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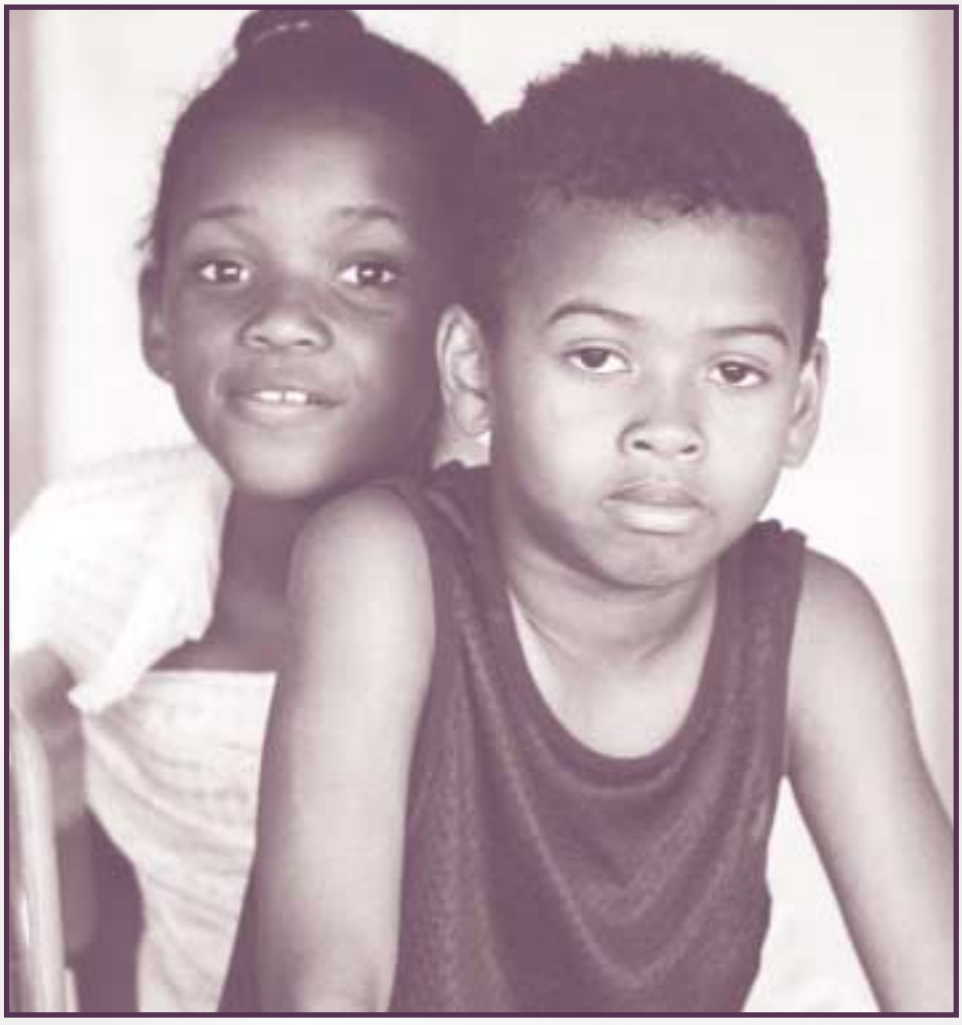
Statistical Analysis Report — July 2001

# EDUCATIONAL ACHIEVEMENT AND BLACK-WHITE INEQUALITY



U.S. Department of Education
Office of Educational Research and Improvement NCES 2001–061

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# EDUCATIONAL ACHIEVEMENT AND BLACK-WHITE INEQUALITY

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# EXECUTIVE SUMMARY

## I. MAJOR FINDINGS

The study reported here explored the relationship between black-white differences in educational achievement and black-white differences in a variety of educational and economic outcomes. Comparisons were made, first between overall average outcomes for blacks and whites and then between average outcomes for blacks and whites with similar levels of prior educational achievement.[1] The major findings of the study reveal that

1. For women with similar levels of prior educational achievement, blacks earned as much, or more, per year as whites. For men with similar levels of prior educational achievement, black-white gaps in annual earnings were at least two-fifths smaller than black-white gaps for men as a whole. Black-white disparities in employment were, for young adults with similar levels of prior educational achievement, at least one-half smaller than black-white employment disparities for young adults as a whole.
2. For young adults with similar levels of prior educational achievement, blacks were more likely to attend college than whites. Among college attendees with similar levels of prior educational achievement, blacks' college completion rates were as high as, or higher than, the college completion rates of whites.
3. Throughout elementary and secondary school, blacks scored lower, overall, on mathematics and reading tests than whites. Even for children with similar test scores one or two grades earlier, blacks generally scored lower in mathematics and reading than whites.

   The black-white mathematics gap differed in size across grades, in a manner consistent with, but not necessarily demonstrating, a narrowing of the gap during elementary school, followed by a widening of the gap during junior high school and little change during senior high school. The black-white reading gap also differed in size across grades, but not in an entirely consistent manner; it grew wider between grades within two elementary school cohorts, but was narrower for cohorts observed in grades 9 and 12 than for a cohort observed in grade 2.

In general, the findings show that, for children and young adults with similar levels of prior educational achievement, the educational and economic performance of blacks relative to whites was substantially greater than the performance of blacks relative to whites as a whole. While blacks have lower levels of educational achievement, educational attainment, and earnings than whites, these disparities are frequently smaller, and are sometimes entirely absent, for individuals with similar levels of prior educational achievement. Factors other than differences in prior educational achievement may contribute to black-white gaps in achievement, employment, and earnings; nonetheless, blacks' relative edu-

[1]Comparisons between individuals with similar levels of prior educational achievement involved (i) whites as a whole, and (ii) blacks with prior educational achievement similar to that for whites.

cational achievement during elementary and secondary school appeared to be highly correlated with their relative success in the academy and the economy.

Note: This study does *not* attempt to isolate the causal relationship between educational achievement and subsequent educational and economic outcomes. Rather, using educational achievement as an indicator for the cognitive backgrounds of children and young adults, it investigates the extent to which black-white disparities are present for individuals with similar levels of prior educational achievement. The comparison of outcomes for blacks and whites with similar levels of educational achievement does *not* indicate what outcomes for *all* blacks would be if their average achievement were raised to the level for whites. Educational achievement differences are correlated with many other possible sources of black-white disparities, some measured in survey data, others unmeasured.

## II. BACKGROUND

Over the past quarter-century, black Americans have made important gains in narrowing the gaps in educational and economic performance between themselves and whites. Between 1973 and 1996, for example, average scores of black 17-year-olds on the mathematics portion of the National Assessment of Education Progress (NAEP) grew by 6 percent, while average scores of white 17-year-olds remained about the same (NCES 1997b). Black-white gaps in NAEP reading scores also narrowed over this period. Further, in 1974, the high school dropout rate for 15- through 24-year-old blacks was twice the corresponding rate for whites; but by 1997, blacks and whites in this age bracket remained in high school at similar rates (NCES 1999).

Despite progress in reducing black-white gaps in mathematics and reading achievement, blacks have continued to score lower on the NAEP than whites (NCES 1997b). And, despite the convergence in high school completion rates of blacks and whites, the black-white gap in 4-year college completion rates of high school graduates 25–29 years old has increased slightly over the past quarter century. Between 1975 and 1998 this gap increased from 13 to 17 percentage points (NCES 1999).

In recent years black-white disparities have also persisted—and have sometimes grown larger—for labor market outcomes such as labor force participation,[2] unemployment,[3] and hourly wages. Between 1973 and 1993, black-white differences in the labor force participation rates of 25- through 34-year-olds widened by 3.4 percentage points for men and 19 percentage points for women, and the corresponding black-white gaps in unemployment rates widened by about 2.4 percentage points for both men and women. Over the same time period, the black-white gap in hourly wages narrowed by one-third for 25- through 34-year-old men, but more than doubled for 25- through 34-year-old women (Bernstein 1995).

Recent studies have revealed a strong relationship between differences in prior educational achievement and black-white disparities in college attendance and earnings. With black-white disparities remaining in both educational and economic outcomes, it is important to understand the relationship between educational achievement during elementary and secondary school and subsequent academic and labor market performance.

[2]The *labor force participation rate* is defined as the percentage of noninstitutionalized civilians who are employed, otherwise with a job, or looking for a job.

[3]The *unemployment rate* is defined as the percentage of labor force participants who are without a job.

## III. THE PRESENT STUDY

The study documented in this report used multiple datasets to confirm and extend earlier findings. Specifically, this study included three sets of analyses designed to investigate the relationship between black-white differences in prior educational achievement and a variety of subsequent outcomes:[4]

- The first set of analyses considered the extent to which black-white differences in *labor market outcomes* were present for young adults as a whole and for young adults with similar levels of prior educational achievement.
- The second set of analyses considered the extent to which black-white differences in *educational attainment* were present for young adults as a whole and for young adults with similar levels of prior educational achievement.
- The final set of analyses considered the extent to which black-white differences in *mathematics and reading achievement* were present for children as a whole and for children with similar levels of prior educational achievement. These analyses also considered the extent to which black-white achievement gaps varied in size during elementary and secondary school.

## IV. BLACK-WHITE DIFFERENCES IN LABOR MARKET OUTCOMES

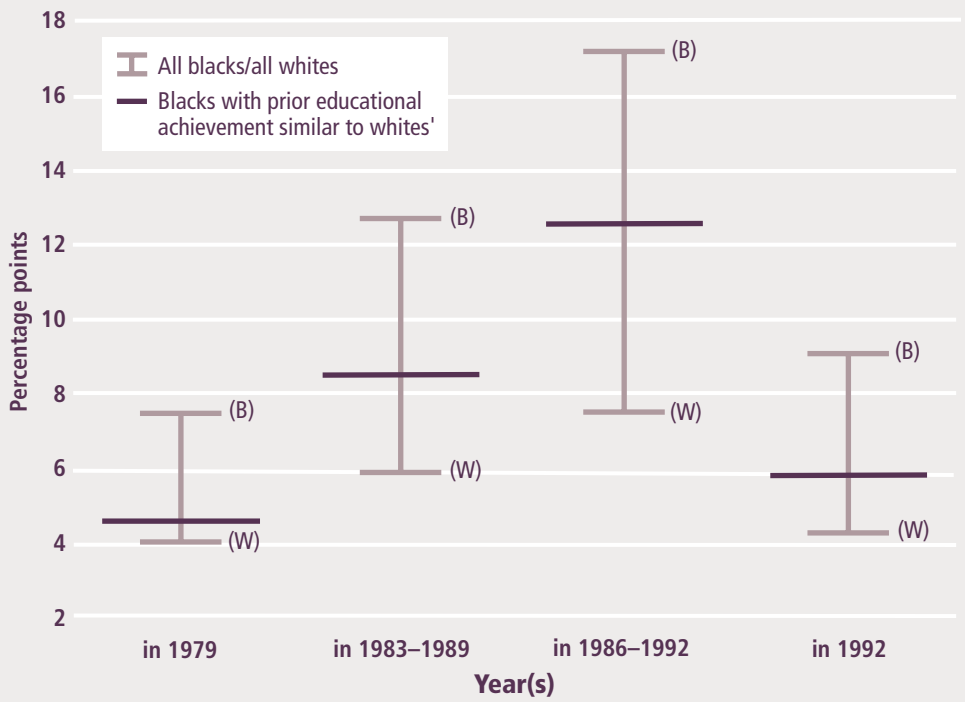
### A. Main Findings

Analyses of labor market outcomes between 1979 and 1992[5] indicate that, for young adults with similar levels of prior educational achievement, the economic performance of blacks relative to whites was substantially greater than for young adults as a whole. For young adults with similar levels of prior educational achievement, black-white gaps in unemployment rates were at least one-half smaller than for young adults as a whole. Among men with similar levels of prior educational achievement, black-white gaps in annual earnings were at least two-fifths smaller than for men as a whole. Black women with levels of prior educational achievement similar to white women earned as much as, or more than, their white counterparts.

[4] *Prior educational achievement* is defined as prior mathematics and/or reading achievement. The accompanying figures indicate outcomes for all whites, all blacks, and blacks at whites' level of prior educational achievement.

[5] The analyses of labor market outcomes focused on four samples of young adults: (1) young adults who were high school seniors in 1972 and who were observed 7 years later through the National Longitudinal Study of the High School Class of 1972 ("the 1979 sample"); (2) young adults who were high school seniors between 1976 and 1982 and who were observed 7 years later through the National Longitudinal Survey of Youth ("the 1983–1989 sample"); (3) young adults who were high school sophomores between 1974 and 1980 and who were observed 12 years later through the National Longitudinal Survey of Youth ("the 1986–1992 sample"); and (4) young adults who were high school sophomores in 1980 and who were observed 12 years later through the High School and Beyond Survey ("the 1992 sample"). High school sophomores and seniors were generally identified as of the spring of each year. Educational achievement was measured in 1972 for the 1979 samples and in 1980 for the other samples.

**Figure 1—Unemployment rates for black and white young adults, 1979–1992**




NOTE: Samples restricted to civilian labor force participants; higher end of gray range is for blacks.

SOURCE: U. S. Department of Education, National Center for Education Statistics, National Longitudinal Study of the High School Class of 1972 (1979 sample, 7 years after grade 12), High School and Beyond (1992 sample, 12 years after grade 10); and U. S. Department of Labor, Bureau of Labor Statistics, National Longitudinal Survey of Youth (1983-89 sample, 7 years after grade 12, and 1986-92 sample, 12 years after grade 10)

## B. Unemployment Rates

For the samples of young adults studied, there were no consistent differences between blacks and whites in terms of labor force participation, but black labor force participants were more likely to be unemployed than white labor force participants (figure 1). The absolute black-white gaps in unemployment rates ranged between 4 and 10 percentage points, and were similar in size for men and women. These gaps were at least one-half smaller for young adults with similar levels of prior educational achievement than for young adults as a whole.

## C. Annual Earnings

For the samples of young adults studied, blacks generally earned less per year than whites (figure 2).[6] Black-white gaps in annual earnings for men ranged from 16 percent in the 1979 sample to about 32 percent in the 1983-1989 and 1986–1992 samples. In the 1979 and 1992 samples, black women and white women had similar earnings. In the 1986–1992 sample, the black-white earnings gap for women was about two-thirds smaller than the corresponding gap for men.

[6]The pattern of black-white gaps in hourly wages—reported in every sample except the 1992 High School and Beyond sample—was generally similar to the pattern of gaps in annual earnings.

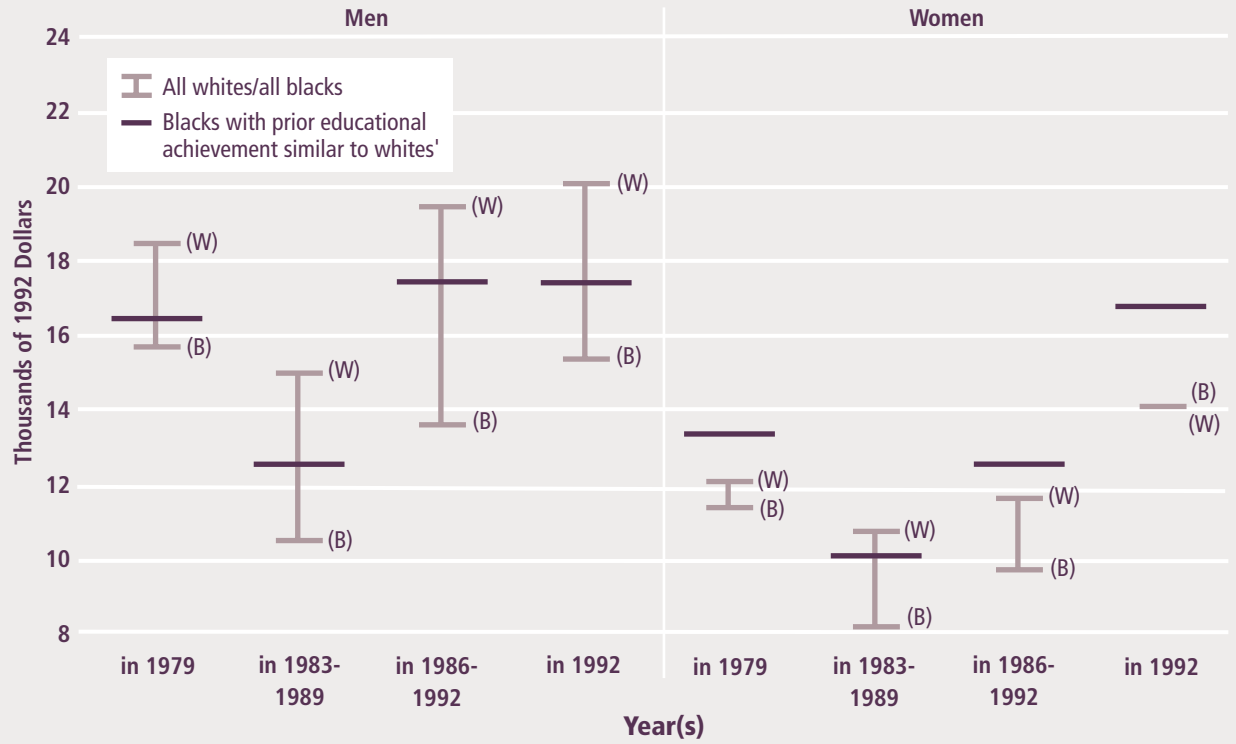
For men with similar levels of prior educational achievement, the black-white gap in annual earnings was measured imprecisely in the 1979 sample, such that it was distinguishable neither from zero, nor from the gap for men as a whole. In the 1983-1989, 1986-1992, and 1992 samples, the black-white earnings gap for men with similar educational achievement was over two-fifths smaller than for men as a whole.

For women with similar levels of prior educational achievement, blacks earned 12 percent more per year than whites in the 1979 sample, 22 percent more per year than whites in the 1992 sample, and about the same as whites in the 1983-1989 and 1986-1992 samples.

## D. Additional Sources of Disparities in Labor Market Outcomes

Since differences in educational achievement can predict only a portion of black-white differences in employment and men's earnings, other factors must contribute to racial disparities in these outcomes. Possible reasons for the remainder of these gaps include a relative shortage of jobs in areas where blacks live, fewer job networks for blacks, and the existence of labor market discrimination against blacks. Unmeasured skill differences between labor force participants of different racial backgrounds may also contribute to the remaining black-white disparities in employment and men's earnings.

**Figure 2—Average annual earnings for black and white young men and women, 1979-1992**




NOTE: Samples restricted to civilians reporting some earnings; higher end of gray range is for whites, except in the case of women in 1992.

SOURCE: U.S. Department of Education, National Center for Education Statistics, National Longitudinal Study of the High School of 1972 (1979 sample, 7 years after grade 12), High School and Beyond (1992 sample, 12 years after grade 10); and U.S. Department of Labor, Bureau of Labor Statistics, National Survey of Youth (1983-89 sample, 7 years after grade 12, and 1986-92 sample, 12 years

## V. BLACK-WHITE DIFFERENCES IN EDUCATIONAL ATTAINMENT

### A. Main Findings

Blacks having similar levels of prior educational achievement as whites had received a high school diploma or General Educational Development (GED) certificate at an equal or higher rate than whites. For young adults with similar levels of prior educational achievement in the same four samples observed between 1979 and 1992, the postsecondary educational attainment of blacks was as high as, or higher than, that of whites.[7] For such young adults, the college attendance rate was higher for blacks than for whites. Further, black college attendees with levels of prior educational achievement similar to those for whites completed college at rates similar to, or higher than, the rates for white college attendees.

### B. High School/GED Completion Rates

Black-white differences in high school/GED completion rates could be compared for every sample of young adults except the 1979 sample.[8] A black-white gap in high school/GED completion rates (in the range of 2 to 8 percentage points) was evident in the 1983–1989, 1986–1992, and 1992 samples. For young adults with similar levels of prior educational achievement, blacks received high school diplomas or GED certificates at a rate similar to or higher than whites.

### C. College Attendance Rates

Young adults observed between 1979 and 1992 generally showed a black-white gap in college attendance rates (figure 3). Compared with whites, blacks had a 4- to 7-percentage-point lower rate of college attendance in the 1979 and 1983–1989 samples, and a 10-percentage-point lower rate of college attendance in the 1992 sample.[9] In contrast, for young adults with similar levels of prior educational achievement, blacks had a 6- to 17-percentage-point *higher* rate of college attendance than whites.

### D. College Completion Rates

For young adults who had attended at least some college, college completion rates[10] were consistently lower for blacks than for whites (figure 4). The black-white gap in college completion ranged from about 13 percentage points in the 1979 sample to about 19 percentage points in the other three samples. Again, in contrast, among college attendees with similar levels of prior educational achievement, the college completion rate of blacks equaled or exceeded that of whites.

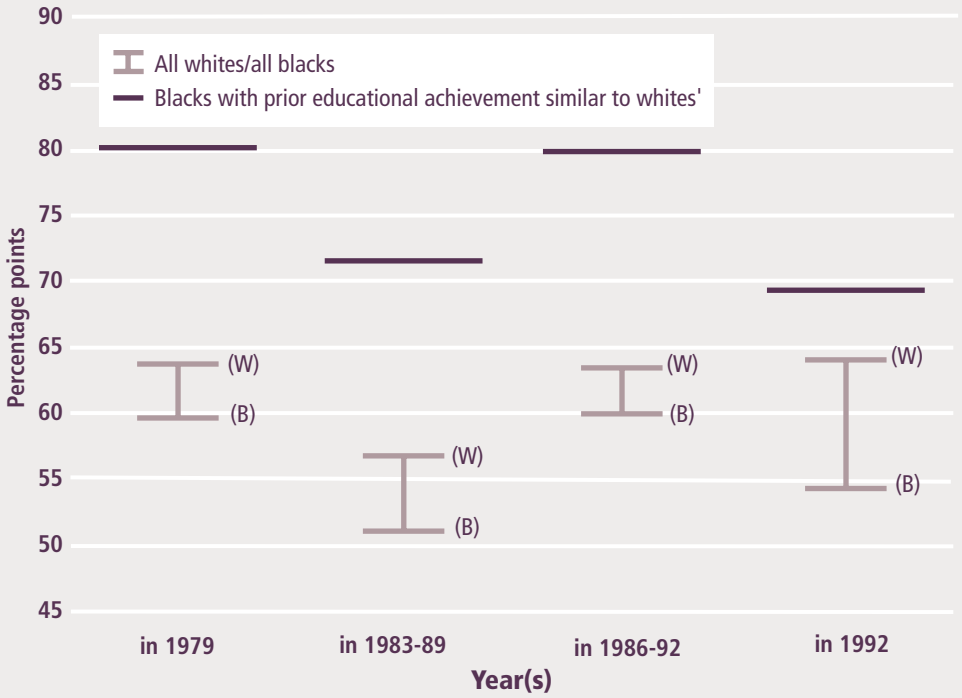
[7]The analyses of educational attainment outcomes focused on the same four samples of young adults studied for the analyses of labor market outcomes. Black-white differences in postsecondary educational attainment were generally similar for males and females.

[8]High school/GED completion status was ambiguous for individuals in the 1979 sample.

[9]In the 1986-1992 sample, the black-white difference in college attendance was significant for men (8 percent) but not for women or for young adults as a whole.

[10]*College completion* is defined here as completion of at least four years of college or an equivalent bachelor's degree.

**Figure 3—College attendance rates for black and white young adults, 1979–1992**




NOTE: Samples restricted to former 12th-graders or high school graduates (as indicated below); higher end of gray range is for whites.

SOURCE: U. S. Department of Education, National Center for Education Statistics, National Longitudinal Study of the High School Class of 1972 (1979 sample, 7 years after grade 12), High School and Beyond (1992 sample, 12 years after grade 10); and U. S. Department of Labor, Bureau of Labor Statistics, National Longitudinal Survey of Youth (1983-89 sample, 7 years after grade 12, and 1986-92 sample, high school graduates 12 years after grade 10)

## VI. BLACK-WHITE DIFFERENCES IN EDUCATIONAL ACHIEVEMENT

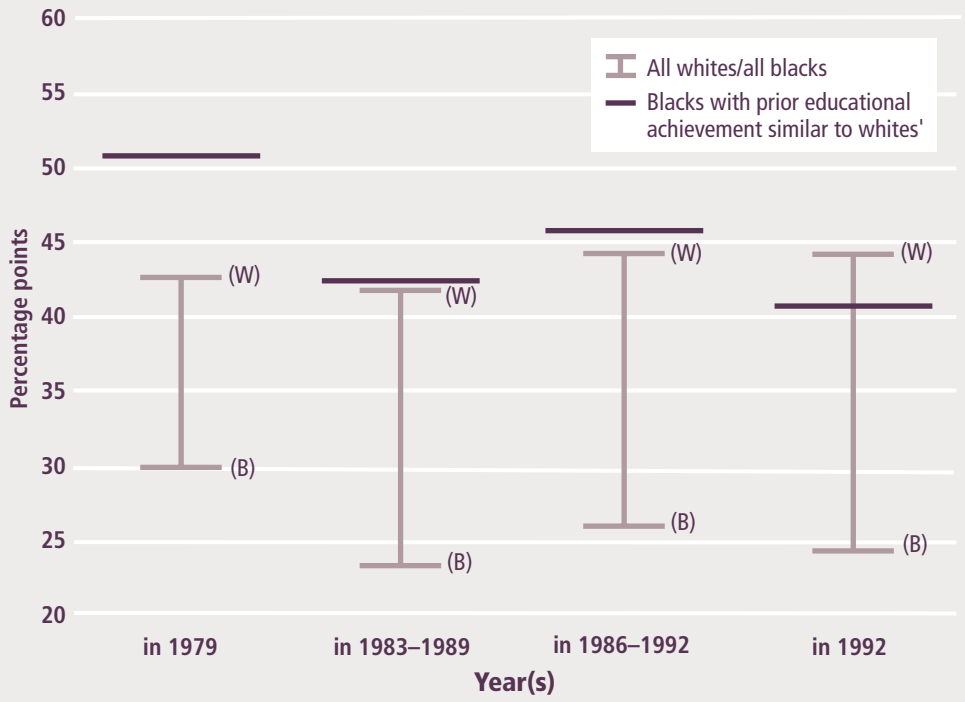
### A. Main Findings

The analyses of educational achievement compared mathematics and reading levels of black and white children at various points between grades 1 and 12.[11] Black-white gaps in mathematics and reading achievement appeared at every grade studied. Even for children with similar levels of prior achievement one or two grades earlier,[12] mathematics and reading scores of blacks were generally lower than the corresponding scores of whites.

[11] The analyses of educational achievement outcomes focused on four samples of children: (1) children between grades 1 and 2, observed from 1992 to 1993 in Cohort 1 of the Chapter 1 Prospects Study; (2) children between grades 3 and 5, observed from 1991 to 1993 in Cohort 3 of the Prospects Study; (3) children between grades 7 and 9, observed from 1991 to 1993 in Cohort 7 of the Prospects Study; and (4) children between grades 10 and 12, observed from 1990 to 1992 in the National Educational Longitudinal Study of 1988. Black-white differences in educational achievement were usually similar for boys and girls.

[12] *Prior educational achievement* was defined as the corresponding mathematics or reading score for the earliest grade in which a sample of children was observed (grades 1, 3, 7, and 10, respectively).

**Figure 4—College completion rates for black and white young adults, 1979-1992**




NOTE: College completion is defined as completion of four years of college or the equivalent. Samples restricted to persons who have attended at least some college; higher end of gray range is for whites.

SOURCE: U. S. Department of Education, National Center for Education Statistics, National Longitudinal Study of the High School Class of 1972 (1979 sample, 7 years after grade 12), High School and Beyond (1992 sample, 12 years after grade 10); and U. S. Department of Labor, Bureau of Labor Statistics, National Longitudinal Survey of Youth (1983-89 sample, 7 years after grade 12, and 1986-92 sample, high school graduates 12 years after grade 10)

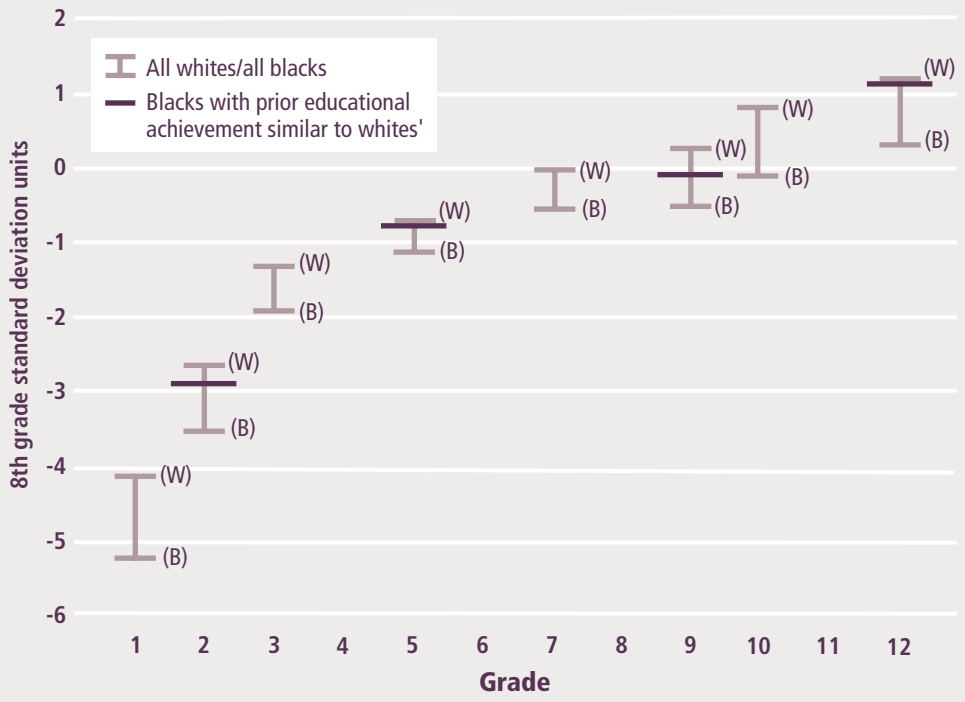
Comparisons of the size of black-white achievement gaps were possible between nearby grades within the same sample of children, as well as across different samples of children from grades 1 to 12. The black-white mathematics gap differed in size across grades, in a manner consistent with a narrowing of the gap during elementary school, followed by a widening of the gap during junior high school and little change during senior high school. The black-white reading gap also differed in size across grades, but not in an entirely consistent manner; it grew wider between grades within two elementary school cohorts, but was narrower in cohorts observed in grades 9 and 12 than in a cohort observed in grade 2.

## B. Mathematics Achievement

Compared with white children, blacks scored lower on mathematics tests at every grade level studied between grades 1 and 12 (figure 5). Black-white mathematics gaps were usually similar in size for both boys and girls.

Within the same samples of children, the black-white gap increased by two-fifths between grades 7 and 9, but changed little between grades 1 and 2, grades 3 and 5, and grades 10 and 12. Across different samples of children, the black-white math gap was two-fifths smaller in grade 5 than in grade 2, but one-half larger in grade 9 than in

**Figure 5—Average mathematics achievement scores for black and white children, 1990-1993**




NOTE: Prior mathematics achievement refers to mathematics achievement one grade earlier for grade 2 sample and two grades earlier for the grade 5, grade 9, and grade 12 samples. Mathematics scores are normalized so the grade 8 score for children of all races has mean 0 and standard deviation 1 in the grade 9 and grade 12 samples. Higher end of gray range is for whites.

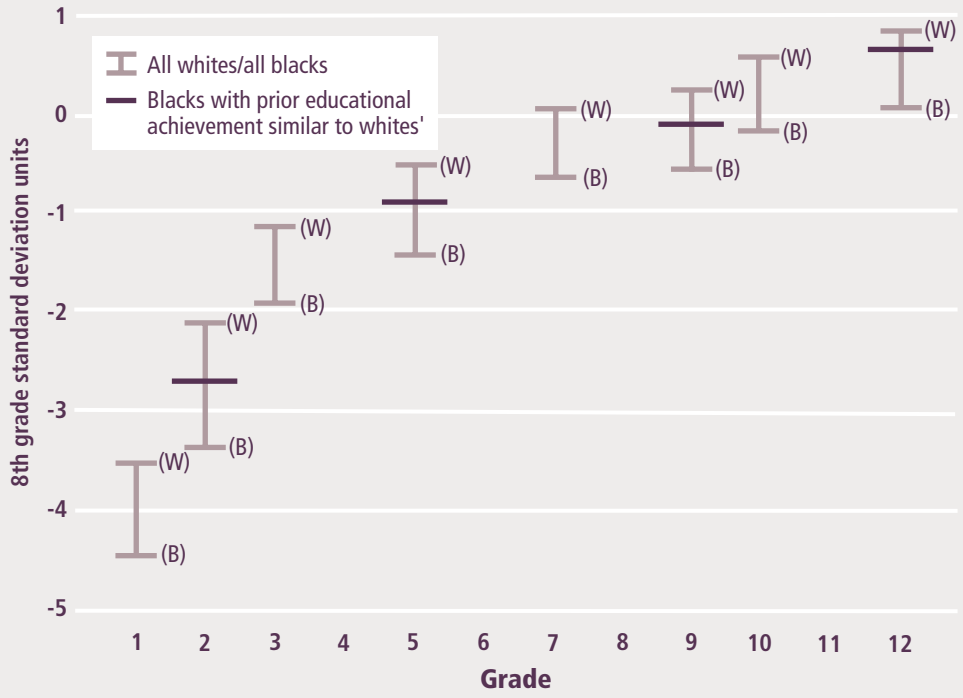
SOURCE: U. S. Department of Education, Chapter 1 Prospects Study (1992-1993 sample of 1st- through 2nd- graders, and 1991-1993 samples of 3rd- through 5th- graders and 7th- through 9th- graders), and National Educational Longitudinal Study of 1988 (1990-1992 sample of 10th- through 12th- graders).

grade 5, and about the same size in grade 12 as in grade 9. Between the grade 2 and grade 12 samples there was no difference in the size of the black-white math gap, suggesting that any narrowing of the gap between grades 2 and 5 was largely negated by the widening of the gap between grades 5 and 9.[13]

Even for children who had similar math scores one or two grades earlier,a black-white mathematics gap usually appeared. A black-white mathematics gap was present in grade 2, even for children with similar math scores in grade 1; in grade 5, even for children with similar math scores in grade 3; in grade 9, even for children with similar math scores in grade 7. These gaps were 59 to 70 percent smaller than the corresponding mathematics gaps for children as a whole. (Black and white children with similar math scores in grade 10 had similar math scores in grade 12.)

