the 2000s.

This study uses data from the 1979 and 1997 NLSY cohorts and examines changes in returns to formal education and cognitive ability as measured by the AFQT, Math and Verbal scores. We find that cognitive skills were substantially more important in determining wages in the 1980s than in the 2000s. Using the standard Mincer model we show that returns to cognitive ability decreased by more than 50% between the 1980s and 2000s for men, and by around 40% for women. We also show that the slowing down in the increase of returns to education during this period is less pronounced if controlling for ability. When performing the estimations, we control for various personal characteristics and macroeconomic conditions and find that results are robust under all specifications. We also reweight the NLSY97 to look like the NLSY79 along a number of dimensions using a propensity score matching procedure; we show that changing distributions of various workers characteristics or changing labor market structure cannot explain the findings.

[26] Evidence about the introduction of such policies in the later years is provided in Castex (2010) and Kinsler and Pavan (2011).

Additionally, we show that differences in returns to skills cannot be explained by modifications in survey methodology.

To further examine the changes in skill prices over the 20 year period we estimate 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 argue that these changes in wage dynamics and therefore the overall decline in returns to ability can be attributed to the changing pace of technological progress between the two periods. More rapid technological growth raises the importance of on-the-job training and therefore raises returns to experience, with a larger increase for more able workers if these workers are more trainable. We also address the changes in wage dynamics within the employer-learning theory. Within this framework, the results suggest that there were advances in signaling about unobserved ability between 1980s and 2000s.

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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	8.3	15.8	9.7	12.3	5.7	12.1	6.4	13.4	7.7
AFQT	161.5	31.0	162.2	32.3	158.9	33.4	167.3	26.8	165.6	29.0	161.1	31.1
math score	48.2	8.1	48.6	8.9	48.1	9.0	46.9	6.6	49.6	8.1	48.7	8.4
varbal score	45.3	9.8	45.4	10.2	44.2	10.7	47.9	8.5	46.8	9.3	45.2	10.1
hs	0.68	0.47	0.69	0.46	0.65	0.48	0.69	0.46	0.62	0.49	0.59	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	0.34	0.16	0.37	0.16	0.36	0.21	0.40	0.22	0.41
ma	0.01	0.11	0.01	0.09	0.02	0.13	0.02	0.12	0.02	0.14	0.03	0.18
years of school	12.4	2.0	12.5	2.3	12.7	2.5	12.8	1.9	13.1	2.5	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	24.7	2.4
experience	6.5	2.6	4.1	2.8	6.1	3.2	5.9	2.5	3.7	2.8	5.4	3.2
hours worked	45.1	9.7	39.8	8.7	40.6	8.9	39.9	7.8	37.6	8.4	37.9	8.3
black	0.13	0.33	0.15	0.36	0.25	0.43	0.12	0.33	0.16	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		12621				17227		11177			
family intact	0.80	0.40	0.68	0.47	0.66	0.47	0.81	0.40	0.64	0.48	0.61	0.49
mom educ	11.6	2.4	12.9	2.6	12.7	2.8	11.6	2.4	12.9	2.6	12.6	2.8
dad educ	11.7	3.2	12.7	2.9	12.5	3.0	11.8	3.2	12.8	2.8	12.6	3.0
N	17066		10523				14417		9220			
ln(real family inc)	10.82	0.68	11.06	1.08	11.04	1.11	10.90	0.61	10.91	1.16	10.85	1.18
N	8113		8573				6356		7711			

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. In NLSY79 real family income is measured at ages 16 or 17. In NLSY97 family income measured in 1997. 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

Table 2: Returns to ability, standard weights OLS, men

			AFQT80		Math		Verbal	
	NLSY79	NLSY97	NLSY79	NLSY97	NLSY79	NLSY97	NLSY79	NLSY97
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
test score			0.0026	0.0011	0.0122	0.0054	0.0057	0.0021
			(0.0000)	(0.0000)	(0.0010)	(0.0009)	(0.0009)	(0.0008)
hs	0.1926	0.1908	0.1185	0.1669	0.1075	0.1608	0.1441	0.1762
	(0.0017)	(0.0026)	(0.0018)	(0.0026)	(0.0194)	(0.0200)	(0.0199)	(0.0199)
aa	0.3722	0.4548	0.2649	0.4263	0.2540	0.4188	0.2996	0.4372
	(0.0030)	(0.0046)	(0.0031)	(0.0047)	(0.0332)	(0.0440)	(0.0336)	(0.0439)
ba	0.5493	0.6007	0.4048	0.5492	0.3900	0.5277	0.4576	0.5717
	(0.0024)	(0.0035)	(0.0026)	(0.0037)	(0.0276)	(0.0301)	(0.0285)	(0.0296)
ma	0.7449	0.9191	0.5746	0.8602	0.5457	0.8376	0.6407	0.8859
	(0.0051)	(0.0088)	(0.0052)	(0.0090)	(0.0550)	(0.0803)	(0.0556)	(0.0815)
exp	0.0724	0.0570	0.0714	0.0590	0.0718	0.0598	0.0714	0.0580
	(0.0009)	(0.0009)	(0.0009)	(0.0009)	(0.0066)	(0.0055)	(0.0066)	(0.0055)
exp2	-0.0032	-0.0025	-0.0030	-0.0026	-0.0030	-0.0026	-0.0030	-0.0025
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0005)	(0.0005)	(0.0005)	(0.0005)
black	-0.1777	-0.1538	-0.0948	-0.1328	-0.0713	-0.1309	-0.1227	-0.1410
	(0.0016)	(0.0022)	(0.0017)	(0.0023)	(0.0157)	(0.0146)	(0.0159)	(0.0153)
unempl	-1.9061	-2.3615	-1.8850	-2.2289	-1.9809	-2.1900	-1.8549	-2.2750
	(0.0456)	(0.1785)	(0.0451)	(0.1781)	(0.3857)	(0.8465)	(0.3910)	(0.8503)
const	6.8128	6.8695	6.4479	6.7026	6.2980	6.6169	6.5911	6.7802
	(0.0053)	(0.0103)	(0.0060)	(0.0111)	(0.0622)	(0.0661)	(0.0568)	(0.0638)
R2 adj	0.1371	0.1500	0.1569	0.1544	0.1673	0.1577	0.1468	0.1511
N	21062	12621	21062	12621	21062	12621	21062	12621