[13] Note that comparisons of the grade 2, grade 5, grade 9, and grade 12 gaps involve four separate samples of children, which, while generally similar in observed family background characteristics, may differ in terms of unobserved family background and school characteristics. For the sample of children observed between grades 10 and 12, however, there is corroborating evidence of a widening of the black-white mathematics gap by about one-fifth between grades 8 and 10.

**Figure 6—Average reading achievement scores for black and white children, 1990-1993**




NOTE: Prior reading achievement refers to reading achievement one grade earlier for grade 2 sample and two grades earlier for the grade 5, grade 9, and grade 12 samples. Reading scores are normalized so the grade 8 score for children of all races has mean 0 and standard deviation 1 in the grade 9 and grade 12 samples. Higher end of gray range is for whites.

SOURCE: U.S. Department of Education, Chapter 1 Prospects Study (1992-1993 sample of 1st- through 2nd- graders, and 1991-1993 samples of 3rd- through 5th- graders and 7th- through 9th- graders), and National Educational Longitudinal Study of 1988 (1990-1992 sample of 10th- through 12th- graders).

## C. Reading Achievement

Compared with whites, blacks also scored lower on reading tests at every grade level studied between grades 1 and 12 (figure 6). Black-white reading gaps did not differ consistently for boys and girls.

The black-white reading gap grew wider between some grades, but was narrower in grades 9 and 12 than in grade 2.[14] Within the same samples of children, the black-white reading gap increased by one-third between grades 1 and 2 and one-fifth between grades 3 and 5,[15] while remaining about the same between grades 7 and 9, and between grades10 and 12. Across different samples of children, the black-white reading gap was one-third smaller in grade 9 than in grade 2, and two-fifths smaller in grade 12 than in grade 2.

A black-white reading gap was generally present, even for children with similar reading scores one or two grades earlier. For children with similar reading scores one or two

[14] Note that the comparisons of the grade 9 and 12 gaps with the grade 2 gap involve separate samples of children, which may differ in terms of family background and school characteristics.

[15] For the sample of children observed between grades 10 and 12, there was corroborating evidence of a widening of the black-white reading gap by about one-sixth between grades 8 and 10.

grades earlier, respectively, the black-white reading gap was 58 to 77 percent smaller than the corresponding black-white reading gap for children as a whole.

While findings within the same samples of children would, by themselves, suggest a widening of the black-white reading gap as children progressed through school, findings across different samples suggest an overall narrowing of the black-white reading gap between grades 2 and 9, with this narrowing persisting through grade 12. This difference in findings may be consistent with the actual experiences of children as they progressed through school, or it may arise from the use of different cohorts of children in the comparisons. The collection and analysis of longitudinal data following the same sample of children all the way from grade 2 through grade 12 would help to further address the question of how the black-white reading gap changes over the course of the school years.

### D. Additional Sources of Disparities in Educational Achievement

On average, blacks in grade 1 had lower mathematics and reading scores than whites, and blacks in grade 12 also had lower mathematics and reading scores than whites. Among children with similar test scores one or two grades earlier, blacks generally acquired fewer reading skills than whites, and usually acquired fewer mathematics skills as well. These findings imply that black-white disparities in educational achievement can widen as students progress through elementary or secondary school. Possible explanations for these differences in achievement growth include differences in the school or home environments of children of different racial backgrounds that make it more difficult for blacks to acquire math or reading skills at the same pace as whites.

## VII. CONCLUSION

The findings of this study imply that, over the past two decades, black-white differences in educational achievement have been strongly associated with black-white disparities in a variety of educational and economic outcomes. Achievement differences do not necessarily cause gaps in educational attainment, employment, or earnings, but they reflect a set of circumstances responsible for black-white disparities in both the academy and the economy. Addressing the contributing causes of black-white achievement differences will be important in efforts to narrow black-white gaps in educational performance, and perhaps also in subsequent labor market outcomes.

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# 1. PRIOR RESEARCH ON BLACK-WHITE DIFFERENCES IN EDUCATIONAL AND ECONOMIC OUTCOMES

Substantial progress has been made since the early 1970s in narrowing black-white gaps in educational achievement, high school completion, and earnings. During the 1980s, however, progress slowed, giving rise to such questions as: Why do gaps in educational achievement and earnings persist? Why are blacks still less likely to attend and complete college than whites? Are black-white gaps associated primarily with differences in prior educational achievement, or are they related to other factors? To what extent can these gaps be attributed to educational differences, and to what extent can they be attributed to factors not related to education?

This chapter draws on a substantial body of research literature related to such questions. Only a brief overview of this literature is presented here, with a particular focus on documenting what is known about black-white differences in education-related outcomes. More specifically, the chapter discusses recent findings on racial differences in labor market outcomes and in educational achievement.

## I. LABOR MARKET OUTCOMES

**Main Findings: Evidence on Labor Market Outcomes**

- Black-white gaps in employment and earnings increased during the 1980s for both men and women.
- Recent research suggests that black-white differences in educational achievement account for much of the black-white wage gap for men, and all of the black-white wage gap for women.

Labor market outcomes, such as employment and earnings, are important measures of the relative social progress of blacks. Improved employment prospects and earnings capacity are not the only purposes of education, of course; but they are probably the primary reason why most Americans pursue schooling for a period of time longer than is required by law.

## A. Labor Force Participation and Unemployment

In recent years black-white gaps in both labor force participation rates and unemployment rates have increased for both men and women. Understanding the nature and causes of these changes has been a major focus of recent research.

Several studies document a decline over time in the labor force participation rate of blacks relative to whites, and an increase in the unemployment rate of blacks relative to whites.[1] Using Current Population Survey (CPS) data, Juhn (1992) found that, between 1967 and 1987, the labor force participation rate of black males declined relative to the corresponding rate for white males. Juhn also found that, over the same period, the proportion of the male labor force that was unemployed for all or most of the year increased, and the increase was larger for blacks than for whites. Juhn determined that unemployment rates increased, especially for black men, as a result of fewer nonworkers becoming employed, rather than from more workers becoming unemployed.

Similar changes in the relative labor force participation and unemployment rates of blacks were reported by Bernstein (1995), who analyzed CPS data on 25- to 34-year-old men and women between 1973 and 1993. For this age group, the relative labor force participation rate of black men declined by 3.4 percentage points, and the participation rate for black women declined by 19 percentage points between 1973 and 1993. Over the same time period, the black-white unemployment gap widened by 2.4 percentage points for men and 2.3 percentage points for women.[2]

The decline in blacks' relative labor force participation, and the increase in blacks' relative unemployment, appear to be due, at least in part, to an overall decrease in the labor force participation and employment of less educated workers, who are disproportionately black. Juhn found that unemployment rates rose between 1967 and 1987 especially for high school dropouts, for whom real wages declined over this period. Juhn also found that declining wages (perhaps reflecting reduced labor demand) explained almost all of the decrease in the labor force participation rate of white high school dropouts, but explained less than half of the decrease in the labor force participation rate for black high school dropouts. Other factors, such as increases in the incarceration rate of low-skilled black males between 1967 and 1987 or increases in employment discrimination, may be responsible for the remainder of the trends reported by Juhn.

Bernstein (1995) found that declines in relative labor force participation rates vary by education level more for black men than for black women. For black men, the relative labor force participation rate of high school dropouts fell by 14 percentage points between 1973 and 1993, while the corresponding rate for college graduates remained about the

[1] The *labor force participation rate* is the percentage of noninstitutionalized civilians who have jobs or are looking for work. The *unemployment rate* is the percentage of labor force participants who are without jobs and are looking for work.

[2] Bernstein (1995), pp. 36–37. For men, the black-white labor force participation gap was 3.9 percentage points in 1973 and 7.3 percentage points in 1993. For women, the labor force participation of blacks exceeded that of whites by 13.2 percentage points in 1973, but by 1993, the labor force participation of blacks was 5.8 percentage points below that of whites. For men, the black-white unemployment gap was 3.7 percentage points in 1973 and 6.1 percentage points in 1993; for women, the corresponding gaps were 5.5 and 7.8 percentage points, respectively.

same.[3] For black women, the relative labor force participation rate of high school dropouts fell by 18 percentage points over the same time period, and the corresponding rate for college graduates fell by 21 percentage points. These trends for women reflect the fact that, between 1973 and 1993, the labor force participation rate increased for white women at all levels of schooling, and did so at a faster rate than for black women.[4]

For both black men and black women who were already in the labor force, increases in relative unemployment rates between 1973 and 1993 were less pronounced for highly educated individuals than for less educated individuals. For black men in the labor force, the relative unemployment rate of high school dropouts increased by 7 percentage points between 1973 and 1993, while the corresponding rate for college graduates increased by 3 percentage points. For black women in the labor force, the relative unemployment rate of high school dropouts increased by 9 percentage points between 1973 and 1993, while the corresponding rate for college graduates remained about the same (Bernstein 1995). Bernstein argued that decreased demand for less-skilled workers, shifts in employment from manufacturing to services, the decline of unions, and decreases in anti-discrimination enforcement contributed to the increase in the relative unemployment rate of blacks over this period.

## B. Earnings

The black-white wage differential narrowed substantially between 1940 and 1980, but a substantial black-white gap in earnings persisted, and in some cases widened, during the 1980s. The black-white wage gap has been the subject of much research by economists.

Smith and Welch (1986) used decennial census data from 1940 to 1980 to document the narrowing of the black-white wage gap during this period. They found that the narrowing black-white education gap and increased economic returns on education for blacks were largely responsible for this convergence.

Bernstein (1995) used CPS data to measure trends in black-white hourly wage disparities for 25- to 34-year-olds through the early 1990s. He found that the black-white wage gap for men remained at 18 to 20 percent between 1973 and 1993, but that the corresponding gap for women widened from 7 to 16 percent over the same period. Between 1979 and 1989, the wages of black men declined relative to the wages of white men, with the black-white wage gap widening from 16 to 21 percent overall.[5] Declines in the relative wages of black men occurred at all levels of schooling during the 1980s, even for college graduates.

Citing several other studies, Bernstein proposed three possible explanations for the widening black-white wage gap: declining unionization and real minimum wage, industry and occupational shifts, and increases in labor market discrimination. Bound and Freeman (1992) found that 5 percent of the overall drop in black earnings between 1973 and 1989 could be accounted for by the diminishing influence of unions, and 17 per-

[3] Bernstein defined *college graduates* as persons with 4 or more years of postsecondary education.

[4] For black men in both 1973 and 1993, the labor force participation rate was below that of white men at every level of schooling. For black women in 1973 and 1993, the labor force participation rate was above that of white women at every level of schooling, except for women with a high school diploma or less in 1993.

[5] Bernstein (1995), p. 32. Measured in 1993 dollars, the absolute black-white wage gap for 25- to 34-year-old men was $3.04 in 1973, $2.30 in 1979, $2.59 in 1989, and $2.06 in 1993, and the absolute black-white wage gap for 25- to 34-year-old women was $0.74 in 1973, $0.55 in 1979, $1.49 in 1989, and $1.62 in 1993.

cent could be accounted for by a decline in the real minimum wage. (For black high school dropouts, the effects are more dramatic; the two factors account for 23 percent and 98 percent of the widening gap, respectively.) Reardon (1993) estimated that the portion of the black-white wage gap attributable to black-white differences in industry and occupation rose from 17 to 28 percent between 1980 and 1990. During the 1980s, black men moved from the higher-paying manufacturing sector to the lower-paying service sector at a faster rate than white men. Bernstein (1995) also cited several studies documenting either decreased enforcement of anti-discrimination laws over time or the continuation of labor market discrimination against black workers.

Bernstein analyzed black-white trends separately for workers with different levels of educational *attainment*, but he did not account for different levels of educational *achievement*, since this information is not reported in the CPS. Several recent studies using the National Longitudinal Survey of Youth (NLSY) have found that between two-thirds and three-quarters of the black-white wage gap for men can be explained by either achievement alone or by a combination of achievement and educational attainment. Ferguson (1991) and Maxwell (1994) estimated that about two-thirds of the black-white wage gap for men in the NLSY can be explained by differences in scores on the Armed Forces Qualifying Test (AFQT), which is the NLSY's measure of educational achievement. O'Neill (1990) found that differences in both AFQT scores and years of schooling explain three-quarters of the black-white wage gap for men, and argued that this gap increased in the 1980s because of an increased wage premium for higher-skilled workers. Johnson and Neal (1996) found that the AFQT score differences explain three-quarters of the black-white wage gap for men, and all of the black-white wage gap for women.

## II. EDUCATIONAL ATTAINMENT

**Main Findings: Evidence on Educational Attainment**

- Between the early 1970s and mid-1990s, the black-white gap in high school/GED completion rates narrowed substantially.
- Black-white gaps in college attendance and completion persisted throughout the period from the early 1970s to the mid-1990s.

Educational attainment is another major indicator of the social progress of blacks. Several measures of educational attainment appear in the research literature, including completion of high school (or equivalent), college attendance, college completion, and total years of schooling completed. Recent studies find evidence of increases in the educational attainment of blacks, but researchers offer different explanations for these increases.

### A. High School/GED Completion

The high school completion rates of blacks improved between the 1970s and the 1990s. Between 1975 and 1998, the percentage of black 25- to 29-year-olds who had earned a high school diploma or the equivalent increased from 71 to 88, narrowing the black-white gap in high school completion from 16 to 6 percentage points (NCES 1999).

Dropout rates for both black and white students have essentially converged since the early 1970s. In 1974, the high school dropout rate for 15- to 24-year-old blacks was twice

the corresponding rate for whites (12 versus 6 percentage points). By 1997, 15- to 24-year-old blacks and 15- to 24-year-old whites remained in high school at similar rates, with dropout rates of 5.0 and 3.6 percentage points, respectively (NCES 1999).

The National Research Council (NRC) (1989) speculated that at least some of the narrowing of the black-white high school completion gap in recent years has been due to higher rates of completion of GEDs (General Educational Development certificates) by blacks. Using data from the NLSY, Cameron and Heckman (1991) found that although only 7 percent of white 25-year-olds with a high school diploma or equivalent had a GED, 13 percent of black 25-year-olds with a high school diploma or equivalent had a GED. Appendix E uses the NLSY to examine how variable and sample definitions relate to estimated differences in black-white high school/GED completion between 1985 and 1992.

## B. College Attendance and Completion

The evidence on recent trends in college attendance and completion by blacks is more mixed than the evidence on recent trends in high school completion. In absolute terms, the *college attendance rate*, measured as a percentage of the population of 18- to 24-year-old high school graduates, increased for black youth, from 27 percent in 1972 to 39 percent in 1997. On a relative scale, however, the college attendance rate for blacks remained constant at about 83 to 85 percent of the rate for whites.[6] Between 1975 and 1998, the black-white gap in the *4-year college completion rate* of 25- to 29-year-old high school graduates increased slightly from about 13 to about 17 percentage points (NCES 1999).[7]

The NRC (1989) identified several hypotheses that explain why the relative college attendance rates of blacks actually declined between the mid-1970s and mid-1980s. Rather than attribute this trend to data problems or economic changes, the NRC identified changes in financial aid and attitudes toward the military as the most important causes of this shift. Between 1976 and 1985, the portion of financial aid awards represented by grants decreased from 80 to 46 percent, while the portion represented by loans increased from 17 to 50 percent. Between 1977 and 1985, the percentage of black male high school seniors with plans to enter the military increased from 37 percent to 50 percent, compared with an increase from 17 percent to 21 percent for white male seniors (NRC 1989). The NRC argued that black youth perceived lower returns on education than white youth and were therefore less likely to finance a college education through borrowing and more likely to pursue a career in the military.

Several studies have tested competing theories explaining the recent trends in the educational attainment of blacks. Using data from the National Longitudinal Study of the High School Class of 1972 (NLS:72), Clayton et al. (1990) concluded that black students' progress was more likely than that of white students to be based on past educational performance as opposed to opportunities and expenditures in school systems. Using NLSY data, Cameron and Heckman (1992) found that, while schooling choices were sensitive to tuition costs, the availability of alternatives to schooling in the labor market, and observed family background characteristics, differences in these factors explained little of black-white differences in educational attainment. In contrast, Kane

[6] The college attendance rate for 18- to 24-year-old white high school graduates was 33 percent in 1972 and 46 percent in 1997 (NCES 1999, p. 142).

[7] The college completion rate for 25- to 29-year-old white high school graduates was 28 percent in 1975 and 35 percent in 1998 (NCES 1999, p. 152).

(1992), using pooled CPS cross-sections from 1973 to 1988, found that higher tuition costs were responsible for declines in college enrollment rates during the 1980s, and that increases in parental education have increased relative college enrollment rates for blacks. Kane interpreted this latter effect as a long-term consequence of the opening of educational opportunities for blacks during the 1950s and 1960s.

Most researchers have found that, for youth with similar levels of family income and educational achievement, blacks' educational attainment is at least as high as whites'. McMillen et al. (1993) used both the CPS and the National Educational Longitudinal Study (NELS:88) to document changes in high school dropout and retention rates since 1972. They concluded that, for 16- to 24-year-olds with similar family income levels, blacks are no more likely to drop out of high school than whites. Altonjii (1988) analyzed NLS:72 data and concluded that, for youth similar in terms of family background, educational aptitude, and achievement, the schooling completed by blacks actually exceeds by 0.4 year the schooling completed by whites. Myers (1987) analyzed data from the High School and Beyond (HSB) study and concluded that, for youth with similar levels of educational achievement, blacks were just as likely to attend college as whites.

## III. EDUCATIONAL ACHIEVEMENT

**Main Findings: Evidence on Educational Achievement**

- Black-white gaps in mathematics and reading achievement narrowed between the early 1970s and the mid-1990s.
- Recent research suggests that differences in parental background, and differences in school quality, account for at least some of the remaining black-white differences in educational achievement.

Educational achievement is a third indicator of the social progress of blacks. Since the early 1970s, standardized tests in subjects such as reading and mathematics have become one of the most common indicators of the educational progress of black students relative to white students.

### A. Measures of Educational Achievement

Standardized tests designed to measure educational achievement include the Scholastic Assessment Test (SAT) and the reading and mathematics examinations administered as part of the National Assessment of Educational Progress (NAEP). The SAT is a college admissions test administered periodically to a self-selected group of college-bound high school students. The test is designed to predict future academic performance. In contrast, the NAEP is a nationally representative set of tests designed to gauge levels of and trends in educational achievement among students across the nation.

Trends in SAT scores since 1975–76 suggest that black youth taking the test have made gains relative to white youth. In 1975–76, the average combined SAT score of black youth was 73 percent of the average combined score of white youth. By 1994–95, the average combined score of black youth was 79 percent of the average combined score of white youth. In absolute terms, the average SAT scores of black youth rose by 8 percent over this period, while average scores of white youth remained about the same (NCES

1996).[8] Since the SAT is not required of all students, trends in these test scores do not necessarily indicate progress for the whole population of black youth because not all youth take the test. Between 1980 and 1985, for example, the average SAT scores of black youth rose by 5 percent (NCES 1995), but the number of blacks taking the SAT declined by 9 percent (NRC 1989).

Compared with SAT scores, NAEP scores are a better indicator of the educational achievement of the overall population of youth, since the NAEP samples are nationally representative. Trends in NAEP scores indicate both relative and absolute progress for black youth since the early 1970s. Between 1973 and 1996, the average NAEP mathematics scores of black 17-year-olds grew by 6 percent, while the average math scores of white 17-year-olds remained about the same (NCES 1997b). Similarly, between 1971 and 1996, the average NAEP reading scores of black 17-year-olds grew by 11 percent, while the average reading scores of white 17-year-olds remained about the same (NCES 1997b).[9] Bernstein (1995) reported that the NAEP score gains realized by black students are evident both in the South and in metropolitan areas throughout the United States.

Several studies have used data besides the NAEP to confirm the narrowing of the black-white test score gap over time. Hedges and Nowell (1997) studied test scores of blacks and whites in five surveys besides the NAEP,[10] and found consistent evidence of decreasing black-white test score gaps over time. Hauser and Huang (1996) reported evidence from the General Social Survey (GSS) vocabulary test administered since the early 1970s that indicates a longer-term convergence in test scores for black and white adults born between 1909 and 1974. Using data from eight national surveys,[11] Phillips et al. (1997) found that the black-white test score gap narrowed over time for children born between 1948 and 1978, but remained constant or widened for children born between 1979 and 1985.

## B. Explanations of the Relative Educational Achievement of Black Students

The absolute differences in the test scores of black and white youth are a major theme in the research literature. Many studies have investigated the extent to which factors such as family background and school characteristics can account for black-white differences in educational achievement and for changes in the black-white achievement gap over time.

[8] Average combined SAT scores for blacks were 686 in 1975–76 and 744 in 1994–95; and average combined SAT scores for whites were 944 in 1975–76 and 946 in 1994–95 (NCES 1996, p. 240).

[9] Average NAEP mathematics scores for black 17-year-olds were 270 in 1973 and 286 in 1996; average NAEP mathematics scores for white 17-year-olds were 310 in 1973 and 313 in 1996 (NCES 1997b, p. 123). Average NAEP reading scores for black 17-year-olds were 239 in 1971 and 265 in 1996; average NAEP reading scores for white 17-year-olds were 291 in 1971 and 294 in 1996 (NCES 1997b, p. 114).

[10] The six surveys studied were: the NAEP, the Equality of Educational Opportunity (EEO) survey, the National Longitudinal Study of the High School Class of 1972 (NLS:72), the High School and Beyond (HSB) survey, the National Longitudinal Survey of Youth (NLSY), and the National Educational Longitudinal Study of 1988 (NELS:88).

[11] The eight surveys studied were: the NAEP, the EEO survey, the HSB survey, the NLSY, the Children of the National Longitudinal Survey of Youth (CNLSY), the NELS:88, the Longitudinal Study of American Youth (LSAY), and the Chapter 1 Prospects Study.

Since the 1960s, several studies using cross-sectional data have identified differences in family background characteristics as a major reason for the relatively lower average achievement of black students. Using data from the Equality of Educational Opportunity (EEO) survey, Coleman et al. (1966) found that, for children with similar family backgrounds, differences in measured school resources explained little of black-white differences in educational achievement. More recently, O'Connor (1989) synthesized literature published since the early 1970s and identified the use of Black English vernacular by black youth as a major contributing factor to differential test performance by blacks. More recently, Fuchs and Reklis (1994) analyzed average 1992 NAEP mathematics scores of 13-year-olds by state and concluded that child and household characteristics explain much more of the black-white difference in test scores than can be explained by school characteristics.

Differences in black-white achievement may also be attributable to differences in school preparedness. The National Center for Education Statistics (1997) reported that the preschool enrollment of black children has been declining over time relative to the preschool enrollment of white children. In 1975, the preschool enrollment rate for both black and white students was about 25 percent. By 1991, 31 percent of black 3- and 4-year-olds were enrolled in preschool, compared with 40 percent of white 3- and 4-year-olds. The NCES indicated that preschool enrollment may be an important predictor of subsequent academic success, especially for disadvantaged students. Currie and Thomas (1995) concluded that participation in the Head Start program for disadvantaged preschoolers leads to short-term academic gains for both black and white children, but long-term gains for white children only.

Several other studies test hypotheses about the role of school desegregation in black-white differences in achievement over time. Koretz (1987) concluded that neither school desegregation nor increases in Head Start and Chapter 1 compensatory education funding has had a large effect on the average test scores of black youth since the 1960s. The NRC (1989) noted that, while school desegregation was more likely to occur in rural areas, NAEP scores also improved for black youth in urban regions.

Several researchers have argued that changes in socioeconomic status, as indicated by parental education and income, are the major reasons for the narrowing of black-white test score gaps over time. Pointing to the lack of evidence that desegregation raises achievement, Armor (1992) proposed the alternative hypothesis that an improvement in the educational attainment of black parents is largely responsible for the increase in NAEP scores since the early 1970s. Looking at evidence over time from multiple surveys, Hedges and Nowell (1997) concluded that the narrowing of black-white differences in parental education and income was the primary reason for the partial convergence over time in the test scores of blacks and whites. In another study (1996), Armor reported that the relative NAEP scores of 13- and 17-year-old blacks declined slightly between 1988 and 1992, and that this decline was associated with a relative decline in blacks' socioeconomic status, measured by parental education, family structure, and home reading items.

Not all studies have concluded that recent trends in differences in family background are the primary explanation for recent trends in differences in black-white achievement. Grissmer et al. (1996) studied NAEP trends and found that black students made relative gains despite their increasing disadvantage as measured by changes in single-parent families and economic status. On the basis of these findings, the researchers concluded

that nonfamily factors, such as changes in educational spending and programs, led to disproportionate increases in the relative NAEP scores of black students.

## IV. CONCLUSION

Since the early 1970s, as reported in the research literature, blacks have made gains in narrowing the educational and economic gaps between themselves and whites, particularly in the areas of educational achievement and high school completion. Notwithstanding this progress, blacks continue to lag behind whites in terms of college attendance and completion. Black-white disparities have also persisted, and sometimes widened, for labor market outcomes such as labor force participation, employment, and earnings. Researchers have identified a variety of explanations for these trends, some of which center on changes in the economy and culture, and others on changes in public policy. A growing body of research has established a strong link between black-white differences in prior educational achievement and black-white differences in subsequent outcomes such as educational attainment and earnings.

The following chapters describe the original analyses that were the focus of the present study. The findings from the present study confirm and also extend the findings from the literature on the relationships between achievement differences and black-white inequality in educational and economic outcomes.

# 2. BLACK-WHITE DIFFERENCES IN LABOR MARKET OUTCOMES

The evidence reported in chapter 1 indicates that, since the early 1970s, the relative educational achievement and high school attainment of black youth has improved. With regard to labor market outcomes, however, there is little indication that the relative unemployment rates or earnings of young black men and women have improved substantially between the 1970s and the 1990s. Indeed, there is some evidence that black-white labor market disparities have increased, especially for women. Recent research findings have disagreed on the extent to which such persistent black-white labor market disparities can be attributed to skills differences or to other factors such as employment or wage discrimination.

This chapter compares the labor market outcomes of black and white young adults in four samples observed between 1979 and 1992.[1] The analyses addressed several key questions: Do labor market outcomes differ for blacks and whites? Are black-white disparities larger for men than for women? To what extent do black-white labor market differences change after restricting the comparisons to young adults similar in terms of educational achievement and related factors?[2] Are there unexplained disparities in the labor market outcomes of whites and blacks, which could be evidence of unobserved differences in skills between blacks and whites or perhaps of labor market discrimination?

In the sections that follow, this chapter discusses black-white differences in four labor market outcomes: labor force participation rates, unemployment rates, annual earnings, and hourly wages. A final section offers some general observations.

[1] Appendix A discusses the data sources and treatment of missing data for these analyses; appendix B discuss comparability of data; appendix C discusses the analysis methodology; and appendix D presents standard errors for the results in this chapter.

[2] These comparisons, described in appendix C, involve the estimation of analytic models to distinguish how outcomes vary by race when factors such as achievement are held constant. Our analyses compare all whites with blacks similar to whites in terms of background characteristics, rather than vice versa. In general, the pattern of results is similar when we compare all blacks with whites similar to blacks in terms of background characteristics.

# I. LABOR FORCE PARTICIPATION

**Main Findings: Labor Force Participation**

- Labor force participation rates did not differ consistently across samples for blacks and whites.
- For young adults with similar levels of prior educational achievement, blacks were at least as likely to participate in the labor force as whites.

## A. Labor Force Participation Rates

The black-white gap in labor force participation rates[3] was not consistent across the four samples[4] studied (table 2.1). For women in the 1979 sample, the labor force participation rate was 10 percentage points *higher* for blacks than for whites; but in the other three samples, the labor force participation rate was similar for black women and white women. Black men and white men had similar labor force participation rates in the 1979 and 1983-1989 samples, but in the 1986–1992 and 1992 samples, the labor force participation rate was 5 to 8 percentage points lower for black men than for white men.

The decline in the relative labor force participation rate of black women between the 1979 and 1983–1989 samples is consistent with the trends in black and white women's labor force participation rates during the 1980s.[5]

For example, as measured by Bernstein (1995) using Bureau of Labor Statistics data, the labor force participation rate of 25- to 34-year-old white women rose between 1979 and 1989, while the rate for black women in that age bracket remained level over the same period. Bernstein also found that the relative labor force participation rate for blacks continued to decline between 1989 and 1993. In the present study, however, a comparison of the 1986–1992 and 1992 samples revealed no clear difference in the black-white gap in labor force participation between the two samples. It is possible that differences in the design of the 1986–1992 and 1992 samples are responsible for this result.

[3] *The labor force participation rate* is the percentage of civilians who, at the time of the interview, are either working, not at work but have a job, or looking for work. The *unemployment rate* is the percentage of civilian labor force participants who are without a job.

[4] We compared labor market outcomes for blacks and whites in four samples of young adults; participants in the National Longitudinal Study of the High School Class of 1972, observed in 1979, 7 years after Grade 12 ("the 1979 sample"); participants in the National Longitudinal Survey of Youth who were high school seniors between 1976 and 1982, observed between 1983 and 1989, 7 years after Grade 12 ("the 1983–1989 sample"); participants in the National Longitudinal Survey of Youth who were high school sophomores between 1974 and 1980, observed between 1986 and 1992, 12 years after Grade 10 ("the 1986–1992 sample"); and participants in the High School and Beyond Survey of 1980 high school sophomores, observed in 1992, 12 years after Grade 10 ("the 1992 sample"). See appendix A and B for details.

[5] The comparison of the 1979 and 1983-1989 samples assumes that the two underlying samples of young adults are truly comparable, an assumption that is discussed in appendix B.

## Table 2.1—Black-white differences in labor force participation rates for young adults in 4 samples, 1979-1992

| Description of sample of young adults, year observed, source of data, and sex of subgroup | Labor force participation rate for whites (in percentage points) | Black-white differences in labor force participation rates for all persons | for persons with educational achievement similar to whites' | for persons similar in multiple characteristics+ |
|---|---|---|---|---|
| **High school seniors, 7 years later** | | | | |
| **In 1979 (from the NLS-72)** | | | | |
| Men and women combined | 86.2 | 3.8 * | 4.2 * | 5.4 * |
| Men only | 95.4 | -1.5 | -4.0 | 0.0 |
| Women only | 77.1 | 10.3 * | < 12.8 * | 11.2 * |
| Difference for men minus difference for women | | -11.8 * | -16.8 * < | -11.2 * |
| **In 1983-1989 (from the NLSY)** | | | | |
| Men and women combined | 88.1 | -2.0 | < 0.6 | 1.5 |
| Men only | 93.0 | -0.9 | -0.8 < | 1.3 |
| Women only | 83.4 | -2.2 | < 1.4 | 1.3 |
| Difference for men minus difference for women | | 1.3 | -2.2 < | -0.1 |
| **Difference between 1983-1989 and 1979 samples** | | | | |
| Men and women combined | 1.9 | -5.7 * | -3.6 | -3.9 |
| Men only | -2.4 | 0.6 | 3.2 | 1.3 |
| Women only | 6.4 | -12.5 * | -11.4 * | -9.8* |
| Difference for men minus difference for women | | 13.1 * | 14.6 * | 11.1 * |
| **High school sophomores, 12 years later** | | | | |
| **In 1986-1992 (from the NLSY)** | | | | |
| Men and women combined | 85.5 | -1.7 | < 4.3 * | 4.3 * |
| Men only | 92.5 | -4.0 * | < 0.8 < | 2.3 |
| Women only | 78.5 | 0.8 | < 8.4 * | 6.1 * |
| Difference for men minus difference for women | | -4.8 * | > -7.6 * | -3.8 |
| **In 1992 (from HSB)** | | | | |
| Men and women combined | 84.5 | -3.2 * | < 2.3 < | 3.7 * |
| Men only | 92.7 | -6.9 * | < -3.3 | -1.5 |
| Women only | 76.6 | 0.7 | < 7.8 * | 8.6 * |
| Difference for men minus difference for women | | -7.6 * | > -11.1 * | -10.0 * |
| **Difference between 1992 and 1986-1992 samples** | | | | |
| Men and women combined | -1.0 | -1.5 | -2.0 | -0.6 |
| Men only | 0.2 | -2.9 | -4.1 | -3.7 |
| Women only | -1.9 | -0.2 | -0.6 | 2.5 |
| Difference for men minus difference for women | | -2.8 | -3.5 | -6.2 |

TABLE READS: In 1979, labor force participation rates were 3.8 percentage-points higher for blacks than for whites (86.2 percent). While labor force participation rates were similar for black men and white men, black women had an 10.3 percentage-point higher labor force participation rate than white women. For women with similar educational achievement, blacks had a 12.8 percentage-point higher labor force participation rate than whites.

* = Black-white difference is statistically significant at p <= .05; "<" and ">" indicate significant differences between adjacent differences.

+ = Multiple characteristics include educational achievement, educational attainment, and length of work experience.

NOTE: Difference between group X and group Y refers to the mean for group X minus the mean for group Y. Standard errors have been adjusted for complex survey designs. Samples restricted to civilians. Numbers may not sum to totals due to rounding. Multiple imputation used to account for missing data.

SOURCE: U.S. Department of Education, National Center for Education Statistics, National Longitudinal Study of the High School Class of 1972 (NLS-72), High School and Beyond (HSB); and U.S. Department of Labor, Bureau of Labor Statistics, National Longitudinal Survey of Youth (NLSY).

### B. Relating Educational Achievement to Labor Force Participation Rates

In comparisons of young adults with similar levels of prior educational achievement, blacks were at least as likely as whites to participate in the labor force (table 2.1). In the 1979 sample, the labor force participation rate was higher for black women than for white women, and higher still for black women with prior educational achievement similar to that for white women.[6] In the 1986–1992 and 1992 samples, black men had lower labor force participation rates than white men, but black and white men with similar levels of prior educational achievement had similar rates of labor force participation. Moreover, in these two samples, while black women and white women had similar rates of labor force participation overall, black women with similar prior educational achievement as white women had higher rates of labor force participation.

For young adults with similar prior educational achievement, educational attainment, and work experience, labor force participation rates were generally no lower for blacks than for whites. Among men, blacks similar to whites in these characteristics had similar rates of labor force participation, while among women, blacks similar to whites in these characteristics usually had higher rates of labor force participation.

The change in the relative labor force participation rates of black women between the 1979 and 1983–1989 samples was about the same, regardless of whether the change was for women as a whole, or women similar in terms of educational background and work experience. The fact that the relatively lower labor force participation rates in the 1983-1989 samples is not accounted for by differences in educational background or work experience suggests that other factors may be responsible for the lower relative labor force participation rate of black women in the more recent sample.