Note: All statistics are weighted by the cross-sectional weights. Wages are inflation adjusted to 2007 using the CPI-U. 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 3: Returns to ability, standard weights OLS, women

			AFQT80		Math		Verbal	
	NLSY79	NLSY97	NLSY79	NLSY97	NLSY79	NLSY97	NLSY79	NLSY97
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
test score			0.0035	0.0022	0.0141	0.0079	0.0081	0.0054
			(0.0000)	(0.0000)	(0.0011)	(0.0010)	(0.0008)	(0.0008)
hs	0.2117	0.2051	0.1393	0.1636	0.1495	0.1661	0.1575	0.1712
	(0.0023)	(0.0028)	(0.0023)	(0.0028)	(0.0208)	(0.0179)	(0.0212)	(0.0176)
aa	0.4328	0.4869	0.3203	0.4216	0.3326	0.4205	0.3541	0.4365
	(0.0030)	(0.0043)	(0.0030)	(0.0044)	(0.0308)	(0.0377)	(0.0315)	(0.0380)
ba	0.6293	0.6853	0.4761	0.5999	0.4888	0.5961	0.5235	0.6202
	(0.0027)	(0.0034)	(0.0028)	(0.0036)	(0.0277)	(0.0261)	(0.0286)	(0.0258)
ma	0.7643	1.0464	0.5995	0.9487	0.6150	0.9475	0.6537	0.9718
	(0.0048)	(0.0063)	(0.0049)	(0.0064)	(0.0584)	(0.0551)	(0.0594)	(0.0563)
exp	0.0751	0.0392	0.0764	0.0435	0.0774	0.0436	0.0750	0.0424
	(0.0009)	(0.0008)	(0.0009)	(0.0008)	(0.0064)	(0.0051)	(0.0064)	(0.0051)
exp2	-0.0043	-0.0025	-0.0040	-0.0025	-0.0041	-0.0025	-0.0040	-0.0025
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0005)	(0.0005)	(0.0005)	(0.0005)
black	-0.0845	-0.0458	0.0133	-0.0017	0.0078	-0.0136	-0.0137	-0.0082
	(0.0016)	(0.0021)	(0.0017)	(0.0022)	(0.0139)	(0.0137)	(0.0140)	(0.0141)
unempl	-2.5248	-5.2735	-2.2654	-5.0580	-2.1456	-5.1883	-2.3774	-5.0426
	(0.0448)	(0.1750)	(0.0439)	(0.1734)	(0.4007)	(0.8481)	(0.4038)	(0.8524)
const	6.6280	6.8493	6.0794	6.5121	5.9780	6.4831	6.2704	6.6074
	(0.0052)	(0.0102)	(0.0063)	(0.0113)	(0.0665)	(0.0663)	(0.0564)	(0.0609)
R2 adj	0.1940	0.2642	0.2257	0.2776	0.2276	0.2783	0.2124	0.2728
N	17227	11177	17227	11177	17227	11177	17227	11177

Note: All statistics are weighted by the cross-sectional weights. Wages are inflation adjusted to 2007 using the CPI-U. 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. SRespondents are clustered at the primary sampling unit, robust standard errors are reported.

Table 4: Returns to ability, standard weigths, with additional controls, OLS

	NLSY79	NLSY97	NLSY79	NLSY97	NLSY79	NLSY97	NLSY79	NLSY97
				Men				
AFQT	0.0026	0.0011	0.0020	0.0009	0.0024	0.0011	0.0018	0.0008
	(0.0003)	(0.0002)	(0.0004)	(0.0003)	(0.0003)	(0.0002)	(0.0004)	(0.0003)
R2 adj	0.1565	0.1537	0.2252	0.1593	0.2403	0.2918	0.2895	0.3048
Math	0.0124	0.0055	0.0108	0.0048	0.0109	0.0053	0.0097	0.0040
	(0.0010)	(0.0008)	(0.0015)	(0.0011)	(0.0009)	(0.0007)	(0.0014)	(0.0009)
R2 adj	0.1718	0.1585	0.2369	0.1629	0.2510	0.2955	0.2988	0.3071
Verbal	0.0072	0.0022	0.0051	0.0013	0.0065	0.0024	0.0046	0.0013
	(0.0008)	(0.0007)	(0.0012)	(0.0009)	(0.0008)	(0.0006)	(0.0012)	(0.0008)
R2 adj	0.1531	0.1515	0.2219	0.1573	0.2377	0.2899	0.2869	0.3033
N	21062	12621	8093	8573	20890	12529	8064	8511
				Women				
AFQT	0.0035	0.0022	0.0033	0.0023	0.0029	0.0017	0.0026	0.0017
	(0.0003)	(0.0003)	(0.0005)	(0.0004)	(0.0003)	(0.0002)	(0.0004)	(0.0003)
R2 adj	0.2253	0.2770	0.2581	0.2917	0.3035	0.4097	0.3336	0.4242
Math	0.0141	0.0079	0.0136	0.0086	0.0117	0.0061	0.0109	0.0063
	(0.0011)	(0.0010)	(0.0019)	(0.0012)	(0.0010)	(0.0009)	(0.0017)	(0.0011)
R2 adj	0.2276	0.2783	0.2632	0.2945	0.3052	0.4106	0.3368	0.4259
Verbal	0.0081	0.0054	0.0070	0.0057	0.0066	0.0041	0.0055	0.0040
	(0.0008)	(0.0008)	(0.0015)	(0.0010)	(0.0008)	(0.0007)	(0.0014)	(0.0009)
R2 adj	0.2124	0.2728	0.2462	0.2871	0.2943	0.4071	0.3260	0.4217
N	17227	11177	6345	7711	17118	11143	6335	7684
occs, inds					+	+	+	+
family background			+	+			+	+

Note: All statistics are weighted by the cross-sectional weights. Wages are inflation adjusted to 2007 using the CPI-U. Other controls - education dummies (see Table 2 note), exp, exp2, black, unemployment, metro status. Coefficients and standard errors presented. Respondents are clustered at the primary sampling unit, robust standard errors are reported.

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

	no high school		high school		ba	
	NLSY79	NLSY97	NLSY79	NLSY97	NLSY79	NLSY97
			Men			
AFQT	0.0033	0.0006	0.0025	0.0011	0.0044	0.0013
	(0.0006)	(0.0005)	(0.0004)	(0.0003)	(0.0008)	(0.0010)
R2 adj	0.0744	0.0485	0.0908	0.0631	0.0764	0.0787
Math	0.0153	0.0017	0.0117	0.0050	0.0176	0.0110
	(0.0025)	(0.0021)	(0.0013)	(0.0010)	(0.0029)	(0.0031)
R2 adj	0.0811	0.0476	0.1022	0.0665	0.0949	0.0952
Verbal	0.0084	0.0017	0.0054	0.0023	0.0058	-0.0026
	(0.0018)	(0.0018)	(0.0011)	(0.0009)	(0.0027)	(0.0034)
R2 adj	0.0692	0.0482	0.0797	0.0602	0.0514	0.0771
N	4480	1837	15509	8818	2428	1421
			Women			
AFQT	0.0023	0.0016	0.0034	0.0023	0.0046	0.0015
	(0.0008)	(0.0007)	(0.0003)	(0.0003)	(0.0008)	(0.0009)
R2 adj	0.0427	0.0261	0.0864	0.0472	0.1193	0.0447
Math	0.0087	0.0054	0.0138	0.0075	0.0161	0.0098
	(0.0032)	(0.0026)	(0.0013)	(0.0011)	(0.0030)	(0.0026)
R2 adj	0.0343	0.0218	0.0872	0.0425	0.1253	0.0587
Verbal	0.0063	0.0045	0.0084	0.0064	0.0085	0.0004
	(0.0022)	(0.0018)	(0.0009)	(0.0009)	(0.0031)	(0.0027)
R2 adj	0.0423	0.0251	0.0733	0.0430	0.0959	0.0404
N	1695	1290	13335	7215	2693	1912

Note: All statistics are weighted by the cross-sectional weights. Wages are inflation adjusted to 2007 using the CPI-U. Other controls - exp, exp2, black, unemployment, metro status. Coefficients and standard errors presented. Respondents are clustered at the primary sampling unit, robust standard errors are reported.

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

	Men				Women			
	white		black		white		black	
	NLSY79	NLSY97	NLSY79	NLSY97	NLSY79	NLSY97	NLSY79	NLSY97
AFQT	0.0025	0.0009	0.0036	0.0023	0.0036	0.0019	0.0048	0.0035
	(0.0004)	(0.0003)	(0.0005)	(0.0004)	(0.0003)	(0.0004)	(0.0005)	(0.0004)
R2 adj	0.1524	0.1375	0.1454	0.1459	0.2435	0.2787	0.2038	0.2969
Math	0.0119	0.0052	0.0160	0.0089	0.0144	0.0073	0.0186	0.0116
	(0.0013)	(0.0011)	(0.0020)	(0.0016)	(0.0012)	(0.0013)	(0.0023)	(0.0016)
R2 adj	0.1640	0.1419	0.1516	0.1482	0.2475	0.2809	0.1853	0.2877
Verbal	0.0049	0.0013	0.0082	0.0057	0.0080	0.0046	0.0123	0.0094
	(0.0011)	(0.0011)	(0.0014)	(0.0013)	(0.0010)	(0.0011)	(0.0014)	(0.0012)
R2 adj	0.1428	0.1352	0.1325	0.1391	0.2290	0.2749	0.1973	0.2897
N	13854	6894	5901	3147	11773	5725	4721	3188

Note: All statistics are weighted by the cross-sectional weights. Wages are inflation adjusted to 2007 using the CPI-U. Other controls - education dummies (see Table 2 note), exp, exp2, unemployment, metro status. Coefficients and standard errors presented. Respondents are clustered at the primary sampling unit, robust standard errors are reported.