## II. UNEMPLOYMENT

**Main Findings: Unemployment**

- Unemployment rates for black labor force participants were 4 to 10 percentage points higher than for white labor force participants.
- For young adults with similar levels of prior educational achievement, the black-white gap in unemployment rates was at least one-half smaller than for young adults as a whole.

[6] These comparisons, described in appendix C, involve the estimation of analytic models to distinguish how outcomes vary by race when factors such as achievement are held constant. Our analyses compare all whites with blacks similar to whites in terms of background characteristics, rather than vice versa. In general, the pattern of results is similar when we compare all blacks with whites similar to blacks in terms of background characteristics.

This section investigates black-white differences in the unemployment rates of civilian labor force participants.[7] Four samples of young adults, observed between 1979 and 1992, were studied.[8]

## A. Unemployment Rates

Overall, black labor force participants had unemployment rates 4 to 10 percentage points higher than white labor force participants (table 2.2). The overall black-white unemployment gap was about 3 percentage points larger for the 1983–1989 sample than for the 1979 sample, a gap consistent with time-series evidence reported in chapter 1. However, the overall black-white gap in unemployment was 5 percentage points smaller for the 1992 sample than for the 1989–1992 sample. It is not clear whether the latter finding reflects a trend from the 1980s to the early 1990s or merely reflects differences in the samples of young adults studied.

## B. Relating Achievement to Unemployment Rates

In comparisons among young adults with similar levels of prior educational achievement, black-white gaps in unemployment rates were at least one-half smaller than the gaps for young adults as a whole (table 2.2). In the 1979 and 1992 samples, blacks with similar educational achievement as whites had similar unemployment rates. In the 1983-1989 and 1986-1992 samples, for young adults with similar prior educational achievement, the black-white gap in unemployment rates was one-half to three-fifths smaller than for young adults as whole. Factors possibly contributing to the remaining difference in unemployment rates include skill differences not captured by achievement measures, differences in the regional availability of jobs, differences in access to job networks, and outright employment discrimination against black labor force participants.[9] In general, among young adults with similar educational achievement, educational attainment, and work experience, blacks and whites had similar unemployment rates.

7 The *labor force participation rate* is the percentage of civilians who, at the time of the interview, are either working, not at work but have a job, or looking for work. The *unemployment rate* is the percentage of civilian labor force participants who are without a job.

8 We compared labor market outcomes for blacks and whites in four samples of young adults: participants in the National Longitudinal Study of the High School Class of 1972, observed in 1979, 7 years after Grade 12 ("the 1979 sample"); participants in the National Longitudinal Survey of Youth who were high school seniors between 1976 and 1982, observed between 1983 and 1989, 7 years after Grade 12 ("the 1983–1989 sample"); participants in the National Longitudinal Survey of Youth who were high school sophomores between 1974 and 1980, observed between 1986 and 1992, 12 years after Grade 10 ("the 1986–1992 sample"); and participants in the High School and Beyond Survey of 1980 high school sophomores, observed in 1992, 12 years after Grade 10 ("the 1992 sample"). See appendix A for details.

9 See Johnson and Neal [1997] for a discussion of these hypotheses.

## Table 2.2—Black-white differences in unemployment rates for young adults in 4 samples, 1979–1992

| Description of sample of young adults, year observed, source of data, and sex of subgroup | Unemployment rates for whites (in percentage points) | Black-white differences in unemployment rates: for all persons | Black-white differences in unemployment rates: for persons with educational achievement similar to whites' | Black-white differences in unemployment rates: for persons similar in multiple characteristics+ |
|---|---|---|---|---|
| **High school seniors, 7 years later** | | | | |
| **In 1979 (from the NLS-72)** | | | | |
| Men and women combined | 4.0 | 3.5 * | < 0.6 | 0.4 |
| Men only | 2.9 | 2.8 * | 1.8 | 1.8 |
| Women only | 5.4 | 3.5 * | < -1.2 | -2.0 * |
| Difference for men minus difference for women | | -0.7 | < 3.0 | 3.8 * |
| **In 1983-1989 (from the NLSY)** | | | | |
| Men and women combined | 5.9 | 6.8 * | < 2.6 * < | 0.7 |
| Men only | 5.9 | 5.8 * | < 2.0 | -0.5 |
| Women only | 5.8 | 7.9 * | < 3.1 * | 2.1 |
| Difference for men minus difference for women | | -2.1 | -1.1 | -2.6 |
| **Difference between 1983-1989 and 1979 samples** | | | | |
| Men and women combined | 1.9 | 3.3 * | 2.0 < | 0.3 |
| Men only | 3.1 | 3.0 | < 0.2 | -2.4 |
| Women only | 0.4 | 4.4 * | 4.3 * | 4.1 * |
| Difference for men minus difference for women | | -1.4 | > -4.1 | -6.5 * |
| **High school sophomores, 12 years later** | | | | |
| **In 1986-1992 (from the NLSY)** | | | | |
| Men and women combined | 7.5 | 9.7 * | < 5.1 * < | 2.3 |
| Men only | 8.0 | 8.4 * | 5.1 * < | 1.3 |
| Women only | 6.8 | 11.2 * | < 4.9 * < | 3.2 * |
| Difference for men minus difference for women | | -2.8 | 0.2 | -1.9 |
| **In 1992 (from HSB)** | | | | |
| Men and women combined | 4.3 | 4.8 * | < 1.5 < | 0.5 |
| Men only | 4.9 | 2.8 * | < 0.7 | -0.5 |
| Women only | 3.7 | 6.8 * | < 2.6 | 1.1 |
| Difference for men minus difference for women | | -4.0 | -1.9 | -1.6 |
| **Difference between 1992 and 1986-1992 samples** | | | | |
| Men and women combined | -3.1 | -4.9 * | -3.6 | -1.8 |
| Men only | -3.2 | -5.5 * | -4.4 > | -1.8 |
| Women only | -3.0 | -4.3 | -2.2 | -2.1 |
| Difference for men minus difference for women | | 1.2 | 2.2 | -0.3 |

TABLE READS: In 1979, unemployment rates were 3.5 percentage points higher for blacks than whites (4.0 percent), and black-white gaps were similar by sex. For young adults with similar educational achievement, blacks and whites had similar unemployment rates. For young adults with similar achievement, attainment, and work experience, blacks and whites had similar unemployment rates.

* = Black-white difference is statistically significant at p <= .05; "<" and ">" indicate significant differences between adjacent differences.

+ = Multiple characteristics include educational achievement, educational attainment, and length of work experience.

NOTE: Difference between group X and group Y refers to the mean for group X minus the mean for group Y. Standard errors have been adjusted for complex survey designs. Samples restricted to civilian labor force participants. Numbers may not sum to totals due to rounding. Multiple imputation used to account for missing data.

SOURCE: U.S. Department of Education, National Center for Education Statistics, National Longitudinal Study of the High School Class of 1972 (NLS-72), High School and Beyond (HSB); and U.S. Department of Labor, Bureau of Labor Statistics, National Longitudinal Survey of Youth (NLSY).

## III. EARNINGS

**Main Findings: Earnings**

- Black young adults consistently earned less than white young adults, and these gaps tend to be larger for men than for women.
- For men with similar levels of prior educational achievement, black-white gaps in annual earnings are at least two-fifths smaller than for men as a whole.
- For women with similar levels of prior educational achievement, blacks earn as much as, or more than, whites.

This section compares both annual and hourly earnings of black workers with the corresponding earnings of white workers. All dollar values are in constant 1992 dollars.[10] Note that these comparisons focus only on individuals with at least some earnings for the time period under consideration.[11]

### A. Annual Earnings

From 1979 through 1992, young black workers earned, on average, between $2,400 and $4,500 (14 to 30 percent) less per year than young white workers (table 2.3). Black-white gaps in annual earnings for men ranged from 16 percent in the 1979 sample to about 32 percent in the 1983-1989 and 1986–1992 samples. In the 1979 and 1992 samples, black women and white women had similar earnings. In the 1986–1992 sample, the black-white earnings gap for women was $4,700 (or about two-thirds) smaller than the corresponding gap for men. The black-white gap in annual earnings was $1,700 (or over two-thirds) larger for the 1983–1989 sample than for the 1979 sample. This gap was consistent with the time-series evidence presented in chapter 1, which indicated a widening black-white earnings gap during the 1980s. In the present study, the black-white gap in annual earnings was $1,800 (or two-fifths) smaller for the 1992 sample than for the 1986–1992 sample; it is not clear whether this finding represents a recent trend or simply differences in the respective samples.[12]

[10] While black-white gaps in earnings were estimated using the natural log of earnings as the outcome variable, these gaps are expressed in dollars in the tables for ease of interpretation.

[11] To the extent that blacks are less likely than whites to have earnings in a given year, the black-white gap in potential earnings may be larger than the black-white gap in reported (positive) earnings.

[12] Because the 1992 sample does not provide hourly wage data, it is not possible to determine whether the narrower earnings gap in the 1992 sample represents a narrower gap in earnings per hour, a narrower gap in hours worked per year, or some combination of the two.

## Table 2.3—Black-white differences in average annual earnings for young adults in 4 samples, 1979-1992

| Description of sample of young adults, year observed, source of data, and sex of subgroup | Average annual earnings for whites (thousands of dollars/year) | Black-white differences in average annual earnings for all persons | | for persons with educational achievement similar to whites' | | for persons similar in multiple characteristics+ |
|---|---|---|---|---|---|---|
| **High school seniors, 7 years later** | | | | | | |
| **In 1979 (from the NLS-72)** | | | | | | |
| Men and women combined | 16.6 | -2.4 * | < | -0.4 | < | 0.9 |
| Men only | 20.4 | -3.3 * | | -2.4 | < | -0.9 |
| Women only | 12.9 | -0.8 | < | 1.6 * | < | 2.6 * |
| Difference for men minus difference for women | | -2.5 | > | -4.0 * | | -3.6 * |
| **In 1983-1989 (from the NLSY)** | | | | | | |
| Men and women combined | 13.6 | -4.1 * | < | -1.8 * | < | -0.8 |
| Men only | 16.2 | -5.3 * | < | -2.8 * | < | -1.2 |
| Women only | 11.3 | -3.1 * | < | -0.8 | | -0.6 |
| Difference for men minus difference for women | | -2.2 | | -2.0 | | -0.6 |
| **Difference between 1983-1989 and 1979 samples** | | | | | | |
| Men and women combined | -3.0 | -1.7 * | < | -1.4 * | | -1.8 |
| Men only | -4.2 | -2.0 * | < | -0.4 | | -0.2 |
| Women only | -1.6 | -2.3 * | | -2.4 * | | -3.2 * |
| Difference for men minus difference for women | | 0.2 | | 2.0 | | 3.0 |
| **High school sophomores, 12 years later** | | | | | | |
| **In 1986-1992 (from the NLSY)** | | | | | | |
| Men and women combined | 16.6 | -4.5 * | < | -0.5 | | -0.6 |
| Men only | 21.6 | -7.0 * | < | -2.5 * | | -1.9 |
| Women only | 12.4 | -2.4 * | < | 1.1 | | 0.5 |
| Difference for men minus difference for women | | -4.7 * | | -3.7 * | | -2.4 |
| **In 1992 (from HSB)** | | | | | | |
| Men and women combined | 18.7 | -2.6 * | < | 0.3 | | 0.4 |
| Men only | 22.3 | -5.6 * | < | -3.1 * | | -2.6 * |
| Women only | 15.3 | 0.1 | < | 3.4 * | | 3.1 * |
| Difference for men minus difference for women | | -5.6 * | | -6.6 * | | -5.7 * |
| **Difference between 1992 and 1986-1992 samples** | | | | | | |
| Men and women combined | 2.0 | 1.8 * | > | 0.9 | | 1.0 |
| Men only | 0.7 | 1.5 | > | -0.6 | | -0.8 |
| Women only | 2.8 | 2.4 * | > | 2.3 | | 2.5 |
| Difference for men minus difference for women | | -0.9 | | -2.9 | | -3.3 |

TABLE READS: In 1979, annual earnings averaged $2400 less for blacks than whites ($16,600). A black-white gap was evident for men ($3300) but not for women. For young adults with similar educational achievement, black women earned $1600 more per year than white women, while the black-white earnings gap for men was not significant. For young adults with similar achievement, attainment, and work experience, black women earned $2600 more per year than white women, and black men earned about the same as white men.

* = Black-white difference is statistically significant at p <= .05; "<" and ">" indicate significant differences between adjacent differences.

+ = Multiple characteristics include educational achievement, educational attainment, and length of work experience.

NOTE: Difference between group X and group Y refers to the mean for group X minus the mean for group Y. Standard errors have been adjusted for complex survey designs. Samples restricted to employed civilians. Numbers may not sum to totals due to rounding. Multiple imputation used to account for missing data.

SOURCE: U.S. Department of Education, National Center for Education Statistics, National Longitudinal Study of the High School Class of 1972 (NLS-72), High School and Beyond (HSB); and U.S. Department of Labor, Bureau of Labor Statistics, National Longitudinal Survey of Youth (NLSY).

## B. Relating Achievement to Annual Earnings

In comparisons between young workers with similar levels of prior educational achievement, the black-white deficit in annual earnings was generally smaller than for young adults as a whole. In the 1979 sample, there was no significant difference in annual earnings for blacks and whites with similar prior educational achievement. In the other three samples, for men with similar levels of prior educational achievement, the black-white gap in annual earnings was $2,500 to $3,100 (or two-fifths to two-thirds) smaller than for men as a whole. In the 1983–1989 and 1986–1992 samples, among women with similar levels of prior educational achievement, blacks earned as much as whites. In the 1979 and 1992 sample, black women with levels of prior educational achievement similar to those for white women earned 12 and 22 percent more per year than white women, respectively.

In the 1979, 1983–1989. and 1986–1992 samples, among men with similar levels of all three factors—prior educational achievement, educational attainment, and work experience—blacks and whites earned about the same per year. In the 1992 sample, however, black men similar to white men in terms of educational background and work experience earned $2,600 (or 12 percent) less per year than white men.

For young workers with similar levels of prior educational achievement, black-white gaps in annual earnings were similar for men in the 1979 and 1983-1989 samples, and for both men and women in the 1986-1992 and 1992 samples. Appendix B indicates that the black-white differences in educational achievement were similar in the 1979 and 1983-1989 samples, but smaller in the 1992 sample than in the 1986-1992 sample. Taken together, these findings suggest that the larger black-white earnings gap for men in the 1983–1989 sample compared with the 1979 sample may be related to a higher economic return on achievement in the 1980s than in 1979. In contrast, the narrower earnings gap in the 1992 sample compared with the 1986–1992 sample may be related, at least in part, to the relatively higher achievement of blacks that was characteristic of the 1992 sample.

## C. Hourly Wages

The hourly wage is arguably the most precise measure of the earnings capacity of workers because, unlike annual earnings, it distinguishes a worker's rate of pay from the number of hours worked. In the present study, hourly earnings information was available for three of the four samples of young adults studied.[13]

Between 1979 and 1992, the hourly earnings of black young adults were between $0.99 and $1.65 (8 to 17 percent) lower than the hourly earnings of white young adults (table 2.4). Black-white wage gaps were generally larger for men than for women. The black-white wage gap for men ranged from $1.35 (10 percent of the average white man's wages) in the 1979 sample to $2.21 (20 percent of the average white man's wages) in the 1986–1992 sample. In contrast, in the 1979 sample, black women and white women had similar wages; and in the 1983–1989 and 1986–1992 samples, black-white wage gaps for women were $0.83 to $1.18 (or two-fifths to one-half) smaller than the corresponding gaps for men.

In the present study, black-white wage gaps were larger in the 1983–1989 sample than in the 1979 sample, by $0.55 for men and $0.94 for women. This finding is consistent

[13] The 1992 follow-up of the High School and Beyond sample ("the 1992 sample") did not include hourly earnings information, so the discussion of hourly earnings is confined to the 1979 sample from the NLS:72 and the 1983–1989 and 1986–1992 samples from the NLSY.

**Table 2.4—Black-white differences in hourly wages for young adults in 3 samples, 1979-1992**

| Description of sample of young adults, year observed, source of data, and sex of subgroup | Average hourly wages for whites (dollars/ hour) | Black-white differences in average hourly wages for all persons | | Black-white differences in average hourly wages for persons with educational achievement similar to whites' | Black-white differences in average hourly wages for persons similar in multiple characteristics+ |
|---|---|---|---|---|---|
| **High school seniors, 7 years later** | | | | | |
| **In 1979 (from the NLS-72)** | | | | | |
| Men and women combined | 11.91 | -0.99 * | < | 0.14 | 0.05 |
| Men only | 13.38 | -1.35 * | | -0.60 | -0.49 |
| Women only | 10.28 | -0.12 | < | 1.01 * | 0.83 * |
| Difference for men minus difference for women | | -1.23 * | | -1.61 * | -1.32 * |
| **In 1983-1989 (from the NLSY)** | | | | | |
| Men and women combined | 9.03 | -1.49 * | < | -0.44 | -0.38 |
| Men only | 10.01 | -1.90 * | < | -0.79 | -0.69 |
| Women only | 8.08 | -1.07 * | < | -0.01 | -0.05 |
| Difference for men minus difference for women | | -0.83 * | | -0.78 | -0.64 |
| **Difference between 1983-1989 and 1979 samples** | | | | | |
| Men and women combined | -2.88 | -0.51 * | | -0.58 | -0.43 |
| Men only | -3.37 | -0.55 * | | -0.19 | -0.20 |
| Women only | -2.20 | -0.94 * | | -1.02 * | -0.88 |
| Difference for men minus difference for women | | 0.39 | | 0.83 | 0.68 |
| **High school sophomores, 12 years later** | | | | | |
| **In 1986-1992 (from the NLSY)** | | | | | |
| Men and women combined | 9.97 | -1.65 * | < | 0.25 | -0.07 |
| Men only | 11.10 | -2.21 * | < | -0.45 | -0.61 |
| Women only | 8.78 | -1.03 * | < | 0.85 * | 0.53 |
| Difference for men minus difference for women | | -1.18 * | | -1.30 * | -1.1 |

TABLE READS: In 1979, average hourly wages were $0.99 lower for blacks than whites ($11.91), but a black-white gap was only evident for men ($1.35). For young adults with similar educational achievement, black women earned an average of $1.01 more per hour than white women, and the gap for men was not significant. For young adults with similar achievement, attainment, and work experience, black women earned an average of $0.83 more per hour than white women, and the gap for men was not significant.

* = Black-white difference is statistically significant at p <= .05; "<" and ">" indicate significant differences between adjacent differences.

+ = Multiple characteristics include educational achievement, educational attainment, and length of work experience.

NOTE: Difference between group X and group Y refers to the mean for group X minus the mean for group Y. Standard errors have been adjusted for complex survey designs. Samples restricted to employed civilians. Numbers may not sum to totals due to rounding. Multiple imputation used to account for missing data.

SOURCE: U.S. Department of Education, National Center for Education Statistics, National Longitudinal Study of the High School Class of 1972 (NLS-72); and U.S. Department of Labor, Bureau of Labor Statistics, National Longitudinal Survey of Youth (NLSY).

with Bernstein's (1995) analysis of Current Population Survey data, in which black-white gaps in hourly wages increased for both men and women between 1979 and 1989. Bernstein (1995) found that, for 25 to 34 year olds during the 1980s, the hourly wages of men decreased at a faster rate for blacks than for whites, and the hourly wages of women decreased for blacks but increased for whites.

## D. Relating Achievement to Hourly Wages

In comparisons of black men with similar levels of prior educational achievement as white men, and of black men similar to white men in terms of educational achievement, educational attainment, and work experience, black-white wage gaps were no longer

statistically significant (table 2.4). These findings suggest black men with similar background characteristics as white men earn about the same per hour as white men.[14]

In comparisons among women with similar levels of prior educational achievement, blacks earned at least as much per hour as whites (table 2.4). In the 1979 and 1986–1992 samples, black women with levels of prior educational achievement similar to those for white women earned $0.85 to $1.01 (or 10 percent) *more* per hour than white women. In the 1983–1989 sample, black and white women with similar levels of prior educational achievement had similar hourly wages. These findings provide no evidence of systematic wage discrimination against black women.

For young workers with prior educational achievement similar to that for whites, the widening of the black-white wage gap between the 1979 and 1983–1989 samples was not evident for men, although it remained evident for women.[15] Since the relative achievement levels of blacks were similar for both samples,[16] this finding may reflect a higher labor market return on educational achievement for men in the 1983–1989 sample than for men in the 1979 sample.[17] The larger premium for higher levels of educational achievement may be due to structural changes in the economy of the 1980s, which favored high-skilled workers over low-skilled workers. Because blacks tend to have lower levels of educational achievement than whites, they may have been at a greater relative disadvantage in the 1983–1989 economy than in the 1979 economy.

## IV. CONCLUSION

The preceding analyses using data from 1979 to 1992 confirm that black-white disparities in the labor market outcomes of young adults persisted from the late 1970s to the early 1990s. In general, black labor force participants were more likely to be unemployed than their white counterparts, and black workers reported lower annual and hourly earnings than white workers. Black-white gaps in annual and hourly earnings were generally larger for men than for women, and they were larger in 1983–1989 than in 1979.

Among young adults with prior educational achievement similar to that for whites, the relative position of blacks in the labor market was substantially better than among young adults as a whole. For young adults with similar achievement, black-white gaps in unemployment were at least one-half smaller than for young adults as a whole. For black men with educational achievement similar to that for white men, the black-white gap in annual earnings was two-fifths to three-fifths smaller than for men as a whole, and there were no significant black-white differences in hourly wages. Black women

[14] In comparisons of *white* men similar to *black* men in terms of educational achievement, educational attainment, and work experience, black-white wage gaps were statistically significant for the 1983-1989 and 1986-1992 samples, though about one-half smaller than black-white gaps for men as a whole. The portion of the gap not accounted for by differences in achievement, attainment, or experience could have been due to differences in unobserved skills, the regional availability of high-paying jobs, or access to job networks, or outright wage discrimination against black men.

[15] Bernstein (1995) found that the black-white gap in hourly earnings increased for both men and women, even after adjusting for educational attainment differences, but he did not have access to educational achievement data for his sample.

[16] See appendix B.

[17] There may be other reasons why the estimated return on educational achievement appears to have been higher in the 1983–1989 sample than in the 1979 sample. It is possible, for example, that the achievement tests in the 1983–1989 sample, administered as part of the Armed Services Vocational Aptitude Battery, captured labor market skills better than did the achievement tests in the 1979 sample.

with prior educational achievement similar to that for white women earned as least as much per year (and per hour) as their white counterparts.

Why is achievement such a powerful predictor of black-white differences in labor market outcomes, especially for women? One possible explanation is that higher levels of educational achievement indicate the presence of skills required for high-wage jobs in the modern economy. Another possible explanation is that young adults with higher levels of educational achievement have better access to job networks than young adults with lower levels of achievement have.

The preceding analyses do not establish the extent to which either of these explanations is true, and they do not rule out the possibility of some employment discrimination against black labor force participants, or some wage discrimination against black men. The chief usefulness of the analyses reported here is not that they explain the precise causal relationship between educational achievement, race, and labor market outcomes, but that they confirm educational achievement as a powerful predictor of black-white differences in labor market performance.

# 3. BLACK-WHITE DIFFERENCES IN EDUCATIONAL ATTAINMENT

Chapter 1 reviewed evidence that the black-white gap in high school completion narrowed substantially between 1971 and 1998, such that blacks and whites now remain in high school at similar rates, and black young adults now have nearly the same high school completion rate as white young adults. At the same time, sizable black-white disparities in college attendance and completion have persisted since the mid-1970s.

This chapter presents findings on black-white differences in educational attainment in four samples of young adults.[1] The analyses investigate the extent to which black-white differences in educational attainment are present for all young adults, for young adults with similar levels of prior educational achievement, and for young adults similar in terms of prior educational achievement, parental socioeconomic status (SES),[2] and census region.[3] The outcomes analyzed include the completion of a high school diploma or an equivalent General Educational Development (GED) certificate, college attendance, and college completion.

## I. HIGH SCHOOL/GED COMPLETION

**Main Findings: High School/GED Completion**

- Black-white gaps in high school/GED completion rates were present for young adults observed during 1983–1989, 1986–1992, and 1992. These gaps were smaller in the 1992 sample than in the 1986-1992 sample.
- Among young adults with similar levels of prior educational achievement, blacks are at least as likely as whites to complete a high school diploma or GED certificate.

[1] Appendix A discusses the data sources and treatment of missing data for these analyses; appendix B discuss comparability of data; appendix C discusses the analysis methodology; appendix D presents standard errors for the results in this chapter; and appendix E describes some additional analyses of high school completion outcomes.

[2] SES is a composite variable including father's years of schooling, mother's years of schooling, father's occupational status, mother's occupational status, and family income.

[3] These comparisons, described in appendix C, involve the estimation of analytic models to distinguish how outcomes vary by race when factors such as achievement are held constant. Our analyses compare all whites with blacks similar to whites in terms of background characteristics, rather than vice versa. In general, the pattern of results is similar when we compare all blacks with whites similar to blacks in terms of background characteristics.

This section presents analyses of black-white differences in high school and GED completion for three samples of young adults from 1983 through 1992.[4] For the purpose of these analyses, we treated high school diplomas and GED certificates as equivalent.[5]

### A. High School/GED Completion Rates

Black-white gaps in high school/GED completion were present in all three samples studied (table 3.1). This gap ranged from 2 percentage points in the 1992 sample to 9 percentage points in the 1986–1992 sample. In each of the three samples studied, black-white gaps in high school/GED completion rates were about the same for men and for women. The narrowing of the black-white gap in high school/GED completion between the 1986–1992 and 1992 samples is consistent with the historical trends discussed in chapter 1.

### B. Relating Achievement to High School/GED Completion Rates

Among young adults with similar levels of prior educational achievement, high school/GED completion rates were at least as high for blacks as for whites (table 3.1).[6] In the 1983–1989 sample, blacks and whites with similar levels of achievement had similar high school/GED completion rates. In the 1986–1992 sample, for young adults with similar levels of achievement, blacks had a 4 percentage-point higher rates of high school/GED completion than whites. In the 1992 sample, for young adults with similar levels of prior achievement, blacks had a 2 percentage-point higher rates of high school/GED completion than whites.

## II. COLLEGE ATTENDANCE AND COMPLETION

**Main Findings: College Attendance and Completion**

- Blacks are less likely to attend college than whites, and black college attendees are less likely to complete college than white college attendees.
- Among young adults with similar levels of educational achievement, college attendance rates are higher for blacks than whites, and college completion rates of black college attendees are at least as high as college completion rates of white college attendees.

[4] We analyzed the black-white gap in high school/GED completion for three samples of young adults: participants in the National Longitudinal Survey of Youth (NLSY) who were high school seniors between 1976 and 1982, observed between 1983 and 1989, 7 years after grade 12 ("the 1983–1989 sample"); participants in the NLSY who were high school sophomores between 1974 and 1980, observed between 1986 and 1992, 12 years after grade 10 ("the 1986–1992 sample"); and participants in the High School and Beyond Survey of 1980 high school sophomores, observed in 1992, 12 years after grade 10 ("the 1992 sample"). No comparable high school completion information was available in 1979 for the members of the National Longitudinal Study of the High School Class of 1972, since questions on high school completion were not included in the 1979 follow-up survey.

[5] Appendix E presents evidence on whether the black-white gap in high school completion is different from the black-white gap in high school/GED completion, and whether black-white gaps in high school/GED completion rates differ when prisoners and other institutionalized persons are included in the sample.

[6] Members of the 1983–1989 and 1986–1992 samples took achievement tests in 1980, after about two-thirds of each sample had already finished high school. The measurement of achievement after high school for a large portion of these samples implies that one should be cautious in interpreting achievement as the "cause" of high school or GED completion. In contrast, for the 1979 and 1992 samples, the achievement tests were administered in grades 12 and 10, respectively, prior to high school completion.

**Table 3.1—Black-white differences in high school/GED completion rates for young adults in 3 samples, 1983-1992**

| Description of sample of young adults, year observed, source of data, and sex of subgroup | High school/GED completion rate for whites (percentage points) | Black-white differences in high school/GED completion rates: for all persons | | for persons with educational achievement similar to whites' | for persons similar in multiple characteristics+ |
|---|---|---|---|---|---|
| **High school seniors, 7 years later** | | | | | |
| **In 1983-1989 (from the NLSY)** | | | | | |
| Men and women combined | 92.9 | -5.4 * | < | -1.1 | -1.1 |
| Men only | 91.1 | -4.8 * | < | 1.4 | 1.7 |
| Women only | 94.8 | -6.2 * | | -3.7 | -3.9 |
| Difference for men minus difference for women | | 1.4 | < | 5.1 * | 5.6 * |
| **High school sophomores, 12 years later** | | | | | |
| **In 1986-1992 (from the NLSY)** | | | | | |
| Men and women combined | 85.8 | -8.5 * | < | 3.5 * | 4.2 * |
| Men only | 83.6 | -9.7 * | < | 3.7 * | 4.3 * |
| Women only | 88.1 | -7.3 * | < | 3.4 * | 4.0 * |
| Difference for men minus difference for women | | -2.3 | < | 0.3 | 0.3 |
| **In 1992 (from HSB)** | | | | | |
| Men and women combined | 95.3 | -2.3 * | < | 1.6 * | 1.5 * |
| Men only | 94.0 | -1.9 | < | 2.1 * | 1.7 |
| Women only | 96.5 | -2.9 | < | 0.9 | 1.2 |
| Difference for men minus difference for women | | 1.0 | | 1.2 | 0.5 |
| **Difference between 1992 and 1986-1992 samples** | | | | | |
| Men and women combined | 9.5 | 6.1 * | > | -1.8 | -2.7 * |
| Men only | 10.4 | 7.8 * | > | -1.6 | -2.6 |
| Women only | 8.4 | 4.5 * | > | -2.5 | -2.7 |
| Difference for men minus difference for women | | 3.3 | | 0.9 | 0.1 |

TABLE READS: Between 1983 and 1989, high school/GED completion rates were 5.4 percentage-points lower for blacks than whites (92.9 percent), and black-white gaps were similar for men and women. For young adults with similar educational achievement, high school/GED completion rates were similar for blacks and whites.

* = Black-white difference is statistically significant at p <= .05; "<" and ">" indicate significant differences between adjacent differences.

+ = Multiple characteristics include educational achievement, parental socio-economic status, and Census region.

NOTE: Difference between group X and group Y refers to the mean for group X minus the mean for group Y. Standard errors have been adjusted for complex survey designs. Numbers may not sum to totals due to rounding. Multiple imputation used to account for missing data.

SOURCE: U.S. Department of Education, National Center for Education Statistics, High School and Beyond (HSB); and U.S. Department of Labor, Bureau of Labor Statistics, National Longitudinal Survey of Youth (NLSY).

Evidence presented in chapter 1 indicates that the black-white gap in college completion remained in the range of 13 to 17 percentage points between 1971 and 1998. In the following section of this report, the analyses of black-white differences in college attendance and completion focus on four samples of young adults observed between 1979

and 1992.[7] College attendance patterns are investigated first, followed by college completion rates conditional on college attendance.[8]

## A. College Attendance Rates

In the four samples studied, blacks were generally less likely to attend college than whites (table 3.2). The overall black-white gap in college attendance rates ranged from 4 to 10 percentage points.[9] In every sample, a black-white gap in college attendance was clearly evident for men (8 to 15 percentage points), but only in the 1992 sample for women (6 percentage points). A comparison of black-white differences in college attendance across samples indicated no substantial differences in the black-white gap between the 1979 and 1983–1989 samples, but a 7 percentage-point wider gap in the 1992 sample than in the 1986-1992 sample.

## B. Relating Achievement to College Attendance Rates

Among young adults with similar levels of prior achievement, blacks were *more* likely than whites to attend college. For similarly skilled individuals, college attendance rates for blacks exceeded college attendance rates for whites by 6 to 17 percentage points overall. For individuals similar in terms of parental SES and census region as well as educational achievement, college attendance for blacks exceeded college attendance for whites by 8 to 21 percentage points overall.

## C. College Completion Rates

In all four samples, black college attendees had lower college completion rates than white college attendees (table 3.3). The magnitude of the overall black-white gap in college completion ranged about 13 percentage points in the 1979 sample to about 19 percentage points in the other three samples. In all four samples, the black-white gap in college completion was similar for men and women. There was no significant difference in the black-white gap in college completion between the 1979 and 1983-1989 samples, or between the 1986-1992 and 1992 samples.

## D. Relating Achievement to College Completion Rates

For young adults with similar levels of prior educational achievement, black college attendees had overall college completion rates at least as high as the college completion rates for white college attendees (table 3.3). Among similarly skilled individuals in the 1979 sample, college completion for blacks was 8 percentage points higher than for whites. College completion rates for similarly skilled blacks and whites were similar

[7] We analyzed black-white gaps in college attendance and completion for four samples of young adults: participants in the National Longitudinal Study of the High School Class of 1972, observed in 1979, 7 years after grade 12 ("the 1979 sample"); participants in the NLSY who were high school seniors between 1976 and 1982, observed between 1983 and 1989, 7 years after grade 12 ("the 1983–1989 sample"); participants in the NLSY who were high school sophomores between 1974 and 1980, observed between 1986 and 1992, 12 years after grade 10 ("the 1986–1992 sample"); and participants in the High School and Beyond Survey of 1980 high school sophomores, observed in 1992, 12 years after grade 10 ("the 1992 sample").

[8] We define college completion as the completion of four years of college or an equivalent bachelor's degree.

[9] The "overall" gap refers to the black-white gap for men and women combined.

## Table 3.2—Black-white differences in college attendance rates for young adults in 4 samples, 1979-1992

| Description of sample of young adults, year observed, source of data, and sex of subgroup | College attendance rate for whites (in percentage points) | Black-white differences in college attendance rates: for all persons | for persons with educational achievement similar to whites' | for persons similar in multiple characteristics+ |
|---|---|---|---|---|
| **High school seniors, 7 years later** | | | | |
| **In 1979 (from the NLS-72)** | | | | |
| Men and women combined | 62.9 | -4.2 * | < 17.1 * | < 20.8 * |
| Men only | 65.5 | -7.7 * | < 14.5 * | < 17.9 * |
| Women only | 60.1 | -0.8 | < 18.4 * | 22.1 * |
| Difference for men minus difference for women | | -6.9 * | < -4.0 | -4.3 |
| **In 1983-1989 (from the NLSY)** | | | | |
| Men and women combined | 55.7 | -6.2 * | < 15.6 * | 14.7 * |
| Men only | 54.1 | -9.4 * | < 17.8 * | 15.7 * |
| Women only | 57.2 | -3.4 | < 14.2 * | 13.9 * |
| Difference for men minus difference for women | | -6.0 | < 3.6 | 1.7 |
| **Difference between 1983-1989 and 1979 samples** | | | | |
| Men and women combined | -7.2 | -2.0 | -1.5 > | -6.1 * |
| Men only | -11.4 | -1.7 | < 3.3 > | -2.2 |
| Women only | -2.9 | -2.6 | -4.2 | -8.2 |
| Difference for men minus difference for women | | 0.9 | < 7.5 | 6.0 |
| **High school sophomores, 12 years later** | | | | |
| **In 1986-1992 (from the NLSY)** | | | | |
| Men and women combined | 62.6 | -3.6 | < 16.9 * | 17.9 * |
| Men only | 62.2 | -7.6 * | < 15.6 * | < 16.9 * |
| Women only | 62.9 | 0.0 | < 18.8 * | < 20.1 * |
| Difference for men minus difference for women | | -7.7 * | < -3.2 | -3.2 |
| **In 1992 (from HSB)** | | | | |
| Men and women combined | 63.2 | -10.2 * | < 5.5 * | 7.6 * |
| Men only | 61.5 | -14.9 * | < 1.1 | 3.9 |
| Women only | 64.8 | -6.1 * | < 9.6 * | 11.8 * |
| Difference for men minus difference for women | | -8.8 * | -8.6 * | -7.8 |
| **Difference between 1992 and 1986-1992 samples** | | | | |
| Men and women combined | 0.6 | -6.6 * | > -11.4 * | -10.3 * |
| Men only | -0.7 | -7.3 | > -14.5 * | -13.0 * |
| Women only | 1.9 | -6.2 | -9.1 * | -8.3 * |
| Difference for men minus difference for women | | -1.1 | -5.4 | -4.6 |

TABLE READS: In 1979, college attendance rates were 4.2 percentage points-lower than for blacks than whites (62.9 percent); a black-white gap was evident for men (7.7 percent) but not for women. For young adults with similar educational achievement, attendance rates were 17.1 percentage-points higher for blacks than whites. For young adults similar in multiple ways, attendance rates were 20.8 percentage-points higher for blacks than whites.

* = Black-white difference is statistically significant at p <= .05; "<" and ">" indicate significant differences between adjacent differences.

+ = Multiple characteristics include educational achievement, parental socioeconomic status, and Census region.

NOTE: Difference between group X and group Y refers to the mean for group X minus the mean for group Y. Standard errors have been adjusted for complex survey designs. Sophomore samples restricted to high school graduates. Numbers may not sum to totals due to rounding. Multiple imputation used to account for missing data.

SOURCE: U.S. Department of Education, National Center for Education Statistics, National Longitudinal Study of the High School Class of 1972 (NLS-72), High School and Beyond (HSB); and U.S. Department of Labor, Bureau of Labor Statistics, National Longitudinal Survey of Youth (NLSY).

## Table 3.3—Black-white differences in college completion rates for young adults in 4 samples, 1979-1992

| Description of sample of young adults, year observed, source of data, and sex of subgroup | college completion rate for whites (in percentage points) | Black-white differences in college completion rates for all persons | for persons with educational achievement similar to whites' | for persons similar in multiple characteristics+ |
|---|---|---|---|---|
| **High school seniors, 7 years later** | | | | |
| **In 1979 (from the NLS-72)** | | | | |
| Men and women combined | 43.2 | -13.2 * | < 8.3 * | 9.2 * |
| Men only | 44.0 | -15.2 * | < 7.6 | 1.9 |
| Women only | 42.3 | -11.4 * | < 9.9 | 14.9 * |
| Difference for men minus difference for women | | -3.7 | -2.4 | -13.0 |
| **In 1983-1989 (from the NLSY)** | | | | |
| Men and women combined | 42.2 | -18.8 * | < 0.8 | -1.0 |
| Men only | 42.8 | -19.3 * | < 2.2 | -2.1 |
| Women only | 41.7 | -18.2 * | < 4.4 > | -2.4 |
| Difference for men minus difference for women | | -1.1 | -2.2 | 0.3 |
| **Difference between 1983-1989 and 1979 samples** | | | | |
| Men and women combined | -0.9 | -5.6 | -7.5 | -10.2 |
| Men only | -1.2 | -4.2 | -5.4 | -4.0 |
| Women only | -0.6 | -6.8 | -5.6 > | -17.3 * |
| Difference for men minus difference for women | | 2.6 | 0.2 | 13.3 |
| **High school sophomores, 12 years later** | | | | |
| **In 1986-1992 (from the NLSY)** | | | | |
| Men and women combined | 44.7 | -18.7 * | < 1.6 | -0.6 |
| Men only | 46.2 | -20.6 * | < -0.7 | -1.5 |
| Women only | 43.3 | -17.0 * | < 5.5 | 0.9 |
| Difference for men minus difference for women | | -3.6 | -6.2 | -2.4 |
| **In 1992 (from HSB)** | | | | |
| Men and women combined | 44.6 | -20.3 * | < -3.4 < | 0.4 |
| Men only | 46.0 | -18.9 * | < -5.2 | -1.5 |
| Women only | 43.4 | -20.9 * | < -1.9 < | 3.4 |
| Difference for men minus difference for women | | 2.0 | -3.3 | -4.8 |
| **Difference between 1992 and 1986-1992 samples** | | | | |
| Men and women combined | -0.1 | -1.5 | -5.1 < | 1.0 |
| Men only | -0.2 | 1.7 | -4.5 | 0.1 |
| Women only | 0.1 | -4.0 | -7.4 < | 2.5 |
| Difference for men minus difference for women | | 5.7 | 2.8 | -2.5 |

TABLE READS: In 1979, college completion rates were 13.2 percentage-points lower for blacks than whites (43.2 percent); black-white gaps were similar for men and women. For young adults with similar educational achievement, completion rates were 8.3 percentage-points higher for blacks than whites. For young adults similar in multiple ways, completion rates were 9.2 percentage-points higher for blacks than whites.

* = Black-white difference is statistically significant at p <= .05; "<" and ">" indicate significant differences between adjacent differences.

+ = Multiple characteristics include educational achievement, parental socioeconomic status, and Census region.

NOTE: Difference between group X and group Y refers to the mean for group X minus the mean for group Y. Standard errors have been adjusted for complex survey designs. College completion refers to completion of four years of college or an equivalent bachelor's degree. Samples restricted to persons who have attended some college. Numbers may not sum to totals due to rounding. Multiple imputation used to account for missing data.

SOURCE: U.S. Department of Education, National Center for Education Statistics, National Longitudinal Study of the High School Class of 1972 (NLS-72), High School and Beyond (HSB); and U.S. Department of Labor, Bureau of Labor Statistics, National Longitudinal Survey of Youth (NLSY).

within each of the three other samples. These findings run counter to the claim that "the deficit in test scores...doesn't begin to explain why black students are more likely to drop out...once they begin college" (Steele 1995).[10] For individuals similar in terms of parental SES and census region as well as educational achievement, college completion for blacks exceeded college completion for whites by 9 percentage points overall in the 1979 sample. Within the other samples, blacks and whites similar in these areas had similar college completion rates.

## III. CONCLUSION

The analyses documented in this chapter provide strong evidence that differences in educational achievement, even when measured as early as the sophomore year of high school, are a powerful predictor of black-white disparities in postsecondary educational attainment. Among young adults with similar levels of prior educational achievement, blacks have rates of high school/GED completion, college attendance, and college completion *at least as high as* the corresponding rates for whites.

One possible reason for the correlation between differences in achievement and attainment is that students' relative educational achievement through high school contributes directly to their relative postsecondary attainment. Another possible reason for this correlation is that the same (unobserved) factors that contribute to students' relative educational achievement also happen to contribute to their relative postsecondary attainment. To the extent that the first explanation is true, differences in achievement are an important *cause* of differences in attainment. To the extent that the second explanation is true, differences in achievement are an important *indicator* of differences in attainment. It is likely that achievement differences are *both* a cause and an indicator of attainment differences. The next chapter analyzes black-white differences in educational achievement for four samples of children observed at various stages between grades 1 and 12.

[10] Steele's observation could still be correct if, among young adults with similar test scores, blacks are more likely than whites to drop out of a particular college, but just as likely to complete a college degree.

# 4. BLACK-WHITE DIFFERENCES IN EDUCATIONAL ACHIEVEMENT

Findings discussed in the preceding chapters show that the labor market performance and educational attainment of blacks relative to whites were substantially greater for young adults with similar levels of prior educational achievement than for young adults as a whole. Nonetheless, black-white disparities in economic and educational outcomes have persisted in the United States, where the average educational achievement of black students has been consistently below the average educational achievement of white students. Historical data from the NAEP show this gap to have narrowed somewhat over time, but black-white differences in educational achievement remain.

Given the strong association between black-white differences in educational achievement and black-white differences in subsequent educational and economic outcomes, it is important to understand the nature of the achievement gap throughout elementary and secondary school. Much research has been done on the magnitude of this gap in cross-sectional surveys, but little is known of the extent to which the black-white achievement gap changes for the *same* group of students as they advance through elementary or secondary school. Evidence of a changing black-white achievement gap for the same group of students would suggest that changes in students' environments—including their homes, neighborhoods, and schools—may influence the magnitude of the achievement gap, as well as the disparities in subsequent outcomes.

This chapter describes findings on the black-white achievement gap in mathematics and in reading, beginning with samples of children from elementary school and concluding with samples from secondary school.[1] The description of the analyses of outcomes within each sample is followed by a description of analyses of black-white differences in achievement across samples from elementary and secondary school. General findings are discussed in a concluding section at the end of the chapter.

Achievement test scores are expressed in eighth grade standard deviation units (SDUs). This metric enables test scores to be compared across samples and across a wide range of grades. An average mathematics or reading score for eighth graders was subtracted from each student's score, and the resulting difference was divided by the standard deviation

[1] Appendix A discusses the data sources and treatment of missing data for these analyses; appendix B discuss comparability of data; appendix C discusses the analysis methodology; and appendix D presents standard errors for the results in this chapter.

of the eighth grade score.[2] With this metric, average test scores are well below zero (the eighth grade mean) in the early grades and are generally positive during high school.

## I. MATHEMATICS ACHIEVEMENT

**Main Findings: Mathematics Achievement**

- At every grade level studied, black children scored lower on mathematics tests than white children.
- For children with similar levels of mathematics achievement one or two grades earlier, the black-white gap in mathematics achievement was at least three-fifths smaller than for children as a whole.
- The black-white gap in mathematics achievement differed in size across grades, in a manner consistent with a narrowing of the black-white achievement gap during elementary school, followed by a widening of the gap during junior high school and little change during senior high school.

### A. Mathematics Achievement in Grades 1 to 5

During elementary school, blacks consistently scored lower on mathematics tests than whites (table 4.1).[3] The black-white math gap during these years was similar in size for boys and for girls.[4] The black-white math gap was 28 percent smaller for boys in grade 2 than for boys in grade 1.

Black-white gaps in mathematics achievement were apparent, even for elementary school children with similar math scores one or two grades earlier. Among children with the same grade 1 math scores, the black-white math gap in grade 2 was 70 percent smaller than the corresponding gap for second graders as a whole.[5] Among children with the

[2] Grade 8 scores were selected to normalize other scores since this grade was the only one represented in both the Chapter 1 Prospects Study and the National Educational Longitudinal Study of 1988 (NELS:88). Average eighth grade scores, and standard deviations of grade scores, were calculated for both the Prospects and NELS:88 samples. Assuming the grade 8 tests for the two studies are comparable, the use of grade 8 SDUs permits achievement gaps to be compared across the Prospects and NELS:88 samples. For two of the samples studied from the Prospects Study, no eighth grade score was available, since the children in the sample were only observed in earlier grades. However, eighth grade scores were available for another Prospects sample; the tests administered to eighth graders in this sample were "vertically equated" with the tests administered to younger children. The mean and standard deviation of the eighth grade score for the third Prospects sample were used to standardize the scores for the other two samples, under the assumption that the eventual distribution of eighth grade scores will be similar across all three Prospects samples. This assumption, while critical for the analysis of differences in black-white gaps across samples, does not affect the comparison of black-white gaps across grades within samples, since the use of the eighth grade metric does not change the relative size of each score within a sample. Refer to appendix A and B for details.

[3] Findings presented for elementary school students are based on analyses of the following two samples: participants in Cohort 1 of the Chapter 1 Prospects Study, observed in 1992 and 1993, in grades 1 and 2; and participants in Cohort 3 of the Chapter 1 Prospects Study, observed in 1991 and 1993 in grades 3 and 5. The achievement tests used in these analyses were the tests administered during the spring of each grade.

[4] The black-white math gap in grades 1, 2, 3, and 5 equaled 1.09 SDU, 0.88 SDU, 0.56 SDU, and 0.50 SDU.

[5] The black-white math gap for second graders with similar grade 1 scores was 0.26 SDU, versus 0.88 SDU for second graders overall.

## Table 4.1—Black-white differences in average mathematics achievement in grades 1 to 2 and 3 to 5 for 2 samples of children, 1991-1993

| Description of source of data, year observed, grade of test, and sex of subgroup of children | Average mathematics achievement score for whites (in 8th grade SDUs) | Black-white differences in average mathematics achievement for all persons | | for persons with educational achievement similar to whites' | | for persons similar in multiple characteristics+ |
|---|---|---|---|---|---|---|
| **Prospects Cohort 1 (1992-1993)** | | | | | | |
| **Grade 1 mathematics achievement** | | | | | | |
| Boys and girls combined | -4.16 | -1.09 * | | —— | | —— |
| Boys only | -4.12 | -1.28 * | | —— | | —— |
| Girls only | -4.20 | -0.89 * | | —— | | —— |
| Difference between boys and girls | | -0.39 | | —— | | —— |
| **Grade 2 mathematics achievement** | | | | | | |
| Boys and girls combined | -2.65 | -0.88 * | < | -0.26 * | | -0.30 * |
| Boys only | -2.66 | -0.92 * | < | -0.26 * | | -0.25 |
| Girls only | -2.63 | -0.83 * | < | -0.30 * | | -0.39 * |
| Difference between boys and girls | | -0.09 | | 0.04 | | 0.14 |
| **Growth between grades 1 and 2** | | | | | | |
| Boys and girls combined | 1.51 | 0.21 | > | -0.13 | | -0.11 |
| Boys only | 1.45 | 0.36 * | > | -0.07 | | -0.05 |
| Girls only | 1.57 | 0.06 | > | -0.16 | | -0.23 |
| Difference between boys and girls | | 0.29 | | 0.08 | > | 0.19 |
| **Prospects Cohort 3 (1991-1993)** | | | | | | |
| **Grade 3 mathematics achievement** | | | | | | |
| Boys and girls combined | -1.35 | -0.56 * | | —— | | —— |
| Boys only | -1.36 | -0.61 * | | —— | | —— |
| Girls only | -1.35 | -0.51 * | | —— | | —— |
| Difference between boys and girls | | -0.10 | | —— | | —— |
| **Grade 5 mathematics achievement** | | | | | | |
| Boys and girls combined | -0.61 | -0.50 * | < | -0.15 * | | -0.06 |
| Boys only | -0.69 | -0.57 * | < | -0.15 * | | -0.16 |
| Girls only | -0.53 | -0.44 * | < | -0.11 * | < | 0.03 |
| Difference between boys and girls | | -0.13 | | -0.04 | | -0.20 |
| **Growth between grades 3 and 5** | | | | | | |
| Boys and girls combined | 0.74 | 0.05 | > | -0.12 * | | -0.04 |
| Boys only | 0.67 | 0.04 | > | -0.14 * | | -0.08 |
| Girls only | 0.82 | 0.07 | > | -0.09 * | | -0.01 |
| Difference between boys and girls | | -0.03 | | -0.04 | | -0.07 |

TABLE READS: In 1992, Grade 1 mathematics scores averaged 1.09 SDUs less for blacks than whites (-4.16); the black-white gap did not differ significantly by sex. In 1993, Grade 2 mathematics scores averaged 0.88 SDU less for blacks than whites (-2.65); the black-white gap was similar for boys and girls. For children with similar Grade 1 scores, Grade 2 scores averaged 0.26 SDU less for blacks than whites, a 70 percent smaller gap than for children as a whole.

* = Difference is statistically significant at p <= .05.

+ = Multiple factors include mathematics achievement one or two grades earlier, parental socioeconomic status, and Census region.

—- = Not applicable because of absence of information on mathematics or reading achievement prior to the initial grade for each sample.

NOTE: Difference between group X and group Y refers to the mean for group X minus the mean for group Y. Standard errors have been adjusted for complex survey designs. "8th Grade SDUs" = eighth-grade standard deviation units; 8th grade score is normalized to have mean of zero and standard deviation of 1.00. Numbers may not sum to totals due to rounding. Multiple imputation used to account for missing data.

SOURCE: U.S. Department of Education, Chapter 1 Prospects Study.

same grade 3 math scores, the black-white math gap in grade 5 was 70 percent smaller than the corresponding gap for fifth graders as a whole.[6]

Within each of the two elementary school samples, the black-white gap in mathematics achievement growth was larger for students with similar prior math scores than for students as a whole. This finding indicates that rates of mathematics achievement growth were somewhat higher for blacks as a whole than for black similar to whites in terms of their prior math achievement.[7]

## B. Mathematics Achievement in Grades 7 to 12

During junior and senior high school, the average mathematics scores of black students lagged behind the average mathematics scores of white students (table 4.2).[8] In grade 12, the black-white math gap was larger for boys than for girls, but otherwise it differed little by sex.[9] While the overall black-white math gap was about two-fifths wider in grade 9 than in grade 7, it was the same size in grade 12 as in grade 10.

During junior high school, black-white gaps in mathematics achievement were apparent, even for students who had similar math scores two grades earlier. Among students with the same grade 7 math scores, the black-white math gap in grade 9 was three-fifths smaller than the corresponding gap for ninth graders as a whole.[10] In contrast, among students with the same grade 10 math scores, blacks and whites had similar grade 12 math scores.[11]

During junior high school, blacks acquired math skills at a slower rate than whites. Between grades 7 and 9, blacks acquired math skills at a 72 percent slower than the rate for whites.[12] In contrast, between grades 10 and 12, blacks and whites acquired math skills at about the same rate. For these two cohorts, black-white differences in mathematics achievement growth were not significantly different for blacks as a whole, and for blacks similar to whites in terms of prior math achievement.

## C. Mathematics Achievement in Grades 2 to 12

Pooling data from multiple cohorts makes it possible to assess differences in the black-white gap in mathematics achievement in samples of students from grades 2, 5, 9,

[6] The black-white math gap for fifth graders with similar grade 3 scores was 0.15 SDU, versus 0.50 SDU for fifth graders overall.

[7] This finding is consistent with the phenomenon of "regression to the mean" in the case of the math scores of black elementary school students.

[8] These comparisons are based on analyses of participants in Cohort 7 of the Chapter 1 Prospects Study, observed in 1991 and 1993, in grades 7 and 9, and of participants in the NELS:88, observed in 1990 and 1992, in grades 10 and 12. The achievement tests used in these analyses were the tests administered during the spring of each grade.

[9] The black-white math gaps in grade 7, 9, 10, and 12 equaled 0.55 SDU, 0.76 SDU, 0.90 SDU, and 0.88 SDU. In the 12th grade, the black-white math gap was 1.00 SDU for boys and 0.76 SDU for girls.

[10] The black-white mathematics gap for 9th graders with similar grade 7 scores was 0.31 SDU, versus 0.76 SDU for 9th graders overall.

[11] Among boys with similar grade 10 math scores, however, there was a black-white math gap in grade 12 equal to 19 percent of the gap for twelfth-grade boys as a whole (0.19 SDU versus 1.00 SDU).

[12] White children's math scores rose by 0.29 SDU between grades 7 and 9; black children had 0.21 SDU slower growth in math achievement over this period. Black children with the same grade 7 scores as whites had 0.27 SDU slower growth in math achievement over this period; and black children with the same grade 7 scores, parental SES, and census region as whites had 0.25 SDU slower growth in math achievement over this period.

## Table 4.2—Black-white differences in average mathematics achievement in grades 7 to 9 and 10 to 12 for 2 samples of children, 1990-1993

| Description of source of data, year observed, grade of test, and sex of subgroup of children | Average mathematics achievement score for whites (in 8th grade SDUs) | Black-white differences in average mathematics achievement: for all persons | for persons with educational achievement similar to whites' | for persons similar in multiple characteristics+ |
|---|---|---|---|---|
| **Prospects Cohort 7 (1991-1993)** | | | | |
| **Grade 7 mathematics achievement** | | | | |
| Boys and girls combined | -0.01 | -0.55 * | —— | —— |
| Boys only | -0.11 | -0.50 * | —— | —— |
| Girls only | 0.10 | -0.61 * | —— | —— |
| Difference between boys and girls | | 0.11 | —— | —— |
| **Grade 9 mathematics achievement** | | | | |
| Boys and girls combined | 0.28 | -0.76 * | < -0.31 * | -0.30 * |
| Boys only | 0.16 | -0.68 * | < -0.26 * | -0.29 * |
| Girls only | 0.41 | -0.85 * | < -0.38 * | -0.30 * |
| Difference between boys and girls | | 0.17 | 0.11 | 0.00 |
| **Growth between grades 7 and 9** | | | | |
| Boys and girls combined | 0.29 | -0.21 * | -0.27 * | -0.25 * |
| Boys only | 0.28 | -0.18 * | -0.22 * | -0.27 * |
| Girls only | 0.31 | -0.24 * | -0.31 * | -0.23 |
| Difference between boys and girls | | 0.06 | 0.09 | -0.04 |
| **NELS:88 (1990-1992)** | | | | |
| **Grade 10 mathematics achievement** | | | | |
| Boys and girls combined | 0.85 | -0.90 * | —— | —— |
| Boys only | 0.86 | -0.95 * | —— | —— |
| Girls only | 0.84 | -0.86 * | —— | —— |
| Difference between boys and girls | | -0.08 | —— | —— |
| **Grade 12 mathematics achievement** | | | | |
| Boys and girls combined | 1.20 | -0.88 * | < -0.07 | -0.14 * |
| Boys only | 1.26 | -1.00 * | < -0.19 * | -0.21 * |
| Girls only | 1.14 | -0.76 * | < 0.05 | -0.05 |
| Difference between boys and girls | | -0.23 * | 0.24 * | 0.16 |
| **Growth between grades 10 and 12** | | | | |
| Boys and girls combined | 0.35 | 0.03 | -0.02 | -0.03 |
| Boys only | 0.40 | -0.05 | > -0.13 * | -0.09 |
| Girls only | 0.31 | 0.10 | 0.09 | 0.02 |
| Difference between boys and girls | | -0.15 * | < 0.22 * > | 0.11 |

TABLE READS: In 1991, Grade 7 mathematics scores averaged 0.55 SDU less for blacks than whites (-0.01); the black-white gap was similar for boys and girls. In 1993, Grade 9 mathematics scores averaged 0.76 SDU less for blacks than whites (0.28); the black-white gap was similar for boys and girls. For children with similar Grade 7 scores, Grade 9 scores averaged 0.31 SDU less for blacks than whites, a 59 percent smaller gap than for children as a whole.

* = Difference is statistically significant at p <= .05.

+ = Multiple factors include mathematics achievement two grades earlier, parental socioeconomic status, and Census region.

—- = Not applicable because of absence of information on mathematics or reading achievement prior to the initial grade for each sample.

NOTE: Difference between group X and group Y refers to the mean for group X minus the mean for group Y. Standard errors have been adjusted for complex survey designs. "8th Grade SDUs" = eighth-grade standard deviation units; 8th grade score is normalized to have mean of zero and standard deviation of 1.00. Numbers may not sum to totals due to rounding. Multiple imputation used to account for missing data.

SOURCE: U.S. Department of Education, Chapter 1 Prospects Study, and National Educational Longitudinal Study of 1988 (NELS:88).

**Table 4.3—Black-white differences in average mathematics achievement in grades 2, 5, 9, and 12 for 4 samples of children, 1992-1993**

| Description of sample(s), year(s) of data, and grades for which differences are calculated | Difference of black-white gaps between samples (in 8th grade SDUs) for boys and girls combined | boys only | girls only | difference of boys and girls |
|---|---|---|---|---|
| Grade 2—Prospects Cohort 1 data (observed 1993) | -0.88 * | -0.92 * | -0.83 * | -0.09 |
| Grade 5—Prospects Cohort 3 data (observed 1993) | -0.50 * | -0.57 * | -0.44 * | -0.13 |
| Grade 5 math gap minus Grade 2 math gap | 0.37 * | 0.35 * | 0.39 * | -0.04 |
| Grade 5—Prospects Cohort 3 data (observed 1993) | -0.50 * | -0.57 * | -0.44 * | -0.13 |
| Grade 9—Prospects Cohort 7 data (observed 1993) | -0.76 * | -0.68 * | -0.85 * | 0.17 |
| Grade 9 math gap minus Grade 5 math gap | -0.25 * | -0.10 | -0.41 * | 0.30 |
| Grade 9—Prospects Cohort 7 data (observed 1993) | -0.76 * | -0.68 * | -0.85 * | 0.17 |
| Grade 12—NELS:88 data (observed 1992) | -0.88 * | -1.00 * | -0.76 * | -0.23 * |
| Grade 12 math gap minus Grade 9 math gap | -0.12 | -0.32 * | 0.08 | -0.41 * |
| Grade 2—Prospects Cohort 1 data (observed 1993) | -0.88 * | -0.92 * | -0.83 * | -0.09 |
| Grade 9—Prospects Cohort 7 data (observed 1993) | -0.76 * | -0.68 * | -0.85 * | 0.17 |
| Grade 9 math gap minus Grade 2 math gap | 0.12 | 0.25 | -0.02 | 0.26 |
| Grade 2—Prospects Cohort 1 data (observed 1993) | -0.88 * | -0.92 * | -0.83 * | -0.09 |
| Grade 12—NELS:88 data (observed 1992) | -0.88 * | -1.00 * | -0.76 * | -0.23 * |
| Grade 12 math gap minus Grade 2 math gap | 0.00 | -0.08 | 0.06 | -0.14 |

* = Difference is statistically significant at p <= .05.

TABLE READS: In 1993, Grade 2 mathematics scores averaged 0.88 SDU less for blacks than whites; the black-white gap was similar for boys and girls. In 1993, Grade 5 mathematics scores averaged 0.50 SDU less for blacks than whites; the black-white gap was similar for boys and girls. The black-white mathematics gap was 0.37 SDU smaller in the Grade 5 sample than in the Grade 2 sample, and a narrower Grade 5 gap was evident for both boys and girls.

NOTE: Difference between group X and group Y refers to the mean for group X minus the mean for group Y. Standard errors have been adjusted for complex survey designs. "8th Grade SDUs" = eighth-grade standard deviation units; 8th grade score is normalized to have mean of zero and standard deviation of 1.00. Numbers may not sum to totals due to rounding. Multiple imputation used to account for missing data.

SOURCE: U.S. Department of Education, Chapter 1 Prospects Study, and National Educational Longitudinal Study of 1988 (NELS:88).

and 12.[13] To interpret these differences as changes in the black-white gap across these grades means assuming that the composition of the relevant cohorts is similar except for the student age and that the measures of educational achievement are comparable across cohorts.[14]

The black-white math gap differed in size across grades, in a manner consistent with a narrowing of the black-white gap during elementary school, followed by a widening of the gap during junior high school and little change during senior high school (table 4.3). The math gap was about two-fifths smaller in the grade 5 sample than in the grade 2 sample, and one-half larger in the grade 9 sample than in the grade 5 sample. The math gap was about the same size in the grade 12 sample as in the grade 9 sample. Between the grade 2 and grade 12 samples, there was no difference in the black-white math gap, suggesting that any narrowing of the gap between grades 2 and 5 was largely negated by the widening of the gap between grades 5 and 9.

[13] These analyses pool data from Cohort 1, Cohort 3, and Cohort 7 of the Prospects Study to represent grades 2, 5, and 9 and from the NELS:88 survey to represent grade 12. All of the samples were observed in 1993, except for the grade 12 sample, which was observed in 1992.

[14] Appendix B describes the comparability of the achievement datasets in terms of a variety of student characteristics.

## II. READING ACHIEVEMENT

**Main Findings: Reading Achievement**

- At every grade level studied, black children scored lower on reading tests than white children.
- For children with similar levels of reading achievement one or two grades earlier, the black-white gap in reading achievement was at least three-fifths smaller than for children as a whole.
- The black-white reading gap differed across grades, but not in an entirely consistent manner. Comparisons within the same sample of children indicated that the reading gap grew wider between certain grades, but comparisons across different samples of children indicated that the reading gap was two-fifths narrower in grade 12 than grade 2.

### A. Reading Achievement in Grades 1 to 5

During elementary school, black children's scores on reading tests were consistently lower than the corresponding scores for white children (table 4.4).[15] Black-white reading gaps were of similar magnitude for boys and for girls.[16] The black-white reading gap widened by one-third between grades 1 and 2, and by one-sixth between grades 3 and 5.

Even for elementary school children with similar reading scores one or two grades earlier, black-white gaps in reading achievement were generally apparent. Among children who had the same grade 1 reading scores, the black-white reading gap in grade 2 was three-fifths smaller than the corresponding gap for second graders as a whole.[17] Among children who had the same grade 3 reading scores, the black-white reading gap in grade 5 was three-fifths smaller than the corresponding gap for fifth graders as a whole.[18]

Within each of the elementary school samples, black children acquired reading skills at slower rates than white children. Between grades 1 and 2, and between grades 3 and 5, blacks acquired reading skills at a rate one-fifth slower than the rate for whites.[19] The

[15] These comparisons are based on analyses of participants in Cohort 1 of the Chapter 1 Prospects Study, observed in 1992 and 1993, in grades 1 and 2, and of participants in Cohort 3 of the Chapter 1 Prospects Study, observed in 1991 and 1993, in grade 3 and 5. The achievement tests used in these analyses were the tests administered during the spring of each grade.

[16] The black-white math gaps in grades 1, 2, 3, and 5 equaled 0.94 SDU, 1.24 SDU, 0.76 SDU, and 0.89 SDU, respectively.

[17] The black-white reading gap for second graders with similar grade 1 scores was 0.51 SDU, versus 1.24 SDU for second graders overall.

[18] The black-white reading gap for fifth graders with similar grade 3 scores was 0.37 SDU, versus 0.89 SDU for fifth graders overall.

[19] White children's reading scores rose by 1.42 SDU between grades 1 and 2; black children had 0.30 SDU slower growth in reading achievement over this period. Black children with the same grade 1 scores as whites had 0.40 SDU slower growth in reading achievement over this period; and black children with the same grade 1 scores, parental SES, and census region as whites had 0.36 SDU slower growth in reading achievement over this period. White children's reading scores rose by 0.61 SDU between grades 3 and 5; black children had 0.13 SDU slower growth in reading achievement over this period. Black children with the same grade 3 scores as whites had 0.34 SDU slower growth in reading achievement over this period; and black children with the same grade 3 scores, parental SES, and census region as whites had 0.29 SDU slower growth in reading achievement over this period.

## Table 4.4—Black-white differences in average reading achievement in grades 1 to 2 and 3 to 5 for 2 samples of children, 1991-1993

| Description of source of data, year observed, grade of test, and sex of subgroup of children | Average reading achievement score for whites (in 8th grade SDUs) | Black-white differences in average mathematics achievement for all persons | for persons with educational achievement similar to whites' | for persons similar in multiple characteristics+ |
|---|---|---|---|---|
| **Prospects Cohort 1 (1992-1993)** | | | | |
| **Grade 1 reading achievement** | | | | |
| Boys and girls combined | -3.52 | -0.94 * | —— | —— |
| Boys only | -3.67 | -1.04 * | —— | —— |
| Girls only | -3.37 | -0.84 * | —— | —— |
| Difference between boys and girls | | -0.19 | —— | —— |
| **Grade 2 reading achievement** | | | | |
| Boys and girls combined | -2.10 | -1.24 * | < -0.51 * | -0.55 * |
| Boys only | -2.26 | -1.44 * | < -0.57 * | -0.62 * |
| Girls only | -1.93 | -1.04 * | < -0.42 * | -0.43 * |
| Difference between boys and girls | | -0.41 | < -0.15 | -0.19 |
| **Growth between grades 1 and 2** | | | | |
| Boys and girls combined | 1.42 | -0.30 * | > -0.40 * | -0.36 * |
| Boys only | 1.41 | -0.40 * | -0.45 * | -0.41 * |
| Girls only | 1.43 | -0.19 * | > -0.31 * | -0.32 * |
| Difference between boys and girls | | -0.21 | -0.14 | -0.09 |
| **Prospects Cohort 3 (1991-1993)** | | | | |
| **Grade 3 reading achievement** | | | | |
| Boys and girls combined | -1.12 | -0.76 * | —— | —— |
| Boys only | -1.19 | -0.83 * | —— | —— |
| Girls only | -1.04 | -0.68 * | —— | —— |
| Difference between boys and girls | | -0.14 | —— | —— |
| **Grade 5 reading achievement** | | | | |
| Boys and girls combined | -0.51 | -0.89 * | < -0.37 * | -0.31 * |
| Boys only | -0.61 | -0.98 * | < -0.44 * | -0.41 * |
| Girls only | -0.40 | -0.80 * | < -0.30 * < | -0.21 * |
| Difference between boys and girls | | -0.18 | -0.14 | -0.20 |
| **Growth between grades 3 and 5** | | | | |
| Boys and girls combined | 0.61 | -0.13 * | > -0.34 * | -0.29 * |
| Boys only | 0.58 | -0.15 | > -0.42 * | -0.37 |
| Girls only | 0.64 | -0.12 | > -0.26 * | -0.20 * |
| Difference between boys and girls | | -0.03 | -0.16 | -0.17 |

TABLE READS: In 1992, Grade 1 reading achievement averaged 0.94 SDU less for blacks than whites (-3.52); the black-white gap was similar for boys and girls. In 1993, Grade 2 reading achievement averaged 1.24 SDUs less for blacks than whites (-2.10); the black-white gap did not differ significantly by sex For children with similar Grade 1 scores, Grade 2 scores averaged 0.51 SDU less for blacks than whites, a 59 percent smaller gap than for children as a whole.

* = Difference is statistically significant at p <= .05.

+ = Multiple factors include reading achievement one or two grades earlier, parental socioeconomic status, and Census region.