Table 7: men, std weights, 16yo at time of test

			AFQT80		Math		Verbal	
	NLSY79	NLSY97	NLSY79	NLSY97	NLSY79	NLSY97	NLSY79	NLSY97
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
test score			0.0027	0.0012	0.0115	0.0060	0.0076	0.0018
			(0.0006)	(0.0006)	(0.0025)	(0.0021)	(0.0021)	(0.0019)
hs	0.1498	0.1958	0.0889	0.1707	0.0818	0.1661	0.0944	0.1831
	(0.0456)	(0.0446)	(0.0473)	(0.0467)	(0.0467)	(0.0479)	(0.0475)	(0.0467)
aa	0.4411	0.5776	0.3424	0.5451	0.3216	0.5223	0.3583	0.5645
	(0.0821)	(0.0950)	(0.0818)	(0.0957)	(0.0818)	(0.0951)	(0.0815)	(0.0956)
ba	0.5527	0.7003	0.4265	0.6446	0.4206	0.6229	0.4426	0.6748
	(0.0641)	(0.0577)	(0.0698)	(0.0626)	(0.0691)	(0.0647)	(0.0692)	(0.0619)
ma	0.6406	1.0945	0.4820	1.0366	0.4689	1.0149	0.5086	1.0681
	(0.1276)	(0.1629)	(0.1331)	(0.1592)	(0.1298)	(0.1600)	(0.1331)	(0.1610)
exp	0.0062	0.0667	0.0186	0.0688	0.0197	0.0707	0.0157	0.0674
	(0.0209)	(0.0119)	(0.0207)	(0.0116)	(0.0202)	(0.0115)	(0.0209)	(0.0117)
exp2	0.0007	-0.0030	0.0001	-0.0030	0.0000	-0.0031	0.0003	-0.0029
	(0.0014)	(0.0010)	(0.0014)	(0.0010)	(0.0014)	(0.0010)	(0.0014)	(0.0010)
black	-0.1594	-0.1397	-0.0819	-0.1131	-0.0624	-0.1113	-0.0947	-0.1266
	(0.0346)	(0.0325)	(0.0383)	(0.0364)	(0.0382)	(0.0344)	(0.0387)	(0.0373)
unempl	-6.7918	-4.0092	-5.9266	-4.1249	-6.0144	-4.3230	-6.0225	-4.0234
	(1.3862)	(1.7339)	(1.3456)	(1.7197)	(1.3548)	(1.7167)	(1.3508)	(1.7285)
const	7.3561	6.8939	6.8909	6.7215	6.7802	6.6338	6.9870	6.8209
	(0.1695)	(0.0923)	(0.1959)	(0.1262)	(0.2018)	(0.1272)	(0.1922)	(0.1215)
R2 adj	0.2165	0.2079	0.2393	0.2123	0.2456	0.2165	0.2358	0.2088
N	2620	2935	2620	2935	2620	2935	2620	2935

Note: All statistics are weighted by the cross-sectional weights. Wages are inflation adjusted to 2007 using the CPI-U. 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 8: women, std weights, 16yo at time of test

			AFQT80		Math		Verbal	
	NLSY79	NLSY97	NLSY79	NLSY97	NLSY79	NLSY97	NLSY79	NLSY97
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
test score			0.0048	0.0017	0.0167	0.0076	0.0134	0.0045
			(0.0008)	(0.0006)	(0.0032)	(0.0020)	(0.0027)	(0.0017)
hs	0.2227	0.2390	0.1229	0.1994	0.1584	0.1963	0.1268	0.2052
	(0.0551)	(0.0280)	(0.0554)	(0.0299)	(0.0524)	(0.0306)	(0.0577)	(0.0292)
aa	0.4541	0.4757	0.3319	0.4117	0.3790	0.3954	0.3308	0.4249
	(0.0831)	(0.0603)	(0.0839)	(0.0663)	(0.0886)	(0.0632)	(0.0851)	(0.0667)
ba	0.6880	0.7105	0.4979	0.6378	0.5504	0.6211	0.5234	0.6535
	(0.0744)	(0.0449)	(0.0789)	(0.0513)	(0.0741)	(0.0511)	(0.0825)	(0.0496)
ma	0.4474	0.9939	0.2548	0.9154	0.2925	0.9010	0.2905	0.9317
	(0.2230)	(0.1029)	(0.2300)	(0.1038)	(0.2287)	(0.1012)	(0.2274)	(0.1051)
exp	0.0602	0.0378	0.0734	0.0411	0.0738	0.0416	0.0708	0.0404
	(0.0229)	(0.0102)	(0.0241)	(0.0102)	(0.0236)	(0.0101)	(0.0245)	(0.0103)
exp2	-0.0029	-0.0019	-0.0033	-0.0020	-0.0035	-0.0020	-0.0032	-0.0020
	(0.0016)	(0.0010)	(0.0017)	(0.0009)	(0.0017)	(0.0009)	(0.0018)	(0.0009)
black	-0.1183	-0.0509	0.0106	-0.0172	-0.0001	-0.0194	-0.0127	-0.0223
	(0.0431)	(0.0278)	(0.0478)	(0.0278)	(0.0494)	(0.0271)	(0.0460)	(0.0279)
unempl	-3.2125	-2.3676	-2.0415	-2.4671	-2.0463	-2.6699	-2.1547	-2.3826
	(1.6047)	(1.6143)	(1.6320)	(1.6023)	(1.6206)	(1.6005)	(1.6423)	(1.6038)
const	6.7179	6.6529	5.8537	6.4043	5.8408	6.3330	6.0304	6.4724
	(0.2000)	(0.0842)	(0.2502)	(0.1163)	(0.2576)	(0.1194)	(0.2385)	(0.1038)
R2 adj	0.2275	0.2516	0.2737	0.2603	0.2668	0.2655	0.2657	0.2574
N	2072	2713	2072	2713	2072	2713	2072	2713