—— = Not applicable because of absence of information on mathematics or reading achievement prior to the initial grade for each sample.

NOTE: Difference between group X and group Y refers to the mean for group X minus the mean for group Y. Standard errors have been adjusted for complex survey designs. "8th Grade SDUs" = eighth-grade standard deviation units; 8th grade score is normalized to have mean of zero and standard deviation of 1.00. Numbers may not sum to totals due to rounding. Multiple imputation used to account for missing data.

SOURCE: U.S. Department of Education, Chapter 1 Prospects Study.

black-white gap in reading achievement growth was larger for students with similar prior reading scores than for students as a whole. This finding indicates that rates of reading achievement growth were somewhat higher for blacks as a whole than for black similar to whites in terms of their prior reading achievement.[20]

## B. Reading Achievement in Grades 7 to 12

In junior and senior high school, as in elementary school, the average reading scores of black students lagged behind the average reading scores of white students overall (table 4.5).[21] During high school, black-white reading gaps were of similar size for both boys and girls.[22] The black-white reading gap remained about the same size between grades 7 and 9, and grades 10 and 12.

Even for high school students who had similar reading scores two grades earlier, black-white gaps in reading achievement were generally apparent. Among children with the same reading scores in grade 7, the black-white reading gap in grade 9 was three-fifths smaller than the corresponding gap for ninth graders as a whole.[23] Among students who had the same reading scores in grade 10, the black-white reading gap in grade 12 reading scores was three-quarters smaller than the corresponding gap for twelfth graders as a whole.[24]

During junior and senior high school, the black-white gap in reading achievement growth was larger for students with similar prior reading scores than for students as a whole. This finding indicates that rates of reading achievement growth were somewhat higher for blacks as a whole than for black similar to whites in terms of their prior reading achievement.[25]

## C. Reading Achievement in Grades 2 to 12

Pooling data from multiple samples of students makes it possible to assess differences in the black-white gap in reading achievement in samples of students from grades 2, 5, 9, and 12.[26] These analyses found some evidence that the black-white reading gap was narrower in the junior and senior high school samples than in the early elementary school sample (table 4.6). Overall, the black-white reading gap was one-third smaller in the grade 9 sample than in the grade 2 sample, and two-fifths smaller in the grade 12

[20] This finding is consistent with the phenomenon of "regression to the mean" in the case of the reading scores of black elementary school students.

[21] These comparisons are based on analyses of participants in Cohort 7 of the Chapter 1 Prospects Study, observed in 1991 and 1993, in grades 7 and 9, and of participants in the NELS:88, observed in 1990 and 1992, in grade 10 and 12. The achievement tests used in these analyses were the tests administered during the spring of each grade.

[22] The black-white reading gaps in grades 7, 9, 10, and 12 equaled 0.70 SDU, 0.81 SDU, 0.77 SDU, and 0.78 SDU, respectively.

[23] The black-white reading gap for ninth graders with similar grade 7 scores was 0.34 SDU, versus 0.81 SDU for ninth graders overall.

[24] The black-white reading gap for twelfth graders with similar grade 10 scores was 0.18 SDU, versus 0.78 SDU for twelfth graders overall.

[25] This finding is consistent with the phenomenon of "regression to the mean" in the case of the reading scores of black junior and senior high school students.

[26] In the analyses that follow, data were pooled from Cohort 1, Cohort 3, and Cohort 7 of the Prospects Study to represent grades 2, 5, and 9 and from the NELS:88 survey to represent grade 12. All of the samples were observed in 1993, except for the grade 12 sample, which was observed in 1992. The same qualifications apply for these analyses as for the analyses of mathematics achievement in grades 2 , 5, 9, and 12. See appendix B for a discussion of the comparability of the different achievement datasets.

## Table 4.5—Black-white differences in average reading achievement in grades 7 to 9 and 10 to 12 for 2 samples of children, 1990-1993

| Description of source of data, year observed, grade of test, and sex of subgroup of children | Average reading achievement score for whites (in 8th grade SDUs) | Black-white differences in average mathematics achievement for all persons | | for persons with educational achievement similar to whites' | for persons similar in multiple characteristics+ |
|---|---|---|---|---|---|
| **Prospects Cohort 7 (1992-1993)** | | | | | |
| **Grade 7 reading achievement** | | | | | |
| Boys and girls combined | 0.08 | -0.70 * | | —— | —— |
| Boys only | -0.01 | -0.66 * | | —— | —— |
| Girls only | 0.18 | -0.74 * | | —— | —— |
| Difference between boys and girls | | 0.09 | | —— | —— |
| **Grade 9 reading achievement** | | | | | |
| Boys and girls combined | 0.27 | -0.81 * | < | -0.34 * | -0.32 * |
| Boys only | 0.13 | -0.76 * | < | -0.34 * | -0.32 |
| Girls only | 0.41 | -0.89 * | < | -0.36 * | -0.34 * |
| Difference between boys and girls | | 0.13 | | 0.03 | 0.02 |
| **Growth between grades 7 and 9** | | | | | |
| Boys and girls combined | 0.19 | -0.12 | > | -0.28 * | -0.27 * |
| Boys only | 0.15 | -0.10 | > | -0.28 * | -0.28 |
| Girls only | 0.23 | -0.14 | > | -0.29 * | -0.26 * |
| Difference between boys and girls | | 0.04 | | 0.01 | -0.02 |
| **NELS:88 (1988-1992)** | | | | | |
| **Grade 10 reading' achievement** | | | | | |
| Boys and girls combined | 0.61 | -0.77 * | | —— | —— |
| Boys only | 0.48 | -0.74 * | | —— | —— |
| Girls only | 0.74 | -0.81 * | | —— | —— |
| Difference between boys and girls | | 0.07 | | —— | —— |
| **Grade 12 reading achievement** | | | | | |
| Boys and girls combined | 0.86 | -0.78 * | < | -0.18 * | -0.18 * |
| Boys only | 0.72 | -0.74 * | < | -0.20 * | -0.25 * |
| Girls only | 0.99 | -0.82 * | < | -0.17 * | -0.12 |
| Difference between boys and girls | | 0.08 | | -0.03 | -0.13 |
| **Growth between grades 10 and 12** | | | | | |
| Boys and girls combined | 0.25 | -0.01 | > | -0.13 | -0.07 |
| Boys only | 0.24 | -0.01 | > | -0.16 * | -0.08 |
| Girls only | 0.26 | -0.01 | > | -0.12 | -0.06 |
| Difference between boys and girls | | 0.00 | | -0.03 | -0.02 |

TABLE READS: In 1991, Grade 7 reading scores averaged 0.70 SDU less for blacks than whites (0.08); black-white gaps were similar for boys and girls. In 1993, Grade 9 reading scores averaged 0.81 SDU less for blacks than whites (0.27); black-white gaps were similar for boys and girls. For children with similar Grade 7 scores, Grade 9 scores averaged 0.34 less for blacks than whites, a 58 percent smaller gap than for children as a whole.

* = Difference is statistically significant at p <= .05.

+ = Multiple factors include reading achievement two grades earlier, parental socioeconomic status, and Census region.

—— = Not applicable because of absence of information on math or reading achievement prior to the initial grade for each sample.

NOTE: Difference between group X and group Y refers to the mean for group X minus the mean for group Y. Standard errors have been adjusted for complex survey designs. "8th Grade SDUs" = eighth-grade standard deviation units; 8th grade score is normalized to have mean of zero and standard deviation of 1.00. Numbers may not sum to totals due to rounding. Multiple imputation used to account for missing data.

SOURCE: U.S. Department of Education, Chapter 1 Prospects Study, and National Educational Longitudinal Study of 1988 (NELS:88).

**Table 4.6—Black-white differences in average reading achievement in grades 2, 5, 9, and 12 for 4 samples of children, 1992-1993**

| Description of grades for which differences are calculated, samples, and years observed | Difference of black-white gaps between samples (in 8th grade SDUs) for boys and girls combined | boys only | girls only | difference of boys and girls |
|---|---|---|---|---|
| Grade 2—Prospects Cohort 1 data (observed 1993) | -1.24 * | -1.44 * | -1.04 * | -0.41 |
| Grade 5—Prospects Cohort 3 data (observed 1993) | -0.89 * | -0.98 * | -0.80 * | -0.18 |
| Grade 5 reading gap minus Grade 2 reading gap | 0.35 | 0.46 * | 0.23 | 0.23 |
| Grade 5—Prospects Cohort 3 data (observed 1993) | -0.89 * | -0.98 * | -0.80 * | -0.18 |
| Grade 9—Prospects Cohort 7 data (observed 1993) | -0.81 * | -0.76 * | -0.89 * | 0.13 |
| Grade 9 reading gap minus Grade 5 reading gap | 0.07 | 0.22 | -0.08 | 0.30 |
| Grade 9—Prospects Cohort 7 data (observed 1993) | -0.81 * | -0.76 * | -0.89 * | 0.13 |
| Grade12—NELS:88 data (observed 1992) | -0.78 * | -0.74 * | -0.82 * | 0.08 |
| Grade 12 reading gap minus Grade 9 reading gap | 0.04 | 0.02 | 0.07 | -0.05 |
| Grade 2—Prospects Cohort 1 data (observed 1993) | -1.24 * | -1.44 * | -1.04 * | -0.41 |
| Grade 9—Prospects Cohort 7 data (observed 1993) | -0.81 * | -0.76 * | -0.89 * | 0.13 |
| Grade 9 reading gap minus Grade 2 reading gap | 0.43 * | 0.68 * | 0.15 | 0.54 |
| Grade 2—Prospects Cohort 1 data (observed 1993) | -1.24 * | -1.44 * | -1.04 * | -0.41 |
| Grade12—NELS:88 data (observed 1992) | -0.78 * | -0.74 * | -0.82 * | 0.08 |
| Grade 12 reading gap minus Grade 2 reading gap | 0.46 * | 0.70 * | 0.22 | 0.48 |

* = Difference is statistically significant at p <= .05.

TABLE READS: In 1993, Grade 2 reading scores averaged 1.24 SDU less for blacks than whites; the black-white gap did not differ significantly by sex. In 1993, Grade 5 reading scores averaged 0.89 SDU less for blacks than whites; the black-white gap was similar for boys and girls. The overall black-white reading gap was of similar size in the Grade 5 sample as in the Grade 2 sample, but the reading gap for boys was 0.46 SDU narrower in the Grade 5 sample than in the Grade 2 sample.

NOTE: Difference between group X and group Y refers to the mean for group X minus the mean for group Y. Standard errors have been adjusted for complex survey designs. "8th Grade SDUs" = eighth-grade standard deviation units; 8th grade score is normalized to have mean of zero and standard deviation of 1.00. Numbers may not sum to totals due to rounding. Multiple imputation used to account for missing data.

SOURCE: U.S. Department of Education, Chapter 1 Prospects Study, and National Educational Longitudinal Study of 1988 (NELS:88).

sample than in the grade 2 sample. For boys, the black-white reading gap was one-half smaller in the grade 9 sample than in the grade 2 sample, and one-half smaller in the grade 12 sample than in the grade 2 sample. This evidence is consistent with a narrowing of the black-white reading gap, especially for boys, as children progress through elementary school and high school.[27]

While the *within*-sample findings would, by themselves, suggest a widening of the black-white reading gap as children progressed through elementary school and little change subsequently, the *across*-sample findings suggest an overall narrowing of the black-white reading gap between grades 2 and 12. This difference in findings may be consistent with the actual experiences of children as they progressed through school, or it may arise from the use of different cohorts of children in the comparisons. Further analysis of longitudinal data following the *same* cohort of children all the way from grade 1 through grade 12 is needed to further address the question of how the black-white reading gap changes over the course of the school years.

[27] Because the analyses of black-white reading gaps within each of the four samples did not find evidence of such a narrowing, this finding must be interpreted with caution.

## III. CONCLUSION

On average, blacks in first grade have lower mathematics and reading scores than whites, and blacks in the twelfth grade have lower mathematics and reading scores than whites. While some narrowing of black-white achievement differences may occur during elementary or secondary school, blacks with levels of prior achievement similar to whites still frequently score lower on mathematics and reading tests than whites.

The reasons for black-white disparities in mathematics and reading achievement may include differences in family background not captured by parental SES, as well as differences in peer group characteristics, school resources, and the manner in which children are treated in their classrooms. Whatever the causes of black-white gaps in educational achievement, the perpetuation of a large portion of these gaps throughout elementary and secondary school leaves blacks at a relative disadvantage as they prepare for college and/or the labor market. The existence of a smaller black-white reading gap in grade 12 than in grade 2 suggests that these gaps are not immutable, and that appropriately designed public policies can reduce the educational disparities between black and white children.

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# APPENDIX A: SAMPLE DEFINITIONS AND TREATMENT OF MISSING DATA

To study black-white differences in educational and economic outcomes, efforts were made to construct comparable samples using longitudinal survey data. For the study of labor market outcomes, four samples were defined. These same samples were also used in the study of educational attainment outcomes, together with two additional samples used for the analyses described in appendix E. For the study of educational achievement outcomes, four samples were defined. Each of these samples, and the variables within them, are discussed in this appendix.

In these samples, key analysis variables are missing for a large proportion of cases. Excluding these cases from the analysis would greatly reduce the sample size and could potentially bias the results.[1] Missing data for key variables were imputed using multiple imputation. Section I describes this approach briefly, while subsequent sections provide further details.

## I. MULTIPLE IMPUTATION OF MISSING DATA

The simplest way to deal with missing data is to drop cases with missing values from the analysis. This approach can lead to two problems; the sample size is greatly reduced, leading to less precise estimates, and the estimates will be biased if the cases with missing data are not a random sample of all cases.

Multiple imputation addresses both of these problems. By substituting imputed values for the missing data, the entire sample may be used in the analysis. Careful modeling of the relationships among variables yields imputed values that reflect differences between complete cases and cases with missing values. Multiple imputation has the added advantage of dealing with the uncertainty introduced through imputation. Rather than substituting a single value for each missing value, several plausible values are chosen. Estimates are produced using each of the different imputed values, and the variability among the estimates is incorporated into the standard errors of the estimates. These calculations are described in detail in appendix C, and in Schafer (1997).

[1] In fact, after performing multiple imputation to account for missing data, and redoing our analyses, we obtained similar results as when we used only complete cases, suggesting that any bias from missing data was small.

Imputed data may be obtained using an algorithm known as "data augmentation" (Tanner and Wong 1987). Data augmentation is an iterative process that alternates between estimating the parameters of the distribution of the data, and simulating random variables from this distribution which are substituted for the missing data. These two steps are repeated many times, until the process converges in distribution. At this point the values substituted for the missing data are independent draws from the predictive distribution of the missing data, and may be treated as imputed values.

## II. DATA USED IN THE ANALYSES OF LABOR MARKET OUTCOMES

### A. Samples

Four samples were used to compare the labor market outcomes of black and white young adults. Two of the samples were defined from school-based surveys: the National Longitudinal Study of the High School Class of 1972 (NLS:72), first conducted in 1972, with follow-up surveys in 1973, 1974, 1976, 1979, and 1986; and the High School and Beyond (HSB) survey of high school sophomores, first conducted in 1980, with follow-up surveys in 1982, 1984, 1986, and 1992.

The other two samples were defined from a household-based survey, the National Longitudinal Survey of Youth (NLSY), first administered in 1979, with annual follow-up surveys thereafter. The first NLSY sample was constructed to be comparable to the NLS:72 sample of high school seniors; the second NLSY sample was constructed to be comparable to the HSB sample of high school sophomores. Individuals in the NLSY were identified as being in grade 12 between 1976 and 1982, and in grade 10 between 1974 and 1980.[2] To distinguish the two NLSY samples, we refer below to the sample of high school seniors as the NLSY senior sample and to the sample of high school sophomores as the NLSY sophomore sample.[3]

To allow individuals a considerable length of time to complete their schooling and enter the labor market, employment and earnings were observed several years after high school. Labor market outcomes for the two samples of high school seniors were taken from follow-up surveys occurring 7 years after grade 12, that is, in 1979 for the NLS:72, and between 1983 and 1989 for the NLSY senior sample.

Analysis samples were restricted to cases with known sex and Census region, and which were identified as either non-Hispanic black or non-Hispanic white. The key comparison in this study, black/white differences in the labor market outcomes, relies on reported race, so Hispanics, Asians, Pacific Islanders, and individuals who did not report their race were excluded from the sample.[4]

[2] Because NLSY participants were sampled in 1979 on the basis of age, rather than on the basis of grade 10 or grade 12 attendance, certain individuals may be missing from the NLSY samples who were present in the NLS:72 or HSB samples. For example, individuals who immigrated to the United States after 1979 and were high school sophomores in 1980 or high school seniors between 1980 and 1982 would be excluded from the sample, as would individuals who were high school sophomores in 1974-1978 or high school seniors in 1976-1978 who either had died before 1979 or were not age 14-21 in 1979. This lack of coverage by the NLSY means that comparison between the NLSY samples and the NLS:72 and HSB samples should be interpreted with caution.

[3] There is considerable overlap between the two NLSY samples; 82 percent of the individuals in the NLSY sophomore sample also appear in the NLSY senior sample.

[4] Individuals with unknown race were combined with other races (Hispanic, Asian, or Pacific Islanders) for the purposes of multiple imputation.

## B. Variable Definitions

The following labor market outcome variables were defined in each dataset:

1. *Labor force participation status*—employed or looking for work (defined for all U.S. civilians not living in institutions)
2. *Unemployment status*—looking for work (defined for labor force participants only)
3. *Annual earnings*—the natural log of earnings (in 1992 dollars) for the past calendar year (defined for persons with positive earnings only)
4. *Hourly wage*—the natural log of the hourly wage (in 1992 dollars) for the current job (defined for employed persons only)

An hourly wage variable could not be constructed for the HSB sample since the 1992 survey did not inquire about earnings per hour of work.

The analyses of labor market outcomes used the following variables to describe the different backgrounds of young adults:

1. *Race*—indicator for black young adults (defined for non-Hispanic blacks and non-Hispanic whites only; Hispanic, Asian, or Pacific Islander individuals were excluded from the sample, as were persons of unknown race)
2. *Sex*—indicator for female young adults
3. *Educational achievement* and *educational achievement squared*—an average of mathematics and reading achievement scores, with each component and the overall average normalized to have mean zero and standard deviation one for all individuals (regardless of race) in the same grade in the same year in each sample
4. *Educational attainment* and *educational attainment squared*—number of years of completed schooling
5. *Work experience* and *work experience squared*—cumulative weeks employed divided by 52

High school completion status was not analyzed for the NLS:72 or NLSY senior datasets, since this outcome was not clearly defined in the 1979 NLS:72 sample. Educational achievement scores were normalized separately for each of the class years represented in the NLSY samples (1976 through 1982 for the NLSY senior sample, and 1974 through 1980 for the NLSY sophomore sample), since the underlying achievement tests (the arithmetic, mathematics, paragraph comprehension, and word knowledge sections of the Armed Services Vocational Aptitude Battery) were administered to the entire NLSY sample (aged 15 to 23) in 1980.[5] For the analyses of annual earnings, the measure of work experience excluded weeks employed since the start of the prior calendar year, since these weeks were included in the outcome variable.

[5] Note that some individuals in the NLSY took the ASVAB after completing high school and/or attending college. These observations were included in the sample to keep the sample size reasonably large. Because postsecondary educational experiences may affect one's educational achievement relative to one's grade cohort, the educational achievement measures in the NLSY samples differ in important ways from the achievement measures in the NLS:72 and HSB samples, which were administered prior to high school completion.

## C. Sample Sizes

Table A.1 presents sample sizes for the four analysis samples. Of the 22,652 persons in the NLS:72 who were high school seniors in 1972, 90 percent (20,273) were included in the analysis of labor market outcomes. About 10 percent (2,374) of the sample were not identified as either non-Hispanic black or non-Hispanic white; an additional 5 cases were missing core background information (sex or Census region). Fifty-seven percent of the 20,273 included cases were missing one or more key analysis variables, which were imputed using the procedures outlined in section D.[6]

Of the 7,962 persons in the NLSY who were high school seniors between 1976 and 1982, 93 percent (7,424) were included in the analysis of labor market outcomes. About 5 percent (396) of the sample were not identified as either non-Hispanic black or non-Hispanic white; an additional 2 percent (142) were missing sex or Census region. Of the cases used in the analysis, 27 percent were missing one or more key analysis variables.[7]

Labor market outcomes for the two samples of high school sophomores were taken from follow-up surveys occurring 12 years after grade 10, that is, between 1986 and 1992 for the NLSY sophomore sample, and in 1992 for the HSB sophomore sample. Of the 9,709 persons in the NLSY who were high school sophomores between 1974 and 1980, 93 percent (8,998) were included in the analysis of labor market outcomes. About 5 percent (528) of the sample were not identified as either non-Hispanic black or non-Hispanic white; an additional 2 percent (183) were missing information on sex or Census region. Missing analysis variables were imputed for 24 percent of the cases included in the analysis.[8]

Of the 14,825 persons in the HSB who were high school sophomores in 1980, 77 percent (11,375) were included in the analysis of labor market outcomes. About 23 percent (3,450) of the sample were not identified as either non-Hispanic black or non-Hispanic white; all of the remaining cases had data on sex and Census region. Forty-five percent of included cases had missing values for one or more analysis variables.[9]

## D. Multiple Imputation of Missing Data

Of the cases identified as either non-Hispanic black or non-Hispanic white, with known sex and Census region, between 30 and 57 percent were missing one or more key analysis variables. We address this problem through the use of multiple imputation, which allows the use of all available data for each case, even if some key variables are missing.

Missing values were imputed for each of the analysis variables listed in section I.B, as well as for the parental socioeconomic status variable used in the analysis of educational attainment. Two of the variables to be imputed, presence of earnings and employment/labor force participation status, are categorical. Presence of earnings was imputed separately from amount of earnings because a missing value for log of earnings

[6] Item nonresponse for the sample of blacks and whites in NLS:72 ranged from 0.05 percent for the employment status variable to 32.00 percent for annual earnings.

[7] Item nonresponse for the blacks and whites in the NLSY senior sample ranged from 0.26 percent for the SES variable to 23.44 percent for annual earnings.

[8] Item nonresponse for the blacks and whites in the NLSY sophomore sample ranged from 0.34 percent for the SES variable to 33.27 percent for annual earnings.

[9] Item nonresponse for the sample of blacks and whites in the HSB ranged from 9 to 58 percent for the SES variable to 27 to 31 percent for annual earnings.

**Table A.1— Total sample size and excluded cases (labor market/attainment datasets)**

| | NLS:72 | NLSY-Sr | NLSY-So | HSB |
|---|---|---|---|---|
| Total cases | 22,652 | 7,962 | 9,709 | 14,825 |
| Black | 3,119 | 2,031 | 2,483 | 2,238 |
| White | 17,159 | 5,535 | 6,698 | 9,137 |
| Other/not reported | 2,374 | 396 | 528 | 3,450 |
| Percent missing sex or region | 0.19 | 2.22 | 2.38 | 1.34 |
| Black | 0.03 | 1.62 | 1.57 | 0 |
| White | 0.02 | 1.97 | 2.15 | 0 |
| Other/not reported | 1.60 | 8.84 | 9.09 | 5.77 |
| Total cases included in analysis | 20,273 | 7,424 | 8,998 | 11,375 |
| Black | 3,118 | 1,998 | 2,444 | 2,238 |
| White | 17,155 | 5,426 | 6,554 | 9,137 |
| Percent of cases with missing values | 54.8 | 27.1 | 24.0 | 44.5 |
| Black | 65.3 | 30.7 | 19.5 | 57.2 |
| White | 52.9 | 25.8 | 25.8 | 41.3 |

amount does not distinguish between cases with missing earnings and cases with zero earnings. Employment/labor force participation status has four possible values: civilian employed, unemployed, not in the labor force, and military. However, the small number of military cases made it impossible to treat the military category separately in the multiple imputations. In particular, several subgroups lack cases with military status and no earnings. In order to avoid the estimation problems that arise with empty categories, military cases were combined with employed civilian cases in the multiple imputations. The analyses use the original four-category employment status variable. The military category contains only cases known to be in the military, and all of the imputed cases are assigned to one of the other three categories.[10]

The remaining variables were treated as continuous. Although the analysis treats educational attainment as a categorical variable with four categories, sparseness in several categories made it impossible to include this variable in the imputation model. Instead, the continuous variable years of education was imputed, and cases with missing educational attainment status were assigned to an educational attainment category based on imputed years of education.

To improve the imputations, the model included the sample weight along with averages by school and race of all the continuous variables to be imputed.[11] These variables were intended to capture much of the difference among schools and regions within each sample.

Since it was necessary to impute missing values for both categorical and continuous variables in the labor market/attainment datasets, a model for mixed continuous and

[10] This should have a negligible effect on the results. For example, in NLS: 72, only 2.2% of cases with known employment status are in the military, and only 10 cases have missing employment status, indicating that it is very unlikely that any cases with missing employment status were actually in the military.

[11] The model for the two NLSY datasets does not include average work experience by school and race due to convergence problems when estimating imputed values. This variable is included in the models for HSB and NLS:72, implying that the imputations are somewhat more precise for these two datasets than for the NLSY datasets.

**Table A.2—Sample sizes by race/sex category (labor market/attainment datasets)**

| | NLS: 72 | NLSY-Sr | NLSY-So | HSB |
|---|---|---|---|---|
| Total | 20,273 | 7,424 | 8,998 | 11,375 |
| White males | 8,650 | 966 | 1,232 | 4,520 |
| White females | 8,505 | 1,032 | 1,212 | 4,617 |
| Black males | 1,369 | 2,670 | 3,274 | 1,099 |
| Black females | 1,749 | 2,756 | 3,280 | 1,139 |

categorical data was chosen to approximate the relationships among variables. This model, known as the general location model, is described in Schafer (1997), and assumes that the marginal distribution of the categorical variables is multinomial, and the continuous variables have a multivariate normal distribution conditional on the categorical variables. MIX, a library of S-PLUS routines created by Joe Schafer, was used to implement this model.

Missing values were imputed separately for four subgroups: white/non-Hispanic males, white/non-Hispanic females, black/non-Hispanic males, and black/non-Hispanic females.[12] Persons of unknown race or sex were excluded from the imputation. The sample sizes for the four data subgroups are presented in table A.2.

We used the MIX library of S-Plus subroutines to create multiple imputed datasets. For each of the four subsets of each dataset, we first attempted to determine how many iterations were required for convergence of the data augmentation algorithm. Schafer and Olsen (1998), describing this algorithm in greater detail, report that data augmentation "nearly always converges in fewer cycles than does EM." We ran the EM algorithm several times from a variety of starting values, assessing whether the algorithm converged to a unique solution and how many iterations were required for convergence. We then ran at least that many steps of data augmentation before imputing to be sure that the data augmentation algorithm had converged.

The multiple imputation models were well behaved, converging to a unique value no matter which starting points were used. In almost every subset the EM algorithm converged in fewer than 500 iterations, and it often converged in fewer than 100 iterations. For these subsets we used the results from the EM algorithm as starting values for the data augmentation algorithm, imputing after 500 steps. The EM algorithm required between 500 and 700 iterations to converge for white males in NLS:72 and NLSY-So, and for black males in NLS:72. For these subsets we imputed after 1,000 steps of data augmentation. We then ran four more independent series of data augmentation for each subset, each time using the final values of the previous run as starting values and imputing after 500 (or 1,000) steps.

Finally, for each of the five multiple imputations we merged the four datasets together, creating a single file that included observations from all four sex and race categories. We

[12] Missing data were imputed separately for cases with other race or unknown race for HSB and NLS:72. Missing data were not imputed for other/unknown race cases for NLSY because the small number of such cases led to convergence problems. Since cases with other/unknown race were not used in the analyses described in this report, this appendix focuses primarily on imputation for non-Hispanic blacks and non-Hispanic whites.

merged each imputed dataset onto the original data file and recoded variables that had been standardized to facilitate the imputations.

## E. Characteristics of Cases with Missing Data

If there are systematic differences between complete cases and cases with missing data, estimates based on only complete cases may be biased. In particular, if black-white differences were more (or less) pronounced among complete cases than among cases with missing data, and estimates of black-white differences were based only on complete cases, the results would be misleading. A comparison of complete cases and cases with missing values reveals several differences, suggesting that an analysis restricted to complete cases would be biased.

Tables A.3 through A.7 show summary statistics on the key variables in the analysis of educational attainment and labor market outcomes for complete cases and cases with at least some missing variables. We imputed missing data to address the problem of missing values, and the tables include the imputed values. *Note that, because observations with missing values of some variables often have valid values of other variables, the reported means for observations with missing data include both valid and imputed values.* In every instance, the imputation of missing values utilized any valid information for the observation in question.

For characteristics of black and white young adults, differences between complete cases and cases missing one or more variables tended to be similar across the four datasets. The most striking pattern is that respondents with no missing data are more well-off than those for whom data had to be imputed. SES, educational achievement, college attendance and completion, work experience and earnings are higher for the complete cases than for the cases with missing data, for both blacks and whites. The majority of these differences are statistically significant.

Several other differences exist between complete cases and cases with missing data. For example, the percentage black is higher among cases with missing data, and this difference is statistically significant for three of the four datasets. In NLS:72, the percentage female is higher for cases with missing data, for both blacks and whites. However, among black young adults in HSB, the percentage female is higher for complete cases. Some differences in Census region appear as well, although there is no evidence of a consistent pattern across datasets.

The key concern is whether black-white differences vary according to the presence of missing data. Tables A.3 through A7 reveal several characteristics for which this is the case:

- In NLS: 72, blacks are better off relative to whites among cases with missing data, as compared with black-white differences among complete cases. Black-white differences in percentage attending and completing college, earnings, percentage female, and percentage in the Midwest Census region were significantly smaller among cases with missing data. Among cases with missing data, blacks were more likely than whites to have attended college, participate in the labor force, and have earnings, while the opposite was true for complete cases.
- The pattern is not as clear in the NLSY senior sample. Cases with missing data show significantly larger black-white differences in socioeconomic status (SES) and percentage with earnings, and significantly smaller black-white differences in percentage completing college.

## Table A.3—Comparison of black and white young adults in NLS:72, by presence of all variables

| Sample definition and descriptive variables | Not missing any variables | | Missing one or more variables | | Difference-of-means (missing - not missing) | | Statistical significance |
|---|---|---|---|---|---|---|---|
| | Mean | Std. Error | Mean | Std. Error | Value | Std. Error | |
| Population of black and white children | (N=9160) | | (N=3417) | | | | |
| Percentage black | 9.2 | 0.0 | 11.5 | 0.0 | 2.3 | 0.8 | ** |
| Population of white young adults | (N=8079) | | (N=2899) | | | | |
| Percentage female | 44.6 | 0.7 | 62.2 | 0.0 | 17.5 | 1.3 | ** |
| Percentage attending high school in the Northeast | 25.7 | 1.7 | 26.5 | 0.0 | 0.7 | 1.4 | |
| Percentage attending high school in the Midwest | 32.7 | 1.9 | 35.5 | 0.0 | 2.8 | 1.8 | |
| Percentage attending high school in the South | 25.4 | 1.6 | 20.7 | 0.0 | -4.7 | 1.1 | ** |
| Percentage attending high school in the West | 16.2 | 1.4 | 17.3 | 0.0 | 1.1 | 1.4 | |
| Socioeconomic status | 0.109 | 0.014 | 0.043 | 0.018 | -0.066 | 0.017 | ** |
| Educational achievement | 0.2 | 0.0 | 0.0 | 0.0 | -0.2 | 0.0 | ** |
| Percentage that attended college | 65.6 | 0.8 | 55.3 | 0.0 | -10.3 | 1.3 | ** |
| Percentage that completed college | 29.4 | 0.7 | 20.8 | 0.0 | -8.6 | 1.1 | ** |
| Average years of work experience | 5.1 | 0.0 | 3.8 | 0.1 | -1.3 | 0.1 | ** |
| Percentage that are in the labor force | 92.5 | 0.3 | 60.8 | 1.3 | -31.7 | 1.3 | ** |
| Natural log of wage | 2.5 | 0.0 | 2.3 | 0.0 | -0.2 | 0.0 | ** |
| Percentage that have earnings | 96.4 | 0.2 | 69.6 | 1.2 | -26.8 | 1.2 | ** |
| Earnings in thousands | 21.0 | 0.2 | 13.5 | 0.4 | -7.5 | 0.4 | ** |
| Population of black young adults | (N=1081) | | (N=518) | | | | |
| Percentage female | 54.4 | 1.7 | 64.7 | 2.8 | 10.2 | 3.1 | ** |
| Percentage attending high school in the Northeast | 16.6 | 2.7 | 11.3 | 2.2 | -5.4 | 2.3 | ** |
| Percentage attending high school in the Midwest | 13.1 | 3.0 | 27.5 | 4.8 | 14.4 | 4.7 | ** |
| Percentage attending high school in the South | 64.3 | 3.6 | 53.8 | 4.5 | -10.5 | 4.3 | ** |
| Percentage attending high school in the West | 6.0 | 1.3 | 7.5 | 2.0 | 1.5 | 2.0 | |
| Socioeconomic status | -0.583 | 0.026 | -0.589 | 0.035 | -0.006 | 0.038 | |
| Educational achievement | -0.9 | 0.0 | -1.1 | 0.0 | -0.2 | 0.1 | ** |
| Percentage that attended college | 58.7 | 2.0 | 58.5 | 2.6 | -0.3 | 3.2 | |
| Percentage that completed college | 18.2 | 1.4 | 16.1 | 1.8 | -2.1 | 2.2 | |
| Average years of work experience | 4.7 | 0.1 | 3.3 | 0.1 | -1.3 | 0.1 | ** |
| Percentage that are in the labor force | 91.4 | 1.0 | 74.3 | 2.3 | -17.1 | 2.5 | ** |
| Natural log of wage | 2.3 | 0.0 | 2.3 | 0.0 | 0.0 | 0.0 | |
| Percentage that have earnings | 93.8 | 0.8 | 72.3 | 2.4 | -21.5 | 2.5 | ** |
| Earnings in thousands | 17.6 | 0.4 | 13.4 | 1.0 | -4.2 | 1.0 | ** |
| Difference between black and white children | | | | | | | |
| Percentage female | 9.8 | 1.8 | 2.5 | 2.9 | -7.3 | 3.3 | ** |
| Percentage attending high school in the Northeast | -9.1 | 2.9 | -15.2 | 2.8 | -6.1 | 2.7 | ** |
| Percentage attending high school in the Midwest | -19.6 | 3.4 | -8.0 | 5.1 | 11.6 | 4.9 | ** |
| Percentage attending high school in the South | 38.9 | 3.6 | 33.0 | 4.5 | -5.8 | 4.3 | |
| Percentage attending high school in the West | -10.2 | 1.8 | -9.8 | 2.6 | 0.4 | 2.4 | |
| Socioeconomic status | -0.692 | 0.028 | -0.632 | 0.039 | 0.060 | 0.042 | |
| Educational achievement | -115.2 | 3.8 | -111.3 | 5.4 | 3.9 | 6.0 | |
| Percentage that attended college | -6.8 | 2.1 | 3.2 | 2.8 | 10.0 | 3.4 | ** |
| Percentage that completed college | -11.2 | 1.5 | -4.6 | 2.1 | 6.5 | 2.5 | ** |
| Average years of work experience | -0.5 | 0.1 | -0.5 | 0.1 | 0.0 | 0.1 | |
| Percentage that are in the labor force | -1.1 | 1.1 | 13.5 | 2.6 | 14.6 | 2.7 | ** |
| Natural log of wage | -0.1 | 0.0 | 0.1 | 0.0 | 0.2 | 0.0 | ** |
| Percentage that have earnings | -2.6 | 0.8 | 2.7 | 2.6 | 5.3 | 2.7 | ** |
| Earnings in thousands | -3.4 | 0.5 | -0.1 | 1.1 | 3.3 | 1.1 | ** |

** Difference-of-means between two groups is statistically significant at p<=.05.

NOTE: Standard errors have been adjusted for complex survey designs. Numbers may not sum to totals due to rounding. Sample sizes are smaller than those reported previously because observations with a sampling weight of zero were excluded from the tabulations. Multiple imputation used to account for missing data.