Note: All statistics are weighted by the cross-sectional weights. Wages are inflation adjusted to 2007 using the CPI-U. 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 9: Returns to ability, standard weights, OLS, by reason to take the test

	NLSY79	NLSY97		
	all	all	motivated	non-motivated
	Men			
AFQT	0.0026	0.0011	0.0015	0.0006
	(0.0003)	(0.0002)	(0.0003)	(0.0004)
R2 adj	0.1565	0.1537	0.1793	0.1324
Math	0.0122	0.0054	0.0067	0.0038
	(0.0010)	(0.0009)	(0.0011)	(0.0014)
R2 adj	0.1673	0.1577	0.1839	0.1351
Verbal	0.0057	0.0021	0.0033	0.0007
	(0.0009)	(0.0008)	(0.0010)	(0.0012)
R2 adj	0.1468	0.1511	0.1749	0.1314
N	21062	12621	6529	5822
	Women			
AFQT	0.0035	0.0022	0.0022	0.0020
	(0.0003)	(0.0003)	(0.0003)	(0.0005)
R2 adj	0.2253	0.2770	0.2899	0.2578
Math	0.0141	0.0079	0.0087	0.0063
	(0.0011)	(0.0010)	(0.0012)	(0.0016)
R2 adj	0.2276	0.2783	0.2937	0.2562
Verbal	0.0081	0.0054	0.0055	0.0051
	(0.0008)	(0.0008)	(0.0009)	(0.0014)
R2 adj	0.2124	0.2728	0.2850	0.2550
N	17227	11177	6664	4331

Note: All statistics are weighted by the cross-sectional weights. Wages are inflation adjusted to 2007 using the CPI-U. 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. See Section 3.1 for definitions of "motivated" and "non-motivated" test-takers. Coefficients and standard errors presented. Respondents are clustered at the primary sampling unit, robust standard errors are reported.

Table 10: Returns to ability, constructed weights, OLS, men

	AFQT80		Math		Verbal	
	NLSY79	NLSY97	NLSY79	NLSY97	NLSY79	NLSY97
			A: NLSY97 is reweighted by age			
test score	0.0026	0.0015	0.0122	0.0072	0.0057	0.0031
	(0.0003)	(0.0004)	(0.0010)	(0.0013)	(0.0009)	(0.0011)
R2 adj	0.1565	0.1641	0.1673	0.1690	0.1468	0.1604
N	21062	12621	21062	12621	21062	12621
			B: NLSY97 is reweighted by age and family background (no fam inc)			
test score	0.0026	0.0014	0.0123	0.0069	0.0055	0.0025
	(0.0003)	(0.0004)	(0.0011)	(0.0015)	(0.0010)	(0.0013)
R2 adj	0.1537	0.1508	0.1659	0.1557	0.1441	0.1466
N	16936	10425	16936	10425	16936	10425
			C: NLSY97 is reweighted by age and family background (with fam inc)			
test score	0.0025	0.0014	0.0122	0.0069	0.0059	0.0023
	(0.0004)	(0.0004)	(0.0015)	(0.0016)	(0.0012)	(0.0014)
R2 adj	0.2083	0.1471	0.2202	0.1526	0.2013	0.1432
N	8048	8491	8048	8491	8048	8491
			D: NLSY97 is reweighted by age, inds and occs			
test score	0.0026	0.0013	0.0122	0.0062	0.0058	0.0023
	(0.0003)	(0.0004)	(0.0010)	(0.0011)	(0.0009)	(0.0011)
R2 adj	0.1566	0.1611	0.1674	0.1681	0.1469	0.1574
N	20888	12508	20888	12296	20888	12508
			E: NLSY97 is reweighted by age, ind and occs, and family background (no fam inc)			
test score	0.0026	0.0013	0.0123	0.0063	0.0055	0.0026
	(0.0003)	(0.0005)	(0.0011)	(0.0017)	(0.0010)	(0.0015)
R2 adj	0.1539	0.1603	0.1661	0.1644	0.1443	0.1567
N	16805	10350	16805	10350	16805	10350
			F: NLSY97 is reweighted by age, inds and occs, and family background (with fam inc)			
test score	0.0025	0.0014	0.0122	0.0061	0.0059	0.0030
	(0.0004)	(0.0005)	(0.0015)	(0.0016)	(0.0012)	(0.0014)
R2 adj	0.2090	0.1489	0.2210	0.1518	0.2019	0.1458
N	8019	8419	8019	8419	8019	8419

Note: Statistics are weighted using specified weights. Wages are inflation adjusted to 2007 using the CPI-U. Other controls - education dummies (see Table 2 note), exp, exp2, black, unemployment, metro status. Coefficients and standard errors presented. Respondents are clustered at the primary sampling unit, robust standard errors are reported.