SOURCE: U.S. Department of Education, National Center for Education Statistics, High School and Beyond (HSB); and U.S. Department of Labor, Bureau of Labor Statistics, National Longitudinal Survey of Youth (NLSY).

## Table A.4—Comparison of black and white young adults in NLSY, 7 years after grade 12, by presence of all variables

| Sample definition and descriptive variables | Not missing any variables | | Missing one or more variables | | Difference-of-means (missing - not missing) | | Statistical significance |
|---|---|---|---|---|---|---|---|
| | Mean | Std. Error | Mean | Std. Error | Value | Std. Error | |
| Population of black and white children | (N=5412) | | (N=1458) | | | | |
| Percentage black | 12.2 | 0.0 | 18.1 | 0.1 | 5.9 | | 1.2 |
| Population of white young adults | (N=4027) | | (N=976) | | | | |
| Percentage female | 48.8 | 0.9 | 51.2 | 0.1 | 2.4 | | 2.7 |
| Percentage attending high school in the Northeast | 24.7 | 4.4 | 19.0 | 0.1 | -5.7 | | 2.1 |
| Percentage attending high school in the Midwest | 34.9 | 4.8 | 36.6 | 0.2 | 1.7 | | 2.5 |
| Percentage attending high school in the South | 25.3 | 4.0 | 27.4 | 0.1 | 2.0 | | 2.0 |
| Percentage attending high school in the West | 15.1 | 3.1 | 17.0 | 0.1 | 1.9 | | 1.8 |
| Socioeconomic status | 0.113 | 0.032 | 0.020 | 0.048 | -0.093 | | 0.045 |
| Educational achievement | 0.2 | 0.0 | 0.0 | 0.0 | -0.2 | | 0.0 |
| Percentage that attended college | 58.2 | 1.4 | 47.6 | 0.1 | -10.7 | | 2.2 |
| Percentage that completed college | 26.8 | 1.3 | 12.5 | 0.0 | -14.3 | | 1.7 |
| Average years of work experience | 5.5 | 0.0 | 3.4 | 0.1 | -2.1 | | 0.1 |
| Percentage that are in the labor force | 94.4 | 0.4 | 44.3 | 2.4 | -50.2 | | 2.3 |
| Natural log of wage | 2.2 | 0.0 | 2.2 | 0.3 | 0.0 | | 0.3 |
| Percentage that have earnings | 96.7 | 0.4 | 47.5 | 2.1 | -49.2 | | 2.2 |
| Earnings in thousands | 18.3 | 0.3 | 7.6 | 0.7 | -10.7 | | 0.7 |
| Population of black young adults | (N=1385) | | (N=482) | | | | |
| Percentage female | 51.6 | 1.5 | 50.6 | 2.8 | -1.1 | | 3.3 |
| Percentage attending high school in the Northeast | 16.9 | 3.9 | 15.1 | 3.1 | -1.8 | | 2.7 |
| Percentage attending high school in the Midwest | 17.0 | 3.8 | 22.2 | 4.7 | 5.3 | | 2.7 |
| Percentage attending high school in the South | 60.9 | 5.3 | 56.2 | 5.4 | -4.7 | | 3.6 |
| Percentage attending high school in the West | 5.2 | 1.3 | 6.5 | 1.7 | 1.2 | | 1.4 |
| Socioeconomic status | -0.520 | 0.040 | -0.738 | 0.040 | -0.219 | | 0.046 |
| Educational achievement | -1.0 | 0.0 | -1.1 | 0.1 | -0.2 | | 0.1 |
| Percentage that attended college | 52.0 | 1.9 | 42.3 | 2.8 | -9.7 | | 3.1 |
| Percentage that completed college | 13.9 | 1.1 | 4.7 | 1.2 | -9.2 | | 1.5 |
| Average years of work experience | 4.6 | 0.1 | 2.3 | 0.1 | -2.3 | | 0.1 |
| Percentage that are in the labor force | 94.7 | 0.6 | 40.8 | 2.9 | -53.9 | | 2.9 |
| Natural log of wage | 2.0 | 0.0 | 1.9 | 0.2 | -0.1 | | 0.2 |
| Percentage that have earnings | 95.9 | 0.6 | 31.8 | 2.8 | -64.1 | | 3.0 |
| Earnings in thousands | 13.7 | 0.4 | 3.5 | 0.5 | -10.1 | | 0.6 |
| Difference between black and white children | | | | | | | |
| Percentage female | 2.8 | 1.8 | -0.6 | 3.7 | -3.4 | | 4.3 |
| Percentage attending high school in the Northeast | -7.8 | 5.4 | -3.9 | 4.4 | 3.9 | | 3.1 |
| Percentage attending high school in the Midwest | -17.9 | 5.5 | -14.3 | 6.2 | 3.6 | | 3.3 |
| Percentage attending high school in the South | 35.6 | 5.7 | 28.8 | 6.1 | -6.8 | | 3.9 |
| Percentage attending high school in the West | -9.9 | 3.1 | -10.5 | 3.9 | -0.7 | | 2.3 |
| Socioeconomic status | -0.633 | 0.053 | -0.758 | 0.061 | -0.126 | | 0.064 |
| Educational achievement | -119.2 | 4.4 | -115.6 | 7.3 | 3.6 | | 7.7 |
| Percentage that attended college | -6.3 | 2.3 | -5.3 | 3.6 | 1.0 | | 3.9 |
| Percentage that completed college | -12.8 | 1.7 | -7.7 | 1.9 | 5.1 | | 2.3 |
| Average years of work experience | -0.8 | 0.1 | -1.1 | 0.2 | -0.3 | | 0.2 |
| Percentage that are in the labor force | 0.2 | 0.7 | -3.5 | 3.6 | -3.7 | | 3.6 |
| Natural log of wage | -0.2 | 0.0 | -0.3 | 0.2 | -0.2 | | 0.2 |
| Percentage that have earnings | -0.9 | 0.7 | -15.7 | 3.5 | -14.9 | | 3.7 |
| Earnings in thousands | -4.7 | 0.5 | -4.1 | 0.9 | 0.6 | | 1.0 |

** Difference-of-means between two groups is statistically significant at p<=.05.

NOTE: Standard errors have been adjusted for complex survey designs. Numbers may not sum to totals due to rounding. Sample sizes are smaller than those reported previously because observations with a sampling weight of zero were excluded from the tabulations. Multiple imputation used to account for missing data.

SOURCE: U.S. Department of Education, National Center for Education Statistics, High School and Beyond (HSB); and U.S. Department of Labor, Bureau of Labor Statistics, National Longitudinal Survey of Youth (NLSY).

## Table A.5—Comparison of black and white young adults in NLSY observed 12 years after grade 10, by presence of all variables

| Sample definition and descriptive variables | Not missing any variables | | Missing one or more variables | | Difference-of-means (missing - not missing) | | Statistical significance |
|---|---|---|---|---|---|---|---|
| | Mean | Std. Error | Mean | Std. Error | Value | Std. Error | |
| Population of black and white children | (N=6834) | | (N=450) | | | | |
| Percentage black | 14.0 | 0.0 | 15.4 | 0.1 | 1.4 | 1.6 | |
| Population of white young adults | (N=4866) | | (N=315) | | | | |
| Percentage female | 49.6 | 0.8 | 44.9 | 0.2 | -4.7 | 3.4 | |
| Percentage attending high school in the Northeast | 22.3 | 4.0 | 24.1 | 0.3 | 1.8 | 2.6 | |
| Percentage attending high school in the Midwest | 35.2 | 4.8 | 34.7 | 0.3 | -0.5 | 3.7 | |
| Percentage attending high school in the South | 26.3 | 4.0 | 24.7 | 0.3 | -1.6 | 3.4 | |
| Percentage attending high school in the West | 16.2 | 3.3 | 16.5 | 0.2 | 0.3 | 2.7 | |
| Socioeconomic status | 0.099 | 0.030 | 0.033 | 0.075 | -0.066 | 0.077 | |
| Educational achievement | 0.2 | 0.0 | -0.1 | 0.1 | -0.3 | 0.1 | ** |
| Percentage that completed high school | 87.0 | 0.7 | 82.8 | 0.1 | -4.2 | 2.2 | |
| Percentage that attended college | 55.9 | 1.3 | 43.9 | 0.2 | -11.9 | 3.5 | ** |
| Percentage that completed college | 25.8 | 1.2 | 14.3 | 2.7 | -11.5 | 2.6 | ** |
| Average years of work experience | 7.9 | 0.1 | 7.4 | 0.2 | -0.5 | 0.2 | ** |
| Percentage that are in the labor force | 85.8 | 0.7 | 83.5 | 2.7 | -2.3 | 2.7 | |
| Percentage that have earnings | 87.4 | 0.6 | 80.8 | 2.8 | -6.7 | 2.8 | ** |
| Earnings in thousands | 20.1 | 0.4 | 17.6 | 1.2 | -2.5 | 1.2 | ** |
| Population of black young adults | (N=1968) | | (N=135) | | | | |
| Percentage female | 49.7 | 1.2 | 47.8 | 4.6 | -1.9 | 4.7 | |
| Percentage attending high school in the Northeast | 16.7 | 3.5 | 22.8 | 5.6 | 6.1 | 4.0 | |
| Percentage attending high school in the Midwest | 19.2 | 4.1 | 21.7 | 5.5 | 2.6 | 4.0 | |
| Percentage attending high school in the South | 57.8 | 5.1 | 49.5 | 6.7 | -8.3 | 5.2 | |
| Percentage attending high school in the West | 6.2 | 1.4 | 5.9 | 2.4 | -0.3 | 2.5 | |
| Socioeconomic status | -0.561 | 0.032 | -0.593 | 0.073 | -0.033 | 0.076 | |
| Educational achievement | -1.0 | 0.0 | -1.1 | 0.1 | -0.1 | 0.1 | |
| Percentage that completed high school | 79.0 | 1.0 | 72.9 | 4.2 | -6.2 | 4.3 | |
| Percentage that attended college | 46.5 | 1.6 | 48.8 | 4.8 | 2.3 | 4.9 | |
| Percentage that completed college | 12.2 | 0.9 | 5.7 | 1.9 | -6.5 | 2.0 | ** |
| Average years of work experience | 6.3 | 0.1 | 5.2 | 0.3 | -1.1 | 0.3 | ** |
| Percentage that are in the labor force | 81.4 | 0.9 | 76.1 | 3.7 | -5.3 | 3.7 | |
| Percentage that have earnings | 81.1 | 1.1 | 70.3 | 4.8 | -10.8 | 4.7 | ** |
| Earnings in thousands | 14.3 | 0.4 | 13.9 | 1.8 | -0.4 | 1.8 | |
| Difference between black and white children | | | | | | | |
| Percentage female | 0.1 | 1.4 | 2.9 | 5.6 | 2.8 | 5.8 | |
| Percentage attending high school in the Northeast | -5.6 | 4.8 | -1.3 | 7.0 | 4.3 | 4.8 | |
| Percentage attending high school in the Midwest | -16.0 | 5.6 | -12.9 | 7.3 | 3.1 | 5.4 | |
| Percentage attending high school in the South | 31.6 | 5.6 | 24.8 | 7.5 | -6.7 | 6.1 | |
| Percentage attending high school in the West | -10.0 | 3.2 | -10.6 | 4.6 | -0.6 | 3.5 | |
| Socioeconomic status | -0.660 | 0.044 | -0.626 | 0.104 | 0.034 | 0.109 | |
| Educational achievement | -1.2 | 0.0 | -1.0 | 0.2 | 0.1 | 0.2 | |
| Percentage that completed high school | -7.9 | 1.2 | -9.9 | 4.9 | -2.0 | 5.0 | |
| Percentage that attended college | -9.4 | 2.0 | 4.8 | 6.1 | 14.2 | 6.1 | ** |
| Percentage that completed college | -13.6 | 1.5 | -8.6 | 3.3 | 5.0 | 3.3 | |
| Average years of work experience | -1.6 | 0.1 | -2.2 | 0.4 | -0.6 | 0.4 | |
| Percentage that are in the labor force | -4.4 | 1.2 | -7.4 | 4.5 | -3.0 | 4.5 | |
| Percentage that have earnings | -6.3 | 1.3 | -10.4 | 5.5 | -4.2 | 5.5 | |
| Earnings in thousands | -5.8 | 0.6 | -3.7 | 2.3 | 2.1 | 2.3 | |

** Difference-of-means between two groups is statistically significant at p<=.05.

NOTE: Standard errors have been adjusted for complex survey designs. Numbers may not sum to totals due to rounding. Sample sizes are smaller than those reported previously because observations with a sampling weight of zero were excluded from the tabulations. Multiple imputation used to account for missing data.

SOURCE: U.S. Department of Education, National Center for Education Statistics, High School and Beyond (HSB); and U.S. Department of Labor, Bureau of Labor Statistics, National Longitudinal Study of Youth (NLSY).

## Table A.6—Comparison of black and white young adults in HSB observed 12 years after grade 10, by presence of all variables

| Sample definition and descriptive variables | Not missing any variables | | Missing one or more variables | | Difference-of-means (missing - not missing) | | Statistical significance |
|---|---|---|---|---|---|---|---|
| | Mean | Std. Error | Mean | Std. Error | Value | Std. Error | |
| Percentage of black and whit children | (N=6317) | | (N=4612) | | | | |
| Percentage black | 10.9 | 0.0 | 20.5 | 0.0 | 9.6 | 1.1 | ** |
| Population of white young adults | (N=5360) | | (N=3422) | | | | |
| Percentage female | 51.6 | 0.8 | 49.0 | 0.0 | -2.6 | 1.5 | |
| Percentage attending high school in the Northeast | 23.6 | 1.8 | 24.3 | 0.0 | 0.7 | 1.5 | |
| Percentage attending high school in the Midwest | 34.7 | 2.0 | 27.6 | 0.0 | -7.1 | 1.7 | ** |
| Percentage attending high school in the South | 27.8 | 1.9 | 29.2 | 0.0 | 1.4 | 1.8 | |
| Percentage attending high school in the West | 13.9 | 1.4 | 18.8 | 0.0 | 5.0 | 1.2 | ** |
| Socioeconomic status | 0.102 | 0.016 | -0.016 | 0.024 | -0.118 | 0.023 | ** |
| Educational achievement | 0.4 | 0.0 | -0.1 | 0.0 | -0.4 | 0.0 | ** |
| Percentage that completed high school | 99.5 | 0.1 | 89.1 | 0.0 | -10.5 | 0.9 | ** |
| Percentage that attended college | 68.0 | 0.9 | 48.9 | 0.0 | -19.1 | 1.8 | ** |
| Percentage that completed college | 33.4 | 1.0 | 17.4 | 1.1 | -16.0 | 1.2 | ** |
| Average years of work experience | 7.9 | 0.0 | 7.2 | 0.1 | -0.8 | 0.1 | ** |
| Percentage that are in the labor force | 86.3 | 0.6 | 80.8 | 1.0 | -5.5 | 1.2 | ** |
| Percentage that have earnings | 92.0 | 0.5 | 83.6 | 0.9 | -8.4 | 1.0 | ** |
| Earnings in thousands | 22.0 | 0.3 | 18.7 | 0.4 | -3.3 | 0.5 | ** |
| Population of black young adults | (N=957) | | (N=1190) | | | | |
| Percentage female | 57.3 | 2.2 | 49.4 | 2.1 | -7.9 | 3.1 | ** |
| Percentage attending high school in the Northeast | 14.9 | 2.2 | 26.6 | 3.6 | 11.8 | 2.9 | ** |
| Percentage attending high school in the Midwest | 14.3 | 2.3 | 18.8 | 2.8 | 4.4 | 2.3 | ** |
| Percentage attending high school in the South | 64.8 | 3.4 | 47.5 | 3.8 | -17.3 | 3.2 | ** |
| Percentage attending high school in the West | 6.0 | 1.4 | 7.2 | 1.7 | 1.1 | 1.7 | |
| Socioeconomic status | -0.405 | 0.036 | -0.496 | 0.050 | -0.090 | 0.056 | |
| Educational achievement | -0.6 | 0.0 | -0.9 | 0.0 | -0.3 | 0.1 | ** |
| Percentage that completed high school | 98.9 | 0.5 | 88.8 | 1.6 | -10.1 | 1.6 | ** |
| Percentage that attended college | 59.7 | 2.3 | 42.1 | 2.6 | -17.5 | 3.4 | ** |
| Percentage that completed college | 18.2 | 1.7 | 7.8 | 1.1 | -10.4 | 1.9 | ** |
| Average years of work experience | 7.1 | 0.1 | 6.1 | 0.2 | -1.0 | 0.2 | ** |
| Percentage that are in the labor force | 84.2 | 1.7 | 77.6 | 2.3 | -6.6 | 2.9 | ** |
| Percentage that have earnings | 88.1 | 1.7 | 72.7 | 2.6 | -15.4 | 3.1 | ** |
| Earnings in thousands | 18.2 | 0.7 | 14.6 | 0.9 | -3.6 | 1.1 | ** |
| Difference between black and white children | | | | | | | |
| Percentage female | 5.7 | 2.4 | 0.4 | 2.4 | -5.3 | 3.5 | |
| Percentage attending high school in the Northeast | -8.7 | 2.6 | 2.3 | 3.8 | 11.1 | 3.2 | ** |
| Percentage attending high school in the Midwest | -20.4 | 2.8 | -8.8 | 3.2 | 11.5 | 2.7 | ** |
| Percentage attending high school in the South | 36.9 | 3.4 | 18.2 | 3.9 | -18.7 | 3.5 | ** |
| Percentage attending high school in the West | -7.8 | 1.8 | -11.7 | 2.2 | -3.8 | 2.1 | |
| Socioeconomic status | -0.507 | 0.038 | -0.480 | 0.052 | 0.027 | 0.059 | |
| Educational achievement | -0.9 | 0.0 | -0.8 | 0.0 | 0.1 | 0.1 | ** |
| Percentage that completed high school | -0.6 | 0.5 | -0.2 | 1.8 | 0.4 | 1.8 | |
| Percentage that attended college | -8.3 | 2.5 | -6.8 | 2.9 | 1.6 | 3.7 | |
| Percentage that completed college | -15.2 | 1.9 | -9.6 | 1.5 | 5.6 | 2.2 | ** |
| Average years of work experience | -0.9 | 0.1 | -1.1 | 0.2 | -0.2 | 0.2 | |
| Percentage that are in the labor force | -2.1 | 1.9 | -3.2 | 2.4 | -1.1 | 3.0 | |
| Percentage that have earnings | -3.9 | 1.8 | -10.9 | 2.7 | -7.0 | 3.3 | ** |
| Earnings in thousands | -3.8 | 0.7 | -4.1 | 1.0 | -0.3 | 1.2 | |

** Difference-of-means between two groups is statistically significant at p<=.05.

NOTE: Standard errors have been adjusted for complex survey designs. Numbers may not sum to totals due to rounding. Sample sizes are smaller than those reported previously because observations with a sampling weight of zero were excluded from the tabulations. Multiple imputation used to account for missing data.

SOURCE: U.S. Department of Education, National Center for Education Statistics, High School and Beyond (HSB); and U.S. Department of Labor, Bureau of Labor Statistics, National Longitudinal Study of Youth (NLSY).

## Table A.7—Comparison of black and white young adults in NLSY observed 12 years after grade 10, by presence of all variables (in 1992 only)

| Sample definition and descriptive variables | Not missing any variables Mean | Std. Error | Missing one or more variables Mean | Std. Error | Difference-of-means (missing - not missing) Value | Std. Error | Statistical significance |
|---|---|---|---|---|---|---|---|
| Population of black and white children | (N=948) | | (N=50) | | | | |
| Percentage black | 16.0 | 0.1 | 12.2 | 0.5 | -3.9 | 3.6 | |
| Population of white young adults | (N=632) | | (N=36) | | | | |
| Percentage female | 48.3 | 2.3 | 50.8 | 1.5 | 2.5 | 9.6 | |
| Percentage attending high school in the Northeast | 20.6 | 4.2 | 17.7 | 1.1 | -2.8 | 6.2 | |
| Percentage attending high school in the Midwest | 34.3 | 5.2 | 43.0 | 1.8 | 8.7 | 9.4 | |
| Percentage attending high school in the South | 27.8 | 4.8 | 19.5 | 1.2 | -8.2 | 7.2 | |
| Percentage attending high school in the West | 17.4 | 3.9 | 19.8 | 1.4 | 2.4 | 6.6 | |
| Socioeconomic status | 0.078 | 0.050 | -0.163 | 0.191 | -0.241 | 0.188 | |
| Educational achievement | 0.2 | 0.0 | -0.3 | 0.2 | -0.5 | 0.2 | ** |
| Percentage that completed high school | 81.6 | 1.9 | 84.9 | 1.0 | 3.3 | 6.1 | |
| Percentage that attended college | 53.6 | 2.5 | 31.1 | 1.5 | -22.5 | 8.9 | ** |
| Percentage that completed college | 26.6 | 2.1 | 14.1 | 6.3 | -12.5 | 6.5 | ** |
| Average years of work experience | 8.6 | 0.1 | 9.4 | 0.4 | 0.7 | 0.4 | |
| Percentage that are in the labor force | 87.4 | 1.5 | 88.2 | 5.4 | 0.8 | 5.5 | |
| Percentage that have earnings | 86.8 | 1.4 | 85.1 | 6.8 | -1.7 | 6.8 | |
| Earnings in thousands | 19.3 | 0.6 | 20.4 | 4.1 | 1.1 | 4.1 | |
| Population of black young adults | (N=316) | | (N=14) | | | | |
| Percentage female | 49.9 | 2.8 | 53.7 | 15.3 | 3.8 | 14.8 | |
| Percentage attending high school in the Northeast | 15.4 | 4.0 | 23.5 | 12.1 | 8.2 | 11.6 | |
| Percentage attending high school in the Midwest | 18.6 | 4.5 | 34.6 | 14.5 | 16.0 | 12.8 | |
| Percentage attending high school in the South | 60.0 | 5.9 | 36.8 | 15.2 | -23.2 | 14.6 | |
| Percentage attending high school in the West | 6.0 | 2.3 | 5.0 | 5.2 | -1.0 | 5.4 | |
| Socioeconomic status | -0.548 | 0.053 | -0.290 | 0.285 | 0.258 | 0.286 | |
| Educational achievement | -0.9 | 0.1 | -0.8 | 0.3 | 0.1 | 0.3 | |
| Percentage that completed high school | 71.7 | 2.9 | 75.5 | 13.5 | 3.8 | 13.1 | |
| Percentage that attended college | 37.6 | 3.3 | 46.1 | 16.1 | 8.5 | 15.3 | |
| Percentage that completed college | 10.7 | 2.2 | 13.4 | 9.6 | 2.7 | 9.7 | |
| Average years of work experience | 6.8 | 0.2 | 5.9 | 1.1 | -0.9 | 1.1 | |
| Percentage that are in the labor force | 80.3 | 2.6 | 83.5 | 11.2 | 3.2 | 10.4 | |
| Percentage that have earnings | 78.7 | 2.3 | 69.7 | 14.3 | -9.1 | 13.4 | |
| Earnings in thousands | 13.2 | 0.7 | 10.5 | 4.1 | -2.8 | 4.0 | |
| Difference between black and white children | | | | | | | |
| Percentage female | 1.6 | 3.6 | 2.8 | 17.9 | 1.3 | 18.0 | |
| Percentage attending high school in the Northeast | -5.2 | 5.4 | 5.8 | 13.5 | 11.0 | 13.2 | |
| Percentage attending high school in the Midwest | -15.7 | 6.2 | -8.3 | 16.9 | 7.3 | 15.3 | |
| Percentage attending high school in the South | 32.3 | 6.7 | 17.3 | 16.2 | -15.0 | 16.1 | |
| Percentage attending high school in the West | -11.4 | 4.1 | -14.8 | 9.4 | -3.4 | 8.2 | |
| Socioeconomic status | -0.626 | 0.073 | -0.127 | 0.336 | 0.500 | 0.340 | |
| Educational achievement | -1.1 | 0.1 | -0.5 | 0.4 | 0.6 | 0.4 | |
| Percentage that completed high school | -9.9 | 3.4 | -9.4 | 14.5 | 0.5 | 14.4 | |
| Percentage that attended college | -16.0 | 4.0 | 15.0 | 18.7 | 31.0 | 18.3 | |
| Percentage that completed college | -15.9 | 3.1 | -0.7 | 11.2 | 15.2 | 11.6 | |
| Average years of work experience | -1.8 | 0.2 | -3.5 | 1.2 | -1.7 | 1.2 | |
| Percentage that are in the labor force | -7.1 | 3.0 | -4.7 | 12.2 | 2.4 | 11.9 | |
| Percentage that have earnings | -8.1 | 2.7 | -15.4 | 15.6 | -7.4 | 15.2 | |
| Earnings in thousands | -6.0 | 1.0 | -9.9 | 5.5 | -3.9 | 5.5 | |

** Difference-of-means between two groups is statistically significant at p<=.05.

NOTE: Standard errors have been adjusted for complex survey designs. Numbers may not sum to totals due to rounding. Sample sizes are smaller than those reported previously because observations with a sampling weight of zero were excluded from the tabulations. Multiple imputation used to account for missing data.

SOURCE: U.S. Department of Education, National Center for Education Statistics, High School and Beyond (HSB); and U.S. Department of Labor, Bureau of Labor Statistics, National Longitudinal Study of Youth (NLSY).

- Black-white differences for complete cases in the NLSY sophomore sample are similar to black-white differences for cases with missing values. The only significant discrepancy in this sample is that among complete cases, whites were more likely to complete college than blacks, while the opposite is true for cases with missing data.
- In HSB, black-white differences tended to be smaller for cases with missing data than for complete cases for the region, educational achievement, and educational attainment variables, and larger for the labor market variables.

When comparisons were restricted to only cases from 1992 in the NLSY senior sample (table A.7), differences between complete cases and cases with missing values showed no particular pattern. This is probably due to the fact that only 50 cases in this subset had missing data, so the differences could not be measured precisely. In this subsample, there were no statistically significant differences in black-white gaps between complete cases and cases with missing values.

These results suggest that eliminating cases with missing data from the analysis could bias estimates of black-white differences. Careful imputation of missing values allows use of all available observations and should minimize this problem.

## III. DATA USED IN THE ANALYSES OF EDUCATIONAL ATTAINMENT OUTCOMES

### A. Samples

Six samples were used to compare the educational attainment of black and white young adults. Two of these samples were constructed for the analyses described in appendix D. First, samples of 2,695 black and white (non-Hispanic) youth (16- to 24-year-olds) and 5,421 black and white (non-Hispanic) young adults (25- to 34-year-olds) obtained from the 1992 National Adult Literacy Survey (NALS) were used to analyze black-white differences for both the civilian, noninstitutional population and the population of incarcerated persons. Next, a sample of 8,306 black and white (non-Hispanic) 28-year-olds was defined using 1985 to 1992 data from the NLSY to analyze trends in the completion of high school diplomas and equivalents over time, and to include some institutionalized persons in the sample.

The four remaining samples, the same as those used in the analysis of labor market outcomes, were used in the analysis of black-white differences in educational attainment as a function of black-white differences in educational achievement.

### B. Variable Definitions

The following educational attainment outcome variables were defined in each sample:

1. *High school completion status*—indicator for young adults who had obtained a high school diploma or equivalent (GED, or General Educational Development certificate)
2. *College attendance status*—indicator for young adults who had attended at least some college (defined for young adults with high school diplomas or GEDs only)
3. *College completion status*—indicator for young adults who had completed at least four years of college or an equivalent bachelor's degree (defined for college attendees only)

Of the various surveys, only the NLSY inquired about the GED completion status of all the individuals in the sample, including those who subsequently attended college.

The analyses of educational attainment outcomes used the following variables to describe the different backgrounds of young adults:

1. *Race*—indicator for black children (defined for non-Hispanic blacks and non-Hispanic whites only; Hispanic, Asian, or Pacific Islander individuals were excluded from the sample, as were persons of unknown race)
2. *Sex*—indicator for girls
3. *Census region of high school (Northeast, North Central, South, or West)*—defined as of grade 12 for the NLS:72 sample, as of age 14 (and on the basis of the child's residence) for the NLSY samples, and as of grade 10 for the HSB sample
4. *Parental socioeconomic status (SES)* and *socioeconomic status squared*— a composite variable constructed using any non-missing measures of mother's education, father's education, mother's occupational status (in the NLSY samples only), father's occupational status, family income, and (in the NLS:72 and HSB samples only) the presence of certain household items. For the NLS:72 and HSB samples, the baseline SES measures described by NCES (1997b) were used. For each of the class years represented in the NLSY samples (1976 through 1982 for the NLSY senior sample, and 1974 through 1980 for the NLSY sophomore sample), SES was measured as follows. Each non-missing component was normalized to have mean zero and standard deviation one for youth regardless of race. These components were then averaged for each youth, and the averages were re-normalized the average to have mean zero and standard deviation one across the entire sample. Education levels were expressed by years of schooling, occupational status by the Duncan index, and family income by the natural log of annual income. SES was considered missing only if *all* of the components that could be used to construct the index were missing. These components are assumed to be highly correlated with each other, making it possible to compare SES values across observations and datasets even when specific components may be missing.
5. *Educational achievement* and *educational achievement squared*—an average of mathematics and reading achievement scores, with each component and the overall average normalized to have mean zero and standard deviation one for all individuals (regardless of race) in the same grade in the same year in each sample

## C. Sample Sizes and Multiple Imputation of Missing Data

The analysis of black-white differences in educational attainment used the same four datasets that were used in the analysis of labor market outcomes. Sample sizes for these datasets are reported in tables A.1 and A.2 above.

Between 30 and 57 percent of cases have missing values for one or more key analysis variables. We addressed this problem through multiple imputation. Section I.D above describes the basic approach, and appendix C gives details on the calculation of estimates and standard errors using imputed data.

# IV. DATA USED IN THE ANALYSES OF EDUCATIONAL ACHIEVEMENT OUTCOMES

## A. Samples

Four sources of data were used in the analysis of black-white differences in educational achievement outcomes. These sources included Cohorts 1, 3, and 7 of the Chapter One Prospects Study, and the National Educational Longitudinal Study of 1988 (NELS:88).

The Prospects Study is a panel study of elementary and junior high school education that includes three cohorts distinguished by the grade of students during the base year (grades 1, 3, and 7). Data collection, including mathematics and reading achievement testing, began in 1991 and 1992 and continued through 1994. When the samples were defined, 1994 data were unavailable for each cohort, so the Cohort 1 sample only included data through Grade 2, the Cohort 3 sample only included data through Grade 5, and the Cohort 7 sample only included data through Grade 9. For the NELS:88 sample, data were available for grades 8, 10, and 12, in 1988, 1990, and 1992, respectively.

## B. Variable Definitions

The following educational achievement outcome variables were defined in each sample:

1. *Mathematics achievement*—mathematics achievement test score, measured in grade 8 standard deviation units
2. *Reading achievement*—reading achievement test score, measured in grade 8 standard deviation units

Test scores were converted to grade 8 standard deviation units by subtracting the grade 8 mean for all children (regardless of race) from the raw test score, and dividing that difference by the grade 8 standard deviation for all children (regardless of race). Since no grade 8 scores were available for children in the Prospects Cohort 1 and Prospects Cohort 3 samples, means and standard deviations from the Prospects Cohort 7 sample were used.

The analyses of educational achievement outcomes used the following variables to describe the different backgrounds of young adults:

1. *Race*—indicator for black children (defined for non-Hispanic blacks and non-Hispanic whites only; Hispanic, Asian, or Pacific Islander individuals were excluded from the sample, as were persons of unknown race)
2. *Sex*—indicator for girls
3. *Census region of school (Northeast, North Central, South, or West)*—defined as of grades 1, 3, and 7 for the respective Prospects cohorts, and as of grade 8 for the NELS:88 sample
4. *Parental socioeconomic status (SES)* and *socioeconomic status squared*—a composite variable constructed using any non-missing measures of mother's education, father's education, mother's occupational status, father's occupational status, family income, and (in the NELS:88 sample only) the presence of certain household items. For the NELS:88, the baseline SES measure described by NCES (1995b) was used. For each of the Prospects samples, SES was measured by normalizing each non-missing component to have mean zero and standard deviation one across the entire sample, averaging these components for each child, and then re-

normalizing the average to have mean zero and standard deviation one across the entire sample. Education levels were expressed by years of schooling, occupational status by the Duncan index, and family income by the natural log of annual income. SES was considered missing only if *all* of the components that could be used to construct the index were missing. These components are assumed to be highly correlated with each other, making it possible to compare SES values across observations and datasets even when specific components may be missing.