Table 11: Returns to ability, constructed weights OLS, women

	AFQT80		Math		Verbal	
	NLSY79	NLSY97	NLSY79	NLSY97	NLSY79	NLSY97
	A: NLSY97 is reweighted by age					
test score	0.0035	0.0027	0.0141	0.0101	0.0081	0.0068
	(0.0003)	(0.0004)	(0.0011)	(0.0014)	(0.0008)	(0.0011)
R2 adj	0.2253	0.3165	0.2276	0.3187	0.2124	0.3108
N	17227	11177	17227	11177	17227	11177
	B: NLSY97 is reweighted by age and family background (no fam inc)					
test score	0.0036	0.0025	0.0149	0.0099	0.0083	0.0060
	(0.0003)	(0.0005)	(0.0012)	(0.0017)	(0.0009)	(0.0015)
R2 adj	0.2300	0.2879	0.2349	0.2918	0.2152	0.2819
N	14329	9132	14329	9132	14329	9132
	C: NLSY97 is reweighted by age and family background (with fam inc)					
test score	0.0035	0.0022	0.0141	0.0105	0.0080	0.0047
	(0.0005)	(0.0005)	(0.0018)	(0.0015)	(0.0014)	(0.0015)
R2 adj	0.2508	0.2899	0.2543	0.2997	0.2386	0.2831
N	6306	7639	6306	7639	6306	7639
	D: NLSY97 is reweighted by age, inds and occs					
test score	0.0035	0.0024	0.0141	0.0100	0.0081	0.0053
	(0.0003)	(0.0006)	(0.0011)	(0.0021)	(0.0008)	(0.0017)
R2 adj	0.2252	0.2381	0.2275	0.2441	0.2123	0.2303
N	17118	11133	17118	11133	17118	11133
	E: NLSY97 is reweighted by age, ind and occs, and family background (no fam inc)					
test score	0.0037	0.0019	0.0150	0.0079	0.0083	0.0045
	(0.0003)	(0.0007)	(0.0012)	(0.0024)	(0.0009)	(0.0020)
R2 adj	0.2299	0.2268	0.2347	0.2304	0.2150	0.2231
N	14237	9098	14237	9098	14237	9098
	F: NLSY97 is reweighted by age, inds and occs, and family background (with fam inc)					
test score	0.0035	0.0016	0.0141	0.0077	0.0081	0.0033
	(0.0005)	(0.0006)	(0.0018)	(0.0019)	(0.0014)	(0.0018)
R2 adj	0.2510	0.2384	0.2544	0.2443	0.2389	0.2348
N	6296	7614	6296	7614	6296	7614

Note: Statistics are weighted using specified weights. Wages are inflation adjusted to 2007 using the CPI-U. Other controls - education dummies (see Table 2 note), exp, exp2, black, unemployment, metro status. Coefficients and standard errors presented. Respondents are clustered at the primary sampling unit, robust standard errors are reported.