5. *Prior educational achievement* and *educational achievement squared*—the corresponding math or reading achievement score, measured in grade 8 standard deviation units

## C. Sample Sizes

Table A.8 presents sample sizes for the four analyses samples. Cohort 1 of the Prospects Study includes 13,757 observations, 60 percent (8,236) of which were included in the analysis of achievement outcomes between grades 1 and 2.[13] About 40 percent of the sample (5,513) were not identified as either non-Hispanic black or non-Hispanic white (having either another or a missing indicator for race/ethnicity); eight additional cases had missing background information (sex or Census region). Of cases used in the analysis, 41 percent were missing key analysis variables (test scores or parental SES).[14]

Cohort 3 of the Prospects Study includes 19,311 observations, 61 percent (11,847) of which were included in the analysis of achievement outcomes between grades 3 and 5. About 35 percent of the sample (4,842) were not identified as either non-Hispanic black or non-Hispanic white (having either another or a missing indicator for race/ethnicity); an additional 4 percent (314) had missing sex or Census region. Of cases used in the analysis, 62 percent were missing one or more analysis variables.[15]

Cohort 7 of the Prospects Study includes 9,986 observations, 67 percent (6,655) of which were included in the analysis of achievement outcomes between grades 7 and 9. About 31 percent of the sample (3,069) were not identified as either non-Hispanic black or non-Hispanic white (having either another or a missing indicator for race/ethnicity); an additional 2 percent (262) had missing sex or Census region. Two-thirds of cases used in the analysis were missing one or more analysis variables.[16]

The NELS:88 sample consists of 27,588 observations, 55 percent (15,251) of which were included in the analysis of achievement outcomes between grades 8 and 12. About 40 percent of the sample (11,151) were not identified as either non-Hispanic black or non-Hispanic white (having either another or a missing indicator for race/ethnicity); around 4 percent (1,186) of the observations had missing sex or Census region. Of cases used in the analysis, 37 percent had missing values for one or more key variables.[17]

[13] Both fall and spring scores were available for grade 1. The spring scores were used in the analyses, because the fall math scores covered conceptual skills only, and not computational skills.

[14] Item nonresponse for the sample of blacks and whites in Prospects Cohort 1 ranged from 8.67 percent for the SES variable to 28.91 percent for the grade 2 math score.

[14] Item nonresponse for the sample of blacks and whites in Prospects Cohort 3 ranged from 19.68 percent for the SES variable to 46.26 percent for the grade 5 math score.

[15] Item nonresponse for the sample of blacks and whites in Prospects Cohort 7 ranged from 18.81 percent for the SES variable to 48.69 percent for the grade 9 math score.

[16] Item nonresponse for the sample of blacks and whites in NELS:88 ranged from 4.93 percent for the SES variable to 26.90 percent for the grade 12 reading score.

**Table A.8—Total sample sizes and excluded cases (achievement datasets)**

| | Prospects 1 | Prospects 3 | Prospects 7 | NELS: 88 |
|---|---|---|---|---|
| Total cases | 13,757 | 19,311 | 9,986 | 27,588 |
| Black | 2,559 | 3,765 | 1,790 | 2,300 |
| White | 5,685 | 8,750 | 5,127 | 14,137 |
| Other/not reported | 5,513 | 6,796 | 3,069 | 11,151 |
| Percent missing sex or region | 1.10 | 6.25 | 6.36 | 29.34 |
| Black | 0.16 | 6.61 | 4.86 | 13.35 |
| White | 0.07 | 4.79 | 3.41 | 6.22 |
| Other/not reported | 2.59 | 7.92 | 12.15 | 61.95 |
| Total included in analysis | 8,236 | 11,847 | 6,655 | 15,251 |
| Black | 2,555 | 3,516 | 1,703 | 1,993 |
| White | 5,681 | 8,331 | 4,952 | 13,258 |
| Percent with missing values | 41.2 | 61.7 | 65.0 | 37.3 |
| Black | 43.8 | 64.2 | 74.3 | 47.0 |
| White | 40.0 | 60.7 | 61.8 | 35.8 |

## D. Multiple Imputation of Missing Data

The restriction of each analysis sample to students with valid mathematics and reading scores and parental SES would reduce the number of observations included in the analyses of educational achievement outcomes by 40 to 65 percent. Preliminary comparisons revealed that children with missing test score data tended to have lower parental SES than children with valid test score data. While black-white differences in sex, Census region, and parental SES were similar for children with test score data present and children with test score data absent in the four samples, black-white differences in Census region were dissimilar between the two groups of children in the NELS:88 sample.

These differences suggest that simply excluding cases with missing test scores from the analysis may bias the estimation of equations predicting black-white differences in outcomes, yielding estimates that are only applicable to the population of students with valid SES and test score data. We address this problem through the use of multiple imputation, which allows the use of all available data for each case, even if some key variables such as test scores are missing. Multiple imputation is described in section I.D above, and in Schafer (1997).

The imputations used all observations from non-Hispanic blacks and non-Hispanic whites with known sex and Census region, and missing values were imputed for the remaining variables of interest. These variables were mathematics and reading achievement (initial, final, and grade 8, where available), and parental SES. To improve the efficiency of the imputation and capture school and regional effects, the sample weight, average SES by school and by race, and average initial math and reading achievement by school and by race were also included. Since all of these variables are continuous and approximately normally distributed, it was reasonable to assume a multivariate normal distribution for the variables in the imputation model. This assumption yields a simpler model than the general location model described above and used to impute missing data for mixed categorical/continuous variables. The software package NORM

**Table A.9—Sample sizes by race/sex category (achievement datasets)**

| | | Cohort 1 | Cohort 3 | Cohort 7 | NELS:88 |
|---|---|---|---|---|---|
| Total | all regions | 8,236 | 11,847 | 6,655 | 15,251 |
| White males | Northeast | 448 | 814 | 475 | 1,407 |
| | North Central | 620 | 773 | 596 | 2,104 |
| | South | 1,179 | 1,650 | 1,007 | 2,179 |
| | West | 655 | 1,008 | 505 | 1,013 |
| White females | Northeast | 417 | 780 | 454 | 1,397 |
| | North Central | 626 | 806 | 582 | 2,088 |
| | South | 1,160 | 1,610 | 916 | 2,130 |
| | West | 576 | 890 | 417 | 940 |
| Black males | Northeast | 290 | 455 | 250 | 157 |
| | North Central | 104 | 145 | 86 | 149 |
| | South | 809 | 958 | 437 | 620 |
| | West | 84 | 185 | 63 | 60 |
| Black females | Northeast | 319 | 473 | 251 | 154 |
| | North Central | 103 | 155 | 111 | 145 |
| | South | 749 | 977 | 442 | 645 |
| | West | 97 | 168 | 63 | 63 |

Version 2.0, created by Joe Schafer, was used to create the imputed datasets under the multivariate normal assumption.

Since the relationships among test scores may differ among race, sex, and region categories, missing values were imputed separately for each of the 16 subsets defined by the cross-classification of these variables (2 sexes x 2 races x 4 regions). The sample sizes for these 16 groups are indicated in table A.9. For each of the 16 subsets of NELS:88 and Cohorts 1 and 3 of the Prospects Study, we ran a single series of 2,500 iterations of data augmentation, using the default starting values and standard noninformative priors. We checked this series for convergence using the diagnostic plots suggested by Schaefer (1997)[18]. We examined time series and autocorrelation function (ACF) plots for each parameter (means and covariances for all variables in the imputation model). For all parameters and all subsets of the data, the plots indicated convergence of the data augmentation algorithm after a few hundred iterations. Time series plots for each parameter resembled a horizontal band, and autocorrelations diminished to near zero after a few lags.

Once we were satisfied that the data augmentation series had converged in fewer than 500 steps, we imputed missing values after every 500th step, for a total of 5 imputations. The data augmentation routine appeared to take longer to converge on the Prospects Cohort 7 data files. For each of these data files we ran a series of 5,000 steps of data augmentation and imputed after every 1,000th step.

For the first of the five multiple imputations, we merged the 16 subsets together, creating a single file that included observations from all sex, race, and region categories. We repeated this step for each imputation, creating a total of five files for use in the analysis. In the case of the Prospects Cohort 7 and NELS:88 datasets, we also imputed miss-

[18] Note that the method for assessing convergence is different than that described in section I.D. The software used for the general location model does not allow saving and plotting of series of parameters.

ing math and reading test scores for children of other races than black/non-Hispanic and white/non-Hispanic. These additional imputations allowed us to normalize, for the corresponding imputed datasets, all Prospects and NELS:88 test scores by the mean and standard deviation for the entire sample of 8th graders.

## E. Characteristics of Cases with Missing Data

Tables A.10 through A.13 show summary statistics on the key variables in the analysis of educational achievement. Some key differences exist between the distributions of the data for complete cases and cases with missing values. Test scores for reading and math were lower among cases with missing values than among complete cases in each of the four datasets. Among white children, these differences are statistically significant. Differences among black children are similar in magnitude but are not statistically significant, probably due to the smaller sample sizes for blacks. Cases with missing data had lower average SES and were more likely to come from the bottom SES quartile. This difference holds for both blacks and whites in each dataset.

Despite the differences in characteristics of complete cases and cases with missing data, the estimated black-white differences were similar for the two groups. There were no significant differences in the Prospects samples. In the NELS:88 sample, black-white differences in the percentage attending high school in the Midwest and South Census regions were smaller for cases with missing data. These results suggest that restricting analysis to complete cases might bias estimates of black-white differences only slightly. Strictly speaking, however, results of an analysis restricted to complete cases could be generalized only to the population of students with valid data on test scores and SES. Multiple imputation of missing data avoids this problem.

## Table A.10—Comparison of black and white children in Prospects Cohort 1, by presence of SES and test score data

| Sample definition and descriptive variables | SES and test score data present Mean | Std. Error | SES or test score data absent Mean | Std. Error | Difference-of-means (absent - present) Value | Std. Error | Statistical significance |
|---|---|---|---|---|---|---|---|
| Population of black and white children | (N=4474) | | (N=3068) | | | | |
| Percentage black | 18.4 | 0.0 | 20.0 | 0.1 | 1.6 | 2.7 | |
| Population of white children | (N=3205) | | (N=2074) | | | | |
| Percentage female | 48.2 | 1.3 | 50.1 | 0.0 | 1.9 | 2.4 | |
| Percentage attending high school in the Northeast | 7.6 | 2.8 | 6.7 | 0.0 | -1.0 | 2.3 | |
| Percentage attending high school in the Midwest | 29.2 | 7.0 | 26.7 | 0.2 | -2.5 | 9.1 | |
| Percentage attending high school in the South | 45.8 | 7.6 | 41.0 | 0.2 | -4.9 | 6.8 | |
| Percentage attending high school in the West | 17.3 | 5.5 | 25.6 | 0.2 | 8.3 | 6.6 | |
| Socioeconomic status | 0.222 | 0.060 | 0.076 | 0.065 | -0.146 | 0.068 | ** |
| Percentage in bottom SES quartile | 13.0 | 1.6 | 21.5 | 0.1 | 8.5 | 2.5 | ** |
| Percentage in lower-middle SES quartile | 27.7 | 2.2 | 23.2 | 0.0 | -4.5 | 2.2 | ** |
| Percentage in upper-middle SES quartile | 30.6 | 1.7 | 25.7 | 0.0 | -4.9 | 2.7 | |
| Percentage in top SES quartile | 28.7 | 3.0 | 29.6 | 0.1 | 0.9 | 3.4 | |
| Mean grade 2 math score | -2.6 | 0.1 | -2.8 | 0.1 | -0.2 | 0.1 | ** |
| Mean grade 2 reading score | -2.0 | 0.1 | -2.2 | 0.1 | -0.2 | 0.1 | ** |
| Mean initial (grade 1) math score | -4.0 | 0.1 | -4.3 | 0.1 | -0.3 | 0.1 | ** |
| Mean initial (grade 1) reading score | -3.4 | 0.1 | -3.6 | 0.1 | -0.2 | 0.1 | ** |
| Population of black children | (N=1269) | | (N=994) | | | | |
| Percentage female | 51.1 | 3.2 | 46.7 | 2.1 | -4.4 | 2.7 | |
| Percentage attending high school in the Northeast | 16.9 | 7.5 | 14.5 | 5.2 | -2.4 | 4.5 | |
| Percentage attending high school in the Midwest | 9.8 | 4.8 | 9.1 | 3.8 | -0.7 | 2.7 | |
| Percentage attending high school in the South | 68.1 | 8.8 | 64.0 | 7.2 | -4.1 | 5.5 | |
| Percentage attending high school in the West | 5.2 | 2.4 | 12.4 | 4.2 | 7.2 | 3.0 | ** |
| Socioeconomic status | -0.479 | 0.119 | -0.681 | 0.084 | -0.202 | 0.095 | ** |
| Percentage in bottom SES quartile | 43.4 | 4.9 | 51.3 | 3.2 | 7.9 | 4.4 | |
| Percentage in lower-middle SES quartile | 21.9 | 2.1 | 21.4 | 2.0 | -0.5 | 3.0 | |
| Percentage in upper-middle SES quartile | 22.7 | 3.1 | 15.0 | 1.7 | -7.6 | 3.3 | ** |
| Percentage in top SES quartile | 12.0 | 3.4 | 12.3 | 2.5 | 0.2 | 3.0 | |
| Mean grade 2 math score | -3.4 | 0.1 | -3.7 | 0.2 | -0.3 | 0.1 | ** |
| Mean grade 2 reading score | -3.2 | 0.2 | -3.5 | 0.2 | -0.3 | 0.1 | ** |
| Mean initial (grade 1) math score | -5.2 | 0.3 | -5.4 | 0.2 | -0.2 | 0.2 | |
| Mean initial (grade 1) reading score | -4.4 | 0.2 | -4.6 | 0.2 | -0.2 | 0.2 | |
| Difference between black and white children | | | | | | | |
| Percentage female | 2.9 | 3.6 | -3.4 | 2.8 | -6.4 | 3.9 | |
| Percentage attending high school in the Northeast | 9.3 | 7.6 | 7.8 | 5.4 | -1.4 | 4.9 | |
| Percentage attending high school in the Midwest | -19.4 | 7.1 | -17.7 | 8.9 | 1.8 | 8.5 | |
| Percentage attending high school in the South | 22.3 | 9.8 | 23.0 | 8.8 | 0.7 | 7.8 | |
| Percentage attending high school in the West | -12.1 | 5.0 | -13.2 | 6.8 | -1.1 | 7.0 | |
| Socioeconomic status | -0.702 | 0.111 | -0.758 | 0.096 | -0.056 | 0.108 | |
| Percentage in bottom SES quartile | 30.4 | 4.7 | 29.8 | 3.8 | -0.6 | 4.9 | |
| Percentage in lower-middle SES quartile | -5.8 | 2.8 | -1.8 | 2.5 | 4.0 | 3.5 | |
| Percentage in upper-middle SES quartile | -7.9 | 3.2 | -10.6 | 2.5 | -2.7 | 4.2 | |
| Percentage in top SES quartile | -16.7 | 3.3 | -17.4 | 3.8 | -0.7 | 4.2 | |
| Mean grade 2 math score | -0.8 | 0.1 | -0.9 | 0.1 | -0.1 | 0.2 | |
| Mean grade 2 reading score | -1.2 | 0.2 | -1.3 | 0.2 | -0.1 | 0.2 | |
| Mean initial (grade 1) math score | -1.1 | 0.2 | -1.0 | 0.1 | 0.1 | 0.2 | |
| Mean initial (grade 1) reading score | -1.0 | 0.2 | -0.9 | 0.2 | 0.0 | 0.2 | |

** Difference-of-means between two groups is statistically significant at p<=.05.

NOTE: Standard errors have been adjusted for complex survey designs. Numbers may not sum to totals due to rounding. Sample sizes are smaller than those reported in table A.2 because observations with a sampling weight of zero were excluded from the tabulations. Multiple imputation used to account for missing data.

SOURCE: U.S. Department of Education, Chapter 1 Prospects Study.

## Table A.11—Comparison of black and white children in Prospects Cohort 3, by presence of SES and test score data

| Sample definition and descriptive variables | SES and test score data present Mean | Std. Error | SES or test score data absent Mean | Std. Error | Difference-of-means (absent - present) Value | Std. Error | Statistical significance |
|---|---|---|---|---|---|---|---|
| Population of black and white children | (N=4224) | | (N=6793) | | | | |
| Percentage black | 15.7 | 2.5 | 16.0 | 2.2 | 0.3 | 2.1 | |
| Population of white children | (N=3099) | | (N=4773) | | | | |
| Percentage female | 51.1 | 1.9 | 48.7 | 1.0 | -2.4 | 2.3 | |
| Percentage attending high school in the Northeast | 17.8 | 6.2 | 15.0 | 3.7 | -2.9 | 5.6 | |
| Percentage attending high school in the Midwest | 27.5 | 6.6 | 25.7 | 5.9 | -1.7 | 6.5 | |
| Percentage attending high school in the South | 38.0 | 7.2 | 39.9 | 6.5 | 1.9 | 6.9 | |
| Percentage attending high school in the West | 16.7 | 5.2 | 19.4 | 5.0 | 2.7 | 5.3 | |
| Socioeconomic status | 0.205 | 0.066 | 0.108 | 0.060 | -0.097 | 0.073 | |
| Percentage in bottom SES quartile | 14.7 | 1.7 | 21.1 | 1.7 | 6.4 | 2.0 | ** |
| Percentage in lower-middle SES quartile | 27.4 | 2.4 | 24.4 | 1.6 | -3.0 | 2.5 | |
| Percentage in upper-middle SES quartile | 30.6 | 1.6 | 24.9 | 1.2 | -5.7 | 2.0 | ** |
| Percentage in top SES quartile | 27.4 | 3.5 | 29.7 | 3.0 | 2.3 | 3.9 | |
| Mean grade 5 math score | -0.5 | 0.0 | -0.7 | 0.0 | -0.2 | 0.0 | ** |
| Mean grade 5 reading score | -0.4 | 0.0 | -0.6 | 0.1 | -0.2 | 0.1 | ** |
| Mean initial (grade 3) math score | -1.3 | 0.0 | -1.4 | 0.0 | -0.1 | 0.0 | ** |
| Mean initial (grade 3) reading score | -1.0 | 0.0 | -1.2 | 0.0 | -0.2 | 0.1 | ** |
| Population of black children | (N=1125) | | (N=2020) | | | | |
| Percentage female | 52.8 | 2.0 | 48.6 | 1.9 | -4.2 | 3.0 | |
| Percentage attending high school in the Northeast | 24.6 | 8.6 | 20.9 | 5.9 | -3.7 | 4.3 | |
| Percentage attending high school in the Midwest | 6.9 | 3.7 | 12.5 | 4.1 | 5.5 | 2.9 | ** |
| Percentage attending high school in the South | 61.6 | 8.4 | 57.9 | 6.6 | -3.7 | 5.4 | |
| Percentage attending high school in the West | 6.9 | 2.3 | 8.8 | 2.6 | 1.9 | 2.1 | |
| Socioeconomic status | -0.419 | 0.109 | -0.507 | 0.069 | -0.088 | 0.071 | |
| Percentage in bottom SES quartile | 37.1 | 4.5 | 44.4 | 2.7 | 7.3 | 3.4 | ** |
| Percentage in lower-middle SES quartile | 28.5 | 2.5 | 21.7 | 1.8 | -6.9 | 3.0 | ** |
| Percentage in upper-middle SES quartile | 22.2 | 2.6 | 20.5 | 2.3 | -1.7 | 2.1 | |
| Percentage in top SES quartile | 12.1 | 3.4 | 13.4 | 1.7 | 1.3 | 3.0 | |
| Mean grade 5 math score | -1.0 | 0.1 | -1.2 | 0.1 | -0.3 | 0.1 | ** |
| Mean grade 5 reading score | -1.3 | 0.1 | -1.5 | 0.1 | -0.2 | 0.1 | |
| Mean initial (grade 3) math score | -1.8 | 0.1 | -2.0 | 0.1 | -0.2 | 0.1 | ** |
| Mean initial (grade 3) reading score | -1.7 | 0.1 | -2.0 | 0.1 | -0.2 | 0.1 | ** |
| Difference between black and white children | | | | | | | |
| Percentage female | 1.7 | 3.2 | 0.0 | 2.3 | -1.7 | 4.4 | |
| Percentage attending high school in the Northeast | 6.8 | 9.4 | 5.9 | 6.5 | -0.9 | 6.1 | |
| Percentage attending high school in the Midwest | -20.5 | 7.2 | -13.3 | 6.5 | 7.3 | 7.1 | |
| Percentage attending high school in the South | 23.6 | 9.3 | 18.0 | 8.0 | -5.6 | 7.4 | |
| Percentage attending high school in the West | -9.8 | 4.7 | -10.6 | 5.2 | -0.8 | 5.1 | |
| Socioeconomic status | -0.624 | 0.112 | -0.615 | 0.082 | 0.010 | 0.087 | |
| Percentage in bottom SES quartile | 22.5 | 4.5 | 23.3 | 3.0 | 0.9 | 3.5 | |
| Percentage in lower-middle SES quartile | 1.2 | 3.3 | -2.7 | 2.5 | -3.9 | 3.9 | |
| Percentage in upper-middle SES quartile | -8.4 | 3.2 | -4.4 | 2.5 | 4.0 | 3.0 | |
| Percentage in top SES quartile | -15.3 | 4.3 | -16.3 | 3.2 | -1.0 | 4.4 | |
| Mean grade 5 math score | -0.4 | 0.1 | -0.5 | 0.1 | -0.1 | 0.1 | |
| Mean grade 5 reading score | -0.9 | 0.1 | -0.9 | 0.1 | 0.0 | 0.1 | |
| Mean initial (grade 3) math score | -0.5 | 0.1 | -0.6 | 0.1 | 0.0 | 0.1 | |
| Mean initial (grade 3) reading score | -0.7 | 0.1 | -0.8 | 0.1 | 0.0 | 0.1 | |

** Difference-of-means between two groups is statistically significant at p<=.05.

NOTE: Standard errors have been adjusted for complex survey designs. Numbers may not sum to totals due to rounding. Sample sizes are smaller than those reported in table A.2 because observations with a sampling weight of zero were excluded from the tabulations. Multiple imputation used to account for missing data.

SOURCE: U.S. Department of Education, Chapter 1 Prospects Study.

## Table A.12—Comparison of black and white children in Prospects Cohort 7, by presence of SES and test score data

| Sample definition and descriptive variables | SES and test score data present | | SES or test score data absent | | Difference-of-means (absent - present) | | Statistical-significance |
|---|---|---|---|---|---|---|---|
| | Mean | Std. Error | Mean | Std. Error | Value | Std. Error | |
| Population of black and white children | (N=2332) | | (N=4322) | | | | |
| Percentage black | 12.5 | 2.5 | 19.3 | 2.9 | 6.8 | 2.1 | ** |
| Population of white children | (N=1894) | | (N=3057) | | | | |
| Percentage female | 50.3 | 1.5 | 46.6 | 1.4 | -3.8 | 2.0 | |
| Percentage attending high school in the Northeast | 16.6 | 5.9 | 12.6 | 3.9 | -3.9 | 4.2 | |
| Percentage attending high school in the Midwest | 29.7 | 8.2 | 26.2 | 6.1 | -3.5 | 6.5 | |
| Percentage attending high school in the South | 37.7 | 7.8 | 42.0 | 6.5 | 4.3 | 6.1 | |
| Percentage attending high school in the West | 16.0 | 5.4 | 19.1 | 4.9 | 3.1 | 4.2 | |
| Socioeconomic status | 0.233 | 0.056 | 0.108 | 0.059 | -0.124 | 0.064 | ** |
| Percentage in bottom SES quartile | 13.3 | 1.5 | 21.1 | 1.8 | 7.8 | 1.9 | ** |
| Percentage in lower-middle SES quartile | 28.2 | 1.7 | 24.9 | 1.4 | -3.3 | 2.0 | |
| Percentage in upper-middle SES quartile | 30.5 | 1.7 | 25.4 | 1.7 | -5.1 | 2.4 | ** |
| Percentage in top SES quartile | 28.0 | 2.9 | 28.6 | 2.9 | 0.6 | 3.5 | |
| Mean grade 9 math score | 0.4 | 0.1 | 0.2 | 0.0 | -0.3 | 0.1 | ** |
| Mean grade 9 reading score | 0.4 | 0.1 | 0.2 | 0.0 | -0.3 | 0.1 | ** |
| Mean initial (grade 7) math score | 0.1 | 0.0 | -0.1 | 0.0 | -0.2 | 0.0 | ** |
| Mean initial (grade 7) reading score | 0.2 | 0.0 | 0.0 | 0.0 | -0.2 | 0.0 | ** |
| Population of black children | (N=438) | | (N=1265) | | | | |
| Percentage female | 49.1 | 4.2 | 52.7 | 1.9 | 3.6 | 4.8 | |
| Percentage attending high school in the Northeast | 13.3 | 5.9 | 14.3 | 4.8 | 1.0 | 3.6 | |
| Percentage attending high school in the Midwest | 18.6 | 9.8 | 16.6 | 6.8 | -2.0 | 6.0 | |
| Percentage attending high school in the South | 61.0 | 10.3 | 56.1 | 8.3 | -4.9 | 7.2 | |
| Percentage attending high school in the West | 7.1 | 3.1 | 13.1 | 4.6 | 6.0 | 2.8 | ** |
| Socioeconomic status | -0.351 | 0.102 | -0.524 | 0.101 | -0.173 | 0.115 | |
| Percentage in bottom SES quartile | 35.1 | 4.6 | 45.7 | 3.8 | 10.5 | 5.0 | ** |
| Percentage in lower-middle SES quartile | 25.9 | 3.1 | 19.2 | 1.8 | -6.7 | 3.0 | ** |
| Percentage in upper-middle SES quartile | 24.8 | 3.4 | 19.1 | 2.7 | -5.6 | 4.3 | |
| Percentage in top SES quartile | 14.2 | 2.9 | 16.0 | 2.6 | 1.8 | 3.4 | |
| Mean grade 9 math score | -0.3 | 0.1 | -0.5 | 0.1 | -0.2 | 0.1 | ** |
| Mean grade 9 reading score | -0.4 | 0.1 | -0.6 | 0.1 | -0.2 | 0.1 | |
| Mean initial (grade 7) math score | -0.4 | 0.1 | -0.6 | 0.1 | -0.2 | 0.1 | |
| Mean initial (grade 7) reading score | -0.4 | 0.1 | -0.7 | 0.1 | -0.3 | 0.1 | ** |
| Difference between black and white children | | | | | | | |
| Percentage female | -1.2 | 4.3 | 6.1 | 2.4 | 7.4 | 5.2 | |
| Percentage attending high school in the Northeast | -3.3 | 7.4 | 1.6 | 5.8 | 4.9 | 4.8 | |
| Percentage attending high school in the Midwest | -11.1 | 9.4 | -9.6 | 8.1 | 1.4 | 6.4 | |
| Percentage attending high school in the South | 23.3 | 10.7 | 14.1 | 8.9 | -9.2 | 7.7 | |
| Percentage attending high school in the West | -8.9 | 5.5 | -6.0 | 5.6 | 2.9 | 4.9 | |
| Socioeconomic status | -0.584 | 0.108 | -0.633 | 0.110 | -0.048 | 0.122 | |
| Percentage in bottom SES quartile | 21.8 | 4.6 | 24.5 | 4.1 | 2.7 | 5.0 | |
| Percentage in lower-middle SES quartile | -2.3 | 3.5 | -5.7 | 2.2 | -3.4 | 3.6 | |
| Percentage in upper-middle SES quartile | -5.7 | 3.9 | -6.2 | 3.2 | -0.5 | 4.9 | |
| Percentage in top SES quartile | -13.8 | 3.7 | -12.6 | 3.7 | 1.2 | 4.5 | |
| Mean grade 9 math score | -0.7 | 0.1 | -0.7 | 0.1 | 0.0 | 0.1 | |
| Mean grade 9 reading score | -0.8 | 0.1 | -0.8 | 0.1 | 0.1 | 0.1 | |
| Mean initial (grade 7) math score | -0.5 | 0.1 | -0.5 | 0.1 | 0.0 | 0.1 | |
| Mean initial (grade 7) reading score | -0.6 | 0.1 | -0.7 | 0.1 | -0.1 | 0.1 | |

** Difference-of-means between two groups is statistically significant at p<=.05.

NOTE: Standard errors have been adjusted for complex survey designs. Numbers may not sum to totals due to rounding. Sample sizes are smaller than those reported in table A.2 because observations with a sampling weight of zero were excluded from the tabulations. Multiple imputation used to account for missing data.

SOURCE: U.S. Department of Education, Chapter 1 Prospects Study.

## Table A.13—Comparison of black and white children in NELS:88, by presence of SES and test score data

| Sample definition and descriptive variables | SES and test score data present Mean | Std. Error | SES or test score data absent Mean | Std. Error | Difference-of-means (absent - present) Value | Std. Error | Statistical significance |
|---|---|---|---|---|---|---|---|
| Population of black and white children | (N=9564) | | (N=3390) | | | | |
| Percentage black | 12.5 | 0.9 | 20.7 | 2.0 | 8.2 | 1.8 | ** |
| Population of white children | (N=8508) | | (N=2878) | | | | |
| Percentage female | 49.6 | 0.9 | 50.8 | 1.5 | 1.1 | 1.8 | |
| Percentage attending high school in the Northeast | 21.4 | 2.0 | 20.1 | 2.0 | -1.3 | 1.6 | |
| Percentage attending high school in the Midwest | 33.2 | 2.1 | 26.7 | 2.1 | -6.5 | 1.9 | ** |
| Percentage attending high school in the South | 30.5 | 1.9 | 32.9 | 2.1 | 2.4 | 1.9 | |
| Percentage attending high school in the West | 14.9 | 1.4 | 20.3 | 2.1 | 5.4 | 1.7 | ** |
| Socioeconomic status | 0.12 | 0.02 | 0.02 | 0.03 | -0.10 | 0.03 | ** |
| Percentage in bottom SES quartile | 15.7 | 0.8 | 20.4 | 1.5 | 4.7 | 1.5 | ** |
| Percentage in lower-middle SES quartile | 24.6 | 0.8 | 26.1 | 1.3 | 1.5 | 1.4 | |
| Percentage in upper-middle SES quartile | 28.3 | 0.8 | 25.9 | 1.3 | -2.3 | 1.5 | |
| Percentage in top SES quartile | 31.5 | 1.2 | 27.6 | 1.5 | -3.9 | 1.6 | ** |
| Mean grade 12 math score | 1.32 | 0.03 | 0.90 | 0.04 | -0.42 | 0.04 | ** |
| Mean grade 12 reading score | 0.95 | 0.02 | 0.62 | 0.05 | -0.33 | 0.05 | ** |
| Mean initial (grade 8) math score | 0.31 | 0.02 | -0.01 | 0.03 | -0.32 | 0.03 | ** |
| Mean initial (grade 8) reading score | 0.28 | 0.02 | -0.02 | 0.03 | -0.30 | 0.03 | ** |
| Population of black children | (N=1056) | | (N=512) | | | | |
| Percentage female | 53.3 | 2.2 | 49.5 | 3.9 | -3.8 | 4.4 | |
| Percentage attending high school in the Northeast | 13.1 | 2.3 | 19.3 | 4.3 | 6.1 | 3.7 | |
| Percentage attending high school in the Midwest | 12.8 | 2.3 | 13.3 | 2.7 | 0.5 | 2.7 | |
| Percentage attending high school in the South | 68.4 | 3.3 | 59.6 | 5.2 | -8.8 | 5.0 | |
| Percentage attending high school in the West | 5.6 | 1.3 | 7.7 | 2.3 | 2.1 | 2.3 | |
| Socioeconomic status | -0.37 | 0.04 | -0.41 | 0.07 | -0.04 | 0.07 | |
| Percentage in bottom SES quartile | 37.8 | 2.3 | 41.2 | 4.2 | 3.5 | 4.6 | |
| Percentage in lower-middle SES quartile | 28.3 | 2.5 | 24.0 | 3.2 | -4.4 | 4.0 | |
| Percentage in upper-middle SES quartile | 20.6 | 1.8 | 22.4 | 3.6 | 1.9 | 4.1 | |
| Percentage in top SES quartile | 13.3 | 1.8 | 12.4 | 3.9 | -1.0 | 4.1 | |
| Mean grade 12 math score | 0.42 | 0.06 | 0.18 | 0.12 | -0.24 | 0.13 | |
| Mean grade 12 reading score | 0.21 | 0.05 | -0.09 | 0.14 | -0.30 | 0.14 | ** |
| Mean initial (grade 8) math score | -0.46 | 0.04 | -0.64 | 0.08 | -0.19 | 0.08 | ** |
| Mean initial (grade 8) reading score | -0.35 | 0.04 | -0.61 | 0.09 | -0.26 | 0.09 | ** |
| Difference between black and white children | | | | | | | |
| Percentage female | 3.7 | 2.3 | -1.3 | 4.1 | -4.9 | 4.8 | |
| Percentage attending high school in the Northeast | -8.3 | 2.9 | -0.8 | 4.7 | 7.4 | 4.0 | |
| Percentage attending high school in the Midwest | -20.4 | 2.8 | -13.3 | 3.3 | 7.1 | 3.2 | ** |
| Percentage attending high school in the South | 37.9 | 3.5 | 26.7 | 5.5 | -11.1 | 5.3 | ** |
| Percentage attending high school in the West | -9.3 | 1.8 | -12.6 | 3.0 | -3.3 | 2.8 | |
| Socioeconomic status | -0.49 | 0.04 | -0.43 | 0.08 | 0.06 | 0.08 | |
| Percentage in bottom SES quartile | 22.1 | 2.4 | 20.9 | 4.5 | -1.2 | 4.8 | |
| Percentage in lower-middle SES quartile | 3.8 | 2.6 | -2.2 | 3.4 | -5.9 | 4.2 | |
| Percentage in upper-middle SES quartile | -7.7 | 1.9 | -3.5 | 3.8 | 4.2 | 4.4 | |
| Percentage in top SES quartile | -18.2 | 2.1 | -15.2 | 4.1 | 2.9 | 4.4 | |
| Mean grade 12 math score | -0.90 | 0.06 | -0.72 | 0.12 | 0.18 | 0.13 | |
| Mean grade 12 reading score | -0.74 | 0.06 | -0.71 | 0.15 | 0.03 | 0.16 | |
| Mean initial (grade 8) math score | -0.76 | 0.05 | -0.64 | 0.08 | 0.13 | 0.09 | |
| Mean initial (grade 8) reading score | -0.63 | 0.04 | -0.59 | 0.10 | 0.04 | 0.10 | |

** Difference-of-means between two groups is statistically significant at p<=.05.

NOTE: Standard errors have been adjusted for complex survey designs. Numbers may not sum to totals due to rounding. Sample sizes are smaller than those reported in table A.2 because observations with a sampling weight of zero were excluded from the tabulations. Multiple imputation used to account for missing data.