Table 12: Changes in human capital accumulation mechanism, OLS, men

	AFQT	Math	Verbal	AFQT	Math	Verbal	AFQT	Math	Verbal	AFQT	Math	Verbal
	NLSY79			NLSY97, age-reweighted			NLSY79			NLSY97, age-reweighted		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
test score	0.0023	0.0108	0.0047	0.0009	0.0048	0.0016	0.0010	0.0058	0.0006	0.0008	0.0045	0.0006
	(0.0003)	(0.0011)	(0.0009)	(0.0004)	(0.0013)	(0.0011)	(0.0005)	(0.0017)	(0.0015)	(0.0007)	(0.0025)	(0.0022)
education	0.0699	0.0670	0.0772	0.0986	0.0952	0.1017	0.0972	0.0958	0.1023	0.0907	0.0868	0.0948
	(0.0040)	(0.0038)	(0.0039)	(0.0065)	(0.0067)	(0.0064)	(0.0079)	(0.0077)	(0.0078)	(0.0134)	(0.0134)	(0.0131)
test score*exp							0.0002	0.0008	0.0006	0.0000	0.0000	0.0002
							(0.0001)	(0.0002)	(0.0002)	(0.0001)	(0.0005)	(0.0004)
educ*exp							-0.0049	-0.0052	-0.0045	0.0017	0.0017	0.0015
							(0.0013)	(0.0012)	(0.0012)	(0.0024)	(0.0024)	(0.0024)
experience	0.0508	0.0509	0.0502	0.0661	0.0661	0.0655	0.0973	0.0973	0.0945	0.0293	0.0306	0.0274
	(0.0070)	(0.0069)	(0.0070)	(0.0115)	(0.0114)	(0.0115)	(0.0193)	(0.0197)	(0.0193)	(0.0405)	(0.0406)	(0.0404)
experience^2	-0.0010	-0.0010	-0.0010	-0.0008	-0.0009	-0.0008	-0.0026	-0.0028	-0.0025	0.0002	0.0002	0.0003
	(0.0005)	(0.0005)	(0.0005)	(0.0010)	(0.0010)	(0.0010)	(0.0006)	(0.0006)	(0.0006)	(0.0016)	(0.0016)	(0.0016)
black	-0.1090	-0.0856	-0.1353	-0.1516	-0.1497	-0.1601	-0.1070	-0.0824	-0.1337	-0.1516	-0.1497	-0.1601
	(0.0159)	(0.0156)	(0.0156)	(0.0231)	(0.0231)	(0.0229)	(0.0159)	(0.0156)	(0.0156)	(0.0230)	(0.0231)	(0.0229)
unemployment	-1.3777	-1.4964	-1.2917	-0.9628	-1.0660	-0.9097	-1.5177	-1.6783	-1.4066	-0.6861	-0.7905	-0.6338
	(0.3927)	(0.3900)	(0.3943)	(1.1488)	(1.1497)	(1.1504)	(0.3985)	(0.3961)	(0.4001)	(1.2601)	(1.2606)	(1.2623)
const	5.7934	5.6775	5.8539	5.5538	5.5215	5.5927	5.6244	5.5235	5.6896	5.6959	5.6564	5.7429
	(0.0662)	(0.0680)	(0.0655)	(0.1332)	(0.1313)	(0.1334)	(0.1092)	(0.1142)	(0.1086)	(0.1693)	(0.1673)	(0.1731)
R2 adj	0.1619	0.1714	0.1543	0.1890	0.1914	0.1872	0.1637	0.1735	0.1560	0.1892	0.1916	0.1874
N	21062	21062	21062	12621	12621	12621	21062	21062	21062	12621	12621	12621

Note: NLSY79 statistics are weighted by the cross-sectional weights. NLSY97 statistics are weighted using weights constructed to equalize age distributions. Wages are inflation adjusted to 2007 using the CPI-U. 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.

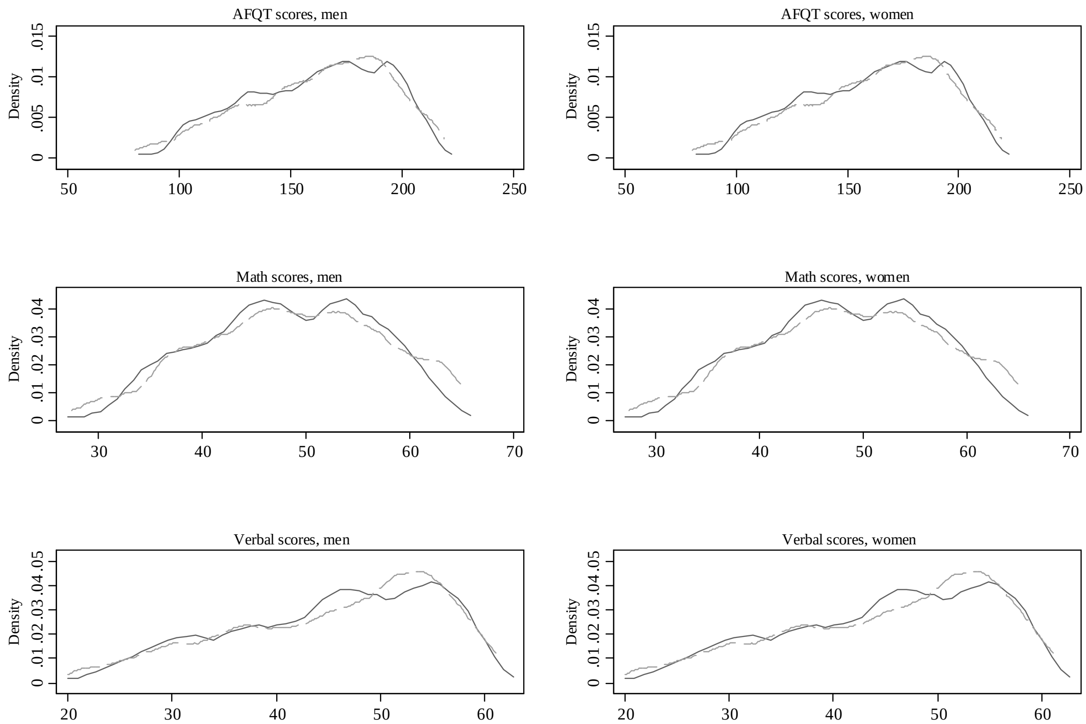
Table 13: Changes in human capital accumulation mechanism, OLS, women

	AFQT	Math	Verbal	AFQT	Math	Verbal	AFQT	Math	Verbal	AFQT	Math	Verbal
		NLSY79			NLSY97, age-reweighted			NLSY79			NLSY97, age-reweighted	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
test score	0.0032	0.0131	0.0068	0.0023	0.0088	0.0057	0.0024	0.0106	0.0040	0.0022	0.0088	0.0050
	(0.0003)	(0.0011)	(0.0008)	(0.0004)	(0.0014)	(0.0010)	(0.0005)	(0.0020)	(0.0015)	(0.0006)	(0.0020)	(0.0017)
education	0.0806	0.0817	0.0884	0.1053	0.1042	0.1089	0.1080	0.1057	0.1160	0.1460	0.1442	0.1502
	(0.0039)	(0.0038)	(0.0039)	(0.0058)	(0.0058)	(0.0058)	(0.0082)	(0.0081)	(0.0083)	(0.0091)	(0.0091)	(0.0090)
test score*exp							0.0001	0.0005	0.0005	0.0000	0.0000	0.0002
							(0.0001)	(0.0003)	(0.0002)	(0.0001)	(0.0004)	(0.0003)
educ*exp							-0.0055	-0.0048	-0.0056	-0.0093	-0.0091	-0.0094
							(0.0014)	(0.0014)	(0.0014)	(0.0018)	(0.0018)	(0.0018)
experience	0.0565	0.0580	0.0542	0.0369	0.0374	0.0360	0.1282	0.1197	0.1242	0.2075	0.2101	0.2061
	(0.0073)	(0.0073)	(0.0074)	(0.0081)	(0.0080)	(0.0082)	(0.0213)	(0.0225)	(0.0211)	(0.0340)	(0.0348)	(0.0333)
experience^2	-0.0021	-0.0022	-0.0020	-0.0002	-0.0003	-0.0001	-0.0043	-0.0042	-0.0041	-0.0056	-0.0057	-0.0055
	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0011)	(0.0011)	(0.0011)
black	-0.0195	-0.0222	-0.0510	-0.0441	-0.0556	-0.0526	-0.0158	-0.0192	-0.0473	-0.0382	-0.0503	-0.0459
	(0.0143)	(0.0141)	(0.0142)	(0.0204)	(0.0204)	(0.0204)	(0.0143)	(0.0141)	(0.0143)	(0.0201)	(0.0201)	(0.0201)
unemployment	-1.8819	-1.7455	-1.9427	-4.4517	-4.5382	-4.3991	-2.0173	-1.8689	-2.0789	-6.0108	-6.1082	-5.9600
	(0.4024)	(0.4023)	(0.4069)	(1.0256)	(1.0210)	(1.0307)	(0.4079)	(0.4079)	(0.4127)	(1.1150)	(1.1099)	(1.1223)
const	5.3180	5.2005	5.4395	5.3251	5.2934	5.3966	5.0467	4.9714	5.1785	4.7644	4.7219	4.8391
	(0.0678)	(0.0717)	(0.0665)	(0.1312)	(0.1323)	(0.1290)	(0.1151)	(0.1228)	(0.1131)	(0.1580)	(0.1604)	(0.1534)
R2 adj	0.2217	0.2254	0.2093	0.3193	0.3208	0.3145	0.2238	0.2271	0.2116	0.3283	0.3297	0.3236
N	17227	17227	17227	11177	11177	11177	17227	17227	17227	11177	11177	11177

Note: NLSY79 statistics are weighted by the cross-sectional weights. NLSY97 statistics are weighted using weights constructed to equalize age distributions. Wages are inflation adjusted to 2007 using the CPI-U. 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.

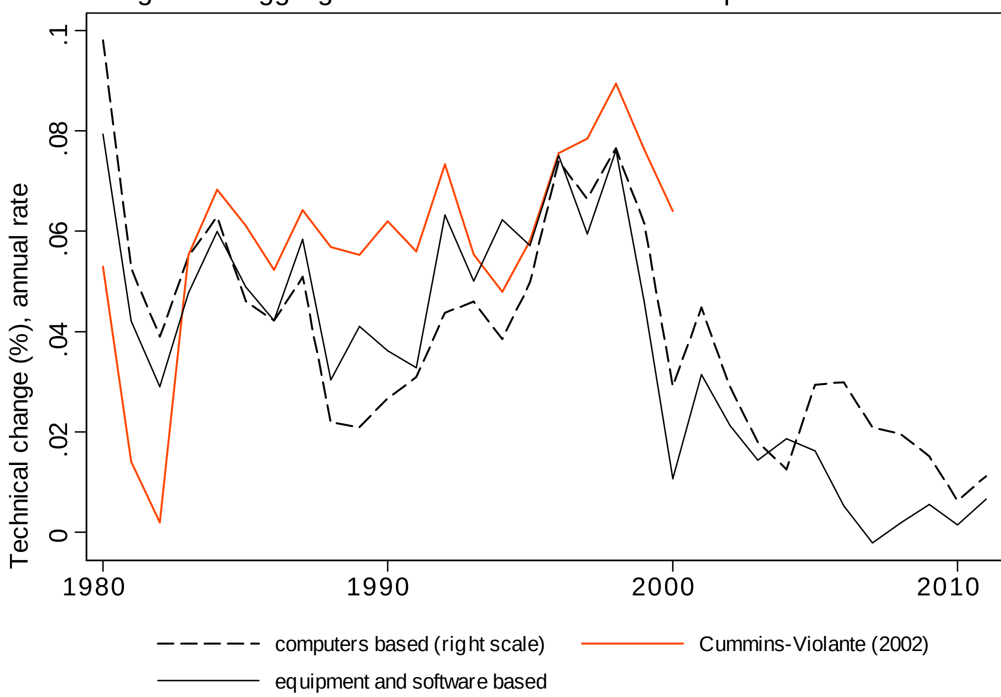
Figure 1

----------- 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.