SOURCE: U.S. Department of Education, National Center for Education Statistics, National Educational Longitudinal Study of 1988 (NELS:88).

# APPENDIX B: SAMPLE COMPARISONS

Several samples were constructed in the study of black-white differences in educational and economic outcomes. While efforts were made to construct comparable samples from different data sources, there are systematic differences among the samples. This appendix compares the samples used in analyses of educational achievement, labor market and attainment outcomes, and describes differences among them. In all instances, the comparisons rely on both reported and (multiple) imputed data to infer the characteristics of each sample of individuals.

## I. COMPARISONS OF SAMPLES USED IN ANALYSES OF LABOR MARKET AND ATTAINMENT OUTCOMES

Comparison of the core background characteristics and levels of educational attainment and work experience in the NLS:72 and NLSY senior samples indicates some differences between the two samples of young adults (table B.1):

- Blacks represented a larger (weighted) proportion of the NLSY sample than the NLS:72 sample.
- Compared with white young adults in the NLS:72 sample, white young adults in the NLSY sample were less likely to have attended or completed college, had more work experience, and had lower wages and lower earnings.
- Compared with black young adults in the NLS:72 sample, black young adults in the NLSY sample were more likely to be male, were less likely to have attended or completed college, had less work experience, were less likely to participate in the labor force, and had lower wages and earnings.

The two samples had similar black-white differences in census region, educational achievement, SES, and college attendance and completion. The two samples had dissimilar black-white differences in sex, work experience, labor force participation, wages, and earnings.

While black young adults represented about the same proportion of the NLSY and HSB sophomore samples, several differences were apparent between these two samples (table B.2):

- Compared with white young adults in the NLSY sample, white young adults in the HSB sample were more likely to have completed high school, attended college and completed college, and had higher earnings.
- Compared with black young adults in the NLSY sample, black young adults in the HSB sample had higher parental SES, had higher levels of educational achievement, were more likely to have completed high school, had more work experience, and had higher earnings.

## Table B.1—Comparison of black and white young adults in two datasets observed 7 years after grade 12

| Sample definition and descriptive variables | Observed in 1979 (from NLS:72) Mean | Std. Error | Observed in 1983-89 (from NLSY) Mean | Std. Error | Difference-of-means (NLSY - NLS:72) Value | Std. Error | Statistical significance |
|---|---|---|---|---|---|---|---|
| Population of black and white children | (N=12,577) | | (N=7424) | | | | |
| Percentage black | 9.8 | 0.0 | 13.1 | 0.0 | 3.3 | 1.7 | ** |
| Population of white young adults | (N=10,978) | | (N=5426) | | | | |
| Percentage female | 49.2 | 0.7 | 49.4 | 0.0 | 0.2 | 1.0 | |
| Percentage attending high school in the Northeast | 25.9 | 1.7 | 23.7 | 0.1 | -2.2 | 4.6 | |
| Percentage attending high school in the Midwest | 33.4 | 1.8 | 35.1 | 0.1 | 1.7 | 5.1 | |
| Percentage attending high school in the South | 24.2 | 1.5 | 25.7 | 0.1 | 1.5 | 4.2 | |
| Percentage attending high school in the West | 16.5 | 1.4 | 15.5 | 0.0 | -1.0 | 3.4 | |
| Socioeconomic status | 0.092 | 0.014 | 0.095 | 0.031 | 0.003 | 0.034 | |
| Educational achievement | 0.2 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | |
| Percentage that attended college | 62.9 | 0.7 | 55.7 | 0.0 | -7.2 | 1.5 | ** |
| Percentage that completed college | 27.1 | 0.7 | 23.5 | 0.0 | -3.6 | 1.3 | ** |
| Average years of work experience | 4.8 | 0.0 | 5.0 | 0.1 | 0.2 | 0.1 | ** |
| Percentage that are in the labor force | 84.2 | 0.4 | 84.8 | 0.7 | 0.6 | 0.8 | |
| Natural log of wage | 2.4 | 0.0 | 2.2 | 0.1 | -0.2 | 0.1 | ** |
| Percentage that have earnings | 89.4 | 0.4 | 87.2 | 0.6 | -2.2 | 0.7 | ** |
| Earnings | 19,052 | 178 | 16,261 | 356 | -2,791 | 395 | ** |
| Population of black young adults | (N=1599) | | (N=1998) | | | | |
| Percentage female | 57.6 | 1.5 | 52.1 | 1.2 | -5.5 | 1.9 | ** |
| Percentage attending high school in the Northeast | 15.0 | 2.3 | 17.4 | 3.7 | 2.5 | 4.4 | |
| Percentage attending high school in the Midwest | 17.6 | 3.0 | 18.2 | 3.9 | 0.6 | 4.9 | |
| Percentage attending high school in the South | 61.0 | 3.4 | 58.8 | 5.2 | -2.2 | 6.2 | |
| Percentage attending high school in the West | 6.5 | 1.3 | 5.5 | 1.3 | -0.9 | 1.8 | |
| Socioeconomic status | -0.585 | 0.023 | -0.557 | 0.035 | 0.028 | 0.042 | |
| Educational achievement | -1.0 | 0.0 | -1.0 | 0.0 | 0.0 | 0.0 | |
| Percentage that attended college | 58.7 | 1.6 | 49.5 | 1.6 | -9.2 | 2.3 | ** |
| Percentage that completed college | 17.6 | 1.1 | 11.6 | 0.9 | -6.0 | 1.4 | ** |
| Average years of work experience | 4.3 | 0.1 | 4.0 | 0.1 | -0.3 | 0.1 | ** |
| Percentage that are in the labor force | 86.1 | 1.0 | 79.2 | 1.3 | -6.8 | 1.6 | ** |
| Natural log of wage | 2.3 | 0.0 | 2.0 | 0.1 | -0.3 | 0.1 | ** |
| Percentage that have earnings | 87.1 | 1.0 | 78.5 | 1.3 | -8.6 | 1.6 | ** |
| Earnings | 16,307 | 439 | 10,822 | 367 | -5,485 | 580 | ** |
| Difference between black and white children | | | | | | | |
| Percentage female | 8.4 | 1.6 | 2.7 | 1.4 | -5.7 | 2.1 | ** |
| Percentage attending high school in the Northeast | -11.0 | 2.6 | -6.3 | 5.1 | 4.7 | 5.7 | |
| Percentage attending high school in the Midwest | -15.8 | 3.3 | -16.9 | 5.5 | -1.1 | 6.5 | |
| Percentage attending high school in the South | 36.8 | 3.4 | 33.1 | 5.7 | -3.7 | 6.6 | |
| Percentage attending high school in the West | -10.0 | 1.8 | -9.9 | 3.1 | 0.1 | 3.6 | |
| Socioeconomic status | -0.677 | 0.026 | -0.652 | 0.047 | 0.025 | 0.054 | |
| Educational achievement | -115.0 | 3.4 | -118.4 | 4.2 | -3.4 | 5.4 | |
| Percentage that attended college | -4.2 | 1.8 | -6.2 | 2.0 | -2.0 | 2.7 | |
| Percentage that completed college | -9.6 | 1.3 | -11.9 | 1.4 | -2.3 | 1.9 | |
| Average years of work experience | -0.5 | 0.1 | -1.0 | 0.1 | -0.5 | 0.1 | ** |
| Percentage that are in the labor force | 1.8 | 1.1 | -5.6 | 1.4 | -7.4 | 1.8 | ** |
| Natural log of wage | -0.1 | 0.0 | -0.2 | 0.0 | -0.1 | 0.0 | ** |
| Percentage that have earnings | -2.3 | 1.1 | -8.7 | 1.4 | -6.4 | 1.7 | ** |
| Earnings | -2,745 | 475 | -5,439 | 511 | -2,694 | 714 | ** |

** Difference-of-means between two groups is statistically significant at p<=.05.

NOTE: Standard errors have been adjusted for complex survey designs. Numbers may not sum to totals due to rounding. Sample sizes are smaller than those reported previously because observations with a sampling weight of zero were excluded from the tabulations. Multiple imputation used to account for missing data.

SOURCE: U.S. Department of Education, National Center for Education Statistics, High School and Beyond (HSB); and U.S. Department of Labor, Bureau of Labor Statistics, National Longitudinal Survey of Youth (NLSY).

## Table B.2—Comparison of black and white young adults in two datasets observed 12 years after grade 10

| Sample definition and descriptive variables | Observed in 1986-92 (from NLSY) Mean | Std. Error | Observed in 1992 (from HSB) Mean | Std. Error | Difference-of-means (HSB - NLSY) Value | Std. Error | Statistical significance |
|---|---|---|---|---|---|---|---|
| Population of black and white children | (N=8998) | | (N=10,929) | | | | |
| Percentage black | 13.8 | 0.0 | 15.0 | 0.0 | 1.2 | 1.8 | |
| Population of white young adults | (N=6554) | | (N=8782) | | | | |
| Percentage female | 49.0 | 0.7 | 50.5 | 0.0 | 1.5 | 0.9 | |
| Percentage attending high school in the Northeast | 23.0 | 4.0 | 23.9 | 0.0 | 0.9 | 4.4 | |
| Percentage attending high school in the Midwest | 34.6 | 4.7 | 31.8 | 0.0 | -2.8 | 5.0 | |
| Percentage attending high school in the South | 26.1 | 3.9 | 28.4 | 0.0 | 2.3 | 4.2 | |
| Percentage attending high school in the West | 16.2 | 3.2 | 15.9 | 0.0 | -0.4 | 3.5 | |
| Socioeconomic status | 0.100 | 0.029 | 0.054 | 0.016 | -0.046 | 0.033 | |
| Educational achievement | 0.2 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | |
| Percentage that completed high school | 85.8 | 0.7 | 95.3 | 0.0 | 9.5 | 0.8 | ** |
| Percentage that attended college | 53.9 | 1.2 | 60.2 | 0.0 | 6.3 | 1.5 | ** |
| Percentage that completed college | 24.0 | 1.1 | 26.9 | 0.8 | 2.9 | 1.4 | ** |
| Average years of work experience | 7.5 | 0.1 | 7.6 | 0.0 | 0.1 | 0.1 | |
| Percentage that are in the labor force | 84.2 | 0.7 | 84.0 | 0.5 | -0.1 | 0.9 | |
| Percentage that have earnings | 82.5 | 0.7 | 88.6 | 0.5 | 6.1 | 0.9 | ** |
| Earnings | 18,690 | 395 | 20,668 | 255 | 1,978 | 474 | ** |
| Population of black young adults | (N=2444) | | (N=2147) | | | | |
| Percentage female | 50.1 | 1.1 | 52.6 | 1.6 | 2.5 | 1.9 | |
| Percentage attending high school in the Northeast | 18.1 | 3.8 | 21.8 | 2.8 | 3.8 | 4.8 | |
| Percentage attending high school in the Midwest | 19.3 | 4.1 | 17.0 | 2.4 | -2.3 | 4.8 | |
| Percentage attending high school in the South | 56.7 | 5.2 | 54.5 | 3.4 | -2.2 | 6.2 | |
| Percentage attending high school in the West | 5.9 | 1.4 | 6.7 | 1.3 | 0.8 | 1.9 | |
| Socioeconomic status | -0.552 | 0.031 | -0.459 | 0.035 | 0.093 | 0.047 | ** |
| Educational achievement | -1.0 | 0.0 | -0.7 | 0.0 | 0.2 | 0.0 | ** |
| Percentage that completed high school | 77.4 | 1.0 | 92.9 | 1.0 | 15.6 | 1.4 | ** |
| Percentage that attended college | 45.8 | 1.5 | 49.3 | 1.9 | 3.5 | 2.4 | |
| Percentage that completed college | 11.9 | 0.9 | 12.0 | 1.0 | 0.1 | 1.3 | |
| Average years of work experience | 6.0 | 0.1 | 6.5 | 0.1 | 0.5 | 0.2 | ** |
| Percentage that are in the labor force | 81.7 | 0.9 | 80.3 | 1.5 | -1.4 | 1.7 | |
| Percentage that have earnings | 75.1 | 1.2 | 79.0 | 1.7 | 3.9 | 2.1 | |
| Earnings | 13,188 | 385 | 16,071 | 609 | 2,883 | 742 | ** |
| Difference between black and white children | | | | | | | |
| Percentage female | 1.1 | 1.3 | 2.1 | 1.7 | 1.0 | 2.1 | |
| Percentage attending high school in the Northeast | -4.9 | 5.0 | -2.1 | 3.0 | 2.9 | 5.8 | |
| Percentage attending high school in the Midwest | -15.3 | 5.5 | -14.9 | 2.7 | 0.5 | 6.2 | |
| Percentage attending high school in the South | 30.6 | 5.7 | 26.1 | 3.3 | -4.5 | 6.6 | |
| Percentage attending high school in the West | -10.3 | 3.2 | -9.2 | 1.7 | 1.1 | 3.6 | |
| Socioeconomic status | -0.651 | 0.042 | -0.513 | 0.036 | 0.138 | 0.056 | ** |
| Educational achievement | -1.1 | 0.0 | -0.9 | 0.0 | 0.2 | 0.1 | ** |
| Percentage that completed high school | -8.5 | 1.2 | -2.3 | 1.0 | 6.1 | 1.6 | ** |
| Percentage that attended college | -8.1 | 1.9 | -10.9 | 2.0 | -2.8 | 2.8 | |
| Percentage that completed college | -12.2 | 1.4 | -14.9 | 1.3 | -2.7 | 1.9 | |
| Average years of work experience | -1.5 | 0.1 | -1.1 | 0.1 | 0.4 | 0.2 | ** |
| Percentage that are in the labor force | -2.5 | 1.1 | -3.8 | 1.6 | -1.3 | 2.0 | |
| Percentage that have earnings | -7.4 | 1.3 | -9.6 | 1.8 | -2.2 | 2.3 | |
| Earnings | -5,501 | 563 | -4,597 | 661 | 905 | 909 | |

** Difference-of-means between two groups is statistically significant at p<=.05.

NOTE: Standard errors have been adjusted for complex survey designs. Numbers may not sum to totals due to rounding. Sample sizes are smaller than those reported previously because observations with a sampling weight of zero were excluded from the tabulations. Multiple imputation used to account for missing data.

SOURCE: U.S. Department of Education, National Center for Education Statistics, High School and Beyond (HSB); and U.S. Department of Labor, Bureau of Labor Statistics, National Longitudinal Study of Youth (NLSY).

Black-white differences in background characteristics were similar between the two samples in the categories of sex, census region, college attendance and completion, and earnings. Black-white differences in background characteristics were dissimilar between the two samples in the categories of parental SES, educational achievement, high school completion, and work experience.

Since both the NLSY sophomore sample and the HSB sophomore sample contain observations from the year 1992, it is possible to compare the 1992 portion of the NLSY sample with the HSB sample. In general, the differences between the NLSY subsample and the HSB sample resemble the differences between the entire NLSY sample and the HSB sample (table B.3):

- Compared with white young adults in the NLSY 1992 sample, white young adults in the HSB sample were more likely to have completed high school and attended college, had less work experience, and had higher earnings.
- Compared with black young adults in the NLSY 1992 samples, black young adults in the HSB sample had higher levels of educational achievement, were more likely to have completed high school and attended college, and had higher earnings.

Black-white differences in background characteristics were similar between the two samples in the categories of sex, census region, parental SES, college attendance and completion, and earnings. Black-white differences in background characteristics were dissimilar between the two samples in the categories of educational achievement, high school completion, and work experience.

These findings suggest that there were systematic differences between the NLSY and HSB sophomore samples, even for young adults sampled during the same year. These differences could be due to differences in sample design or in the wording of survey questions. Consequently, differences between the NLSY and HSB sophomore samples cannot be attributed to time trends alone. In particular, since blacks appear to have been less disadvantaged in the HSB sample than in the NLSY sample in 1992, comparisons of the entire NLSY sample with the HSB sample may show relative gains for blacks between the samples, even though such gains may not have occurred between 1986-1992 and 1992.

Comparisons between NLS:72 and the NLSY senior sample, and HSB and the NLSY sophomore sample both used multiple imputation to account for missing labor market and attainment outcomes.

## II. COMPARISONS OF SAMPLES USED IN ANALYSES OF EDUCATIONAL ACHIEVEMENT OUTCOMES

The across-sample comparisons of black-white differences in educational achievement compared children across the Prospects and NELS:88 samples. The expression of test scores in grade 8 standard deviation units, and the "vertical equation" of the Prospects scores across cohorts, enabled these comparisons. With few exceptions, the background characteristics of children were similar in all of the Prospects samples and in the Prospects and NELS:88 samples.

The Prospects Cohort 1 sample and the Prospects Cohort 3 sample were similar in terms of the proportion of the sample that was black. Black and white children in the

## Table B.3—Comparison of black and white young adults in two datasets observed 12 years after grade 10 (in 1992 only)

| Sample definition and descriptive variables | Observed in 1992 (from NLSY) Mean | Std. Error | Observed in 1992 (from HSB) Mean | Std. Error | Difference-of-means (HSB - NLSY) Value | Std. Error | Statistical significance |
|---|---|---|---|---|---|---|---|
| Population of black and white children | (N=1228) | | (N=10,929) | | | | |
| Percentage black | 15.7 | 0.1 | 15.0 | 0.0 | -0.7 | 2.2 | |
| Population of white young adults | (N=857) | | (N=8782) | | | | |
| Percentage female | 49.2 | 2.2 | 50.5 | 0.0 | 1.3 | 2.3 | |
| Percentage attending high school in the Northeast | 21.3 | 4.1 | 23.9 | 0.0 | 2.6 | 4.5 | |
| Percentage attending high school in the Midwest | 34.8 | 5.1 | 31.8 | 0.0 | -3.0 | 5.4 | |
| Percentage attending high school in the South | 26.8 | 4.4 | 28.4 | 0.0 | 1.6 | 4.7 | |
| Percentage attending high school in the West | 17.1 | 3.8 | 15.9 | 0.0 | -1.2 | 4.0 | |
| Socioeconomic status | 0.105 | 0.048 | 0.054 | 0.016 | -0.051 | 0.051 | |
| Educational achievement | 0.2 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | |
| Percentage that completed high school | 80.1 | 1.7 | 95.3 | 0.0 | 15.2 | 1.7 | ** |
| Percentage that attended college | 52.0 | 2.2 | 60.2 | 0.0 | 8.3 | 2.3 | ** |
| Percentage that completed college | 25.3 | 1.9 | 26.9 | 0.8 | 1.6 | 2.0 | |
| Average years of work experience | 8.3 | 0.1 | 7.6 | 0.0 | -0.7 | 0.1 | ** |
| Percentage that are in the labor force | 86.1 | 1.5 | 84.0 | 0.5 | -2.0 | 1.5 | |
| Percentage that have earnings | 82.7 | 1.5 | 88.6 | 0.5 | 5.9 | 1.6 | ** |
| Earnings | 18,407 | 661 | 20,668 | 255 | 2,261 | 718 | ** |
| Population of black young adults | (N=371) | | (N=2147) | | | | |
| Percentage female | 48.9 | 2.7 | 52.6 | 1.6 | 3.7 | 3.2 | |
| Percentage attending high school in the Northeast | 18.4 | 4.5 | 21.8 | 2.8 | 3.4 | 5.3 | |
| Percentage attending high school in the Midwest | 18.9 | 4.4 | 17.0 | 2.4 | -1.9 | 5.0 | |
| Percentage attending high school in the South | 57.6 | 5.9 | 54.5 | 3.4 | -3.1 | 6.7 | |
| Percentage attending high school in the West | 5.1 | 2.1 | 6.7 | 1.3 | 1.6 | 2.5 | |
| Socioeconomic status | -0.524 | 0.049 | -0.459 | 0.035 | 0.065 | 0.060 | |
| Educational achievement | -0.9 | 0.0 | -0.7 | 0.0 | 0.2 | 0.1 | ** |
| Percentage that completed high school | 69.7 | 2.9 | 92.9 | 1.0 | 23.3 | 3.0 | ** |
| Percentage that attended college | 36.0 | 3.1 | 49.3 | 1.9 | 13.2 | 3.7 | ** |
| Percentage that completed college | 10.3 | 1.9 | 12.0 | 1.0 | 1.7 | 2.2 | |
| Average years of work experience | 6.4 | 0.2 | 6.5 | 0.1 | 0.1 | 0.2 | |
| Percentage that are in the labor force | 80.8 | 2.5 | 80.3 | 1.5 | -0.5 | 2.9 | |
| Percentage that have earnings | 72.5 | 2.7 | 79.0 | 1.7 | 6.5 | 3.3 | ** |
| Earnings | 11,970 | 697 | 16,071 | 609 | 4,101 | 933 | ** |
| Difference between black and white children | | | | | | | |
| Percentage female | -0.3 | 3.5 | 2.1 | 1.7 | 2.5 | 3.9 | |
| Percentage attending high school in the Northeast | -2.9 | 5.6 | -2.1 | 3.0 | 0.8 | 6.3 | |
| Percentage attending high school in the Midwest | -15.9 | 5.9 | -14.9 | 2.7 | 1.1 | 6.5 | |
| Percentage attending high school in the South | 30.8 | 6.5 | 26.1 | 3.3 | -4.7 | 7.3 | |
| Percentage attending high school in the West | -12.0 | 4.1 | -9.2 | 1.7 | 2.8 | 4.4 | |
| Socioeconomic status | -0.629 | 0.070 | -0.513 | 0.036 | 0.116 | 0.078 | |
| Educational achievement | -1.1 | 0.1 | -0.9 | 0.0 | 0.2 | 0.1 | ** |
| Percentage that completed high school | -10.4 | 3.3 | -2.3 | 1.0 | 8.1 | 3.5 | ** |
| Percentage that attended college | -15.9 | 3.7 | -10.9 | 2.0 | 5.0 | 4.3 | |
| Percentage that completed college | -15.0 | 2.8 | -14.9 | 1.3 | 0.1 | 3.1 | |
| Average years of work experience | -1.9 | 0.2 | -1.1 | 0.1 | 0.8 | 0.3 | ** |
| Percentage that are in the labor force | -5.2 | 2.8 | -3.8 | 1.6 | 1.5 | 3.2 | |
| Percentage that have earnings | -10.3 | 3.1 | -9.6 | 1.8 | 0.6 | 3.7 | |
| Earnings | -6,436 | 969 | -4,597 | 661 | 1,840 | 1,234 | |

** Difference-of-means between two groups is statistically significant at p<=.05.

NOTE: Standard errors have been adjusted for complex survey designs. Numbers may not sum to totals due to rounding. Sample sizes are smaller than those reported previously because observations with a sampling weight of zero were excluded from the tabulations. Multiple imputation used to account for missing data.

SOURCE: U.S. Department of Education, National Center for Education Statistics, High School and Beyond (HSB); and U.S. Department of Labor, Bureau of Labor Statistics, National Longitudinal Study of Youth (NLSY).

Prospects Cohort 3 sample were more likely to live in the Northeast, but otherwise, the characteristics of children in both samples were similar (table B.4). The black-white difference in the proportion of the sample in the bottom SES quartile was dissimilar between the two samples; black-white differences in background characteristics were otherwise similar for Cohort 1 and Cohort 3.

The Prospects Cohort 1 sample and the Prospects Cohort 7 sample were similar in terms of the proportion of the sample that was black, and the background characteristics of children in both samples were similar by race (table B.5). Black-white differences in background characteristics were similar for Cohort 1 and Cohort 7.

The Prospects Cohort 1 sample and the NELS:88 sample were similar in terms of the proportion of the sample that was black (table B.6). Compared with white children in the Cohort 1 sample, white children in the NELS:88 sample were more likely to attend school in the Northeast. Compared with black children in the Cohort 1 sample, black children in the NELS:88 sample were more likely to be in the lower-middle SES quartile. The background characteristics of children in the two samples were otherwise similar by race. The black-white differences in the proportion of the sample living in the Northeast, proportion in the lower-middle SES quartile, and average parental SES were dissimilar between the two samples; otherwise, Cohort 1 and NELS:88 samples were similar in black-white differences in background characteristics.

The Prospects Cohort 3 sample and the Prospects Cohort 7 sample were similar in terms of the proportion of the sample that was black, and the background characteristics of children in both samples were similar by race (table B.7). Black-white differences in background characteristics were similar for Cohort 3 and Cohort 7.

The Prospects Cohort 3 sample and the NELS:88 sample were similar in terms of the proportion of the sample that was black, the background characteristics of children in both samples were similar by race (table B.8), and black-white differences in background characteristics were similar for the two samples.

The Prospects Cohort 7 sample and the NELS:88 sample were similar in terms of the proportion of the sample that was black (table B.9). Background characteristics of white children were similar in the two samples. Compared with black children in the Cohort 7 sample, black children in the NELS:88 sample were more likely to be in the lower-middle SES quartile. The black-white difference in the proportion of the sample in the lower-middle SES quartile was dissimilar between the two samples; otherwise, black-white differences in background characteristics were similar for Cohort 7 and NELS:88.

With few exceptions, the background characteristics of children were very similar across the four samples used in the analyses of educational achievement. These similarities suggest that comparisons of black-white differences in educational achievement across the samples are not biased by systematic differences in the observed characteristics of each sample.

## Table B.4—Comparison of black and white children in Prospects Cohort 1 with black and white children in Prospects Cohort 3

| Sample definition and descriptive variables | Prospects Cohort 1 sample Mean | Std. Error | Prospects Cohort 3 sample Mean | Std. Error | Difference-of-means (absent - present) Value | Std. Error | Statistical significance |
|---|---|---|---|---|---|---|---|
| Population of black and white children | (N=7542) | | (N=11,017) | | | | |
| Percentage black | 19.0 | 2.9 | 15.9 | 2.0 | -3.2 | 2.1 | |
| Population of white children | (N=5279) | | (N=7872) | | | | |
| Percentage female | 48.9 | 0.9 | 49.7 | 0.9 | 0.7 | 1.2 | |
| Percentage attending high school in the Northeast | 7.3 | 2.3 | 16.1 | 4.1 | 8.9 | 3.6 | ** |
| Percentage attending high school in the Midwest | 28.3 | 6.4 | 26.4 | 5.3 | -1.8 | 3.0 | |
| Percentage attending high school in the South | 43.9 | 6.9 | 39.1 | 5.9 | -4.8 | 4.1 | |
| Percentage attending high school in the West | 20.5 | 5.2 | 18.3 | 4.4 | -2.2 | 3.2 | |
| Socioeconomic status | 0.165 | 0.052 | 0.148 | 0.051 | -0.018 | 0.049 | |
| Percentage in bottom SES quartile | 16.3 | 1.5 | 18.4 | 1.4 | 2.2 | 1.6 | |
| Percentage in lower-middle SES quartile | 26.0 | 1.6 | 25.6 | 1.5 | -0.3 | 1.5 | |
| Percentage in upper-middle SES quartile | 28.7 | 1.2 | 27.2 | 1.0 | -1.5 | 1.4 | |
| Percentage in top SES quartile | 29.1 | 2.5 | 28.7 | 2.6 | -0.3 | 2.5 | |
| Population of black children | (N=2263) | | (N=3145) | | | | |
| Percentage female | 49.3 | 2.4 | 50.3 | 1.3 | 1.1 | 2.7 | |
| Percentage attending high school in the Northeast | 15.9 | 6.3 | 22.4 | 6.8 | 6.5 | 2.8 | ** |
| Percentage attending high school in the Midwest | 9.5 | 4.2 | 10.2 | 3.7 | 0.7 | 2.2 | |
| Percentage attending high school in the South | 66.4 | 7.7 | 59.4 | 6.9 | -7.0 | 5.1 | |
| Percentage attending high school in the West | 8.2 | 3.0 | 8.0 | 2.3 | -0.2 | 2.5 | |
| Socioeconomic status | -0.563 | 0.094 | -0.471 | 0.081 | 0.092 | 0.067 | |
| Percentage in bottom SES quartile | 46.6 | 3.7 | 41.4 | 3.2 | -5.2 | 3.1 | |
| Percentage in lower-middle SES quartile | 21.7 | 1.5 | 24.5 | 1.5 | 2.8 | 1.9 | |
| Percentage in upper-middle SES quartile | 19.5 | 2.1 | 21.2 | 2.2 | 1.7 | 2.7 | |
| Percentage in top SES quartile | 12.1 | 2.7 | 12.9 | 2.0 | 0.8 | 2.6 | |
| Difference between black and white children | | | | | | | |
| Percentage female | 0.3 | 2.7 | 0.7 | 1.6 | 0.3 | 3.0 | |
| Percentage attending high school in the Northeast | 8.7 | 6.4 | 6.2 | 7.2 | -2.4 | 3.9 | |
| Percentage attending high school in the Midwest | -18.8 | 6.6 | -16.2 | 5.8 | 2.5 | 3.1 | |
| Percentage attending high school in the South | 22.5 | 8.6 | 20.3 | 7.7 | -2.2 | 5.2 | |
| Percentage attending high school in the West | -12.3 | 4.7 | -10.3 | 4.3 | 2.1 | 2.7 | |
| Socioeconomic status | -0.729 | 0.090 | -0.619 | 0.085 | 0.110 | 0.066 | |
| Percentage in bottom SES quartile | 30.4 | 3.5 | 23.0 | 3.2 | -7.4 | 3.2 | ** |
| Percentage in lower-middle SES quartile | -4.2 | 2.1 | -1.1 | 2.1 | 3.1 | 2.4 | |
| Percentage in upper-middle SES quartile | -9.2 | 2.2 | -6.0 | 2.4 | 3.1 | 2.7 | |
| Percentage in top SES quartile | -16.9 | 2.8 | -15.9 | 2.9 | 1.1 | 3.0 | |

** Difference-of-means between two groups is statistically significant at p<=.05.

NOTE: Standard errors have been adjusted for complex survey designs. Numbers may not sum to totals due to rounding. Sample sizes are smaller than those reported in table A.2 because observations with a sampling weight of zero were excluded from the tabulations. Multiple imputation used to account for missing data.

SOURCE: U.S. Department of Education, Chapter 1 Prospects Study.

## Table B.5—Comparison of black and white children in Prospects Cohort 1 with black and white children in Prospects Cohort 7

| Sample definition and descriptive variables | Prospects Cohort 1 Sample Mean | Std. Error | Prospects Cohort 7 Sample Mean | Std. Error | Difference-of-means (absent - present) Value | Std. Error | Statistical significance |
|---|---|---|---|---|---|---|---|
| Population of black and white children | (N=7542) | | (N=6654) | | | | |
| Percentage black | 19.0 | 0.0 | 16.7 | 0.0 | -2.4 | 3.8 | |
| Population of white children | (N=5279) | | (N=4951) | | | | |
| Percentage female | 48.9 | 0.9 | 48.1 | 1.1 | -0.8 | 1.4 | |
| Percentage attending high school in the Northeast | 7.3 | 2.3 | 14.2 | 4.3 | 7.0 | 4.9 | |
| Percentage attending high school in the Midwest | 28.3 | 6.4 | 27.7 | 6.3 | -0.6 | 8.5 | |
| Percentage attending high school in the South | 43.9 | 6.9 | 40.2 | 6.4 | -3.7 | 9.2 | |
| Percentage attending high school in the West | 20.5 | 5.2 | 17.9 | 4.7 | -2.7 | 6.9 | |
| Socioeconomic status | 0.165 | 0.052 | 0.159 | 0.048 | -0.006 | 0.069 | |
| Percentage in bottom SES quartile | 16.3 | 1.5 | 17.9 | 1.4 | 1.6 | 2.1 | |
| Percentage in lower-middle SES quartile | 26.0 | 1.6 | 26.3 | 1.2 | 0.3 | 2.0 | |
| Percentage in upper-middle SES quartile | 28.7 | 1.2 | 27.5 | 1.2 | -1.2 | 1.7 | |
| Percentage in top SES quartile | 29.1 | 2.5 | 28.3 | 2.4 | -0.7 | 3.4 | |
| Population of black children | (N=2263) | | (N=1703) | | | | |
| Percentage female | 49.3 | 2.4 | 51.6 | 1.7 | 2.4 | 2.9 | |
| Percentage attending high school in the Northeast | 15.9 | 6.3 | 14.0 | 4.9 | -2.0 | 7.9 | |
| Percentage attending high school in the Midwest | 9.5 | 4.2 | 17.2 | 7.3 | 7.7 | 8.4 | |
| Percentage attending high school in the South | 66.4 | 7.7 | 57.5 | 8.3 | -8.9 | 11.3 | |
| Percentage attending high school in the West | 8.2 | 3.0 | 11.3 | 4.0 | 3.2 | 5.0 | |
| Socioeconomic status | -0.563 | 0.094 | -0.474 | 0.085 | 0.089 | 0.128 | |
| Percentage in bottom SES quartile | 46.6 | 3.7 | 42.6 | 3.3 | -4.1 | 5.0 | |
| Percentage in lower-middle SES quartile | 21.7 | 1.5 | 21.2 | 1.8 | -0.5 | 2.3 | |
| Percentage in upper-middle SES quartile | 19.5 | 2.1 | 20.8 | 2.2 | 1.3 | 3.1 | |
| Percentage in top SES quartile | 12.1 | 2.7 | 15.5 | 2.2 | 3.3 | 3.5 | |
| Difference between black and white children | | | | | | | |
| Percentage female | 0.3 | 2.7 | 3.5 | 2.0 | 3.2 | 3.3 | |
| Percentage attending high school in the Northeast | 8.7 | 6.4 | -0.3 | 6.1 | -8.9 | 8.7 | |
| Percentage attending high school in the Midwest | -18.8 | 6.6 | -10.5 | 8.0 | 8.3 | 9.9 | |
| Percentage attending high school in the South | 22.5 | 8.6 | 17.3 | 8.9 | -5.2 | 12.2 | |
| Percentage attending high school in the West | -12.3 | 4.7 | -6.5 | 5.2 | 5.8 | 6.9 | |
| Socioeconomic status | -0.729 | 0.090 | -0.633 | 0.093 | 0.096 | 0.129 | |
| Percentage in bottom SES quartile | 30.4 | 3.5 | 24.7 | 3.5 | -5.7 | 5.0 | |
| Percentage in lower-middle SES quartile | -4.2 | 2.1 | -5.1 | 2.0 | -0.8 | 2.9 | |
| Percentage in upper-middle SES quartile | -9.2 | 2.2 | -6.7 | 2.5 | 2.5 | 3.3 | |
| Percentage in top SES quartile | -16.9 | 2.8 | -12.9 | 3.0 | 4.1 | 4.1 | |

** Difference-of-means between two groups is statistically significant at p<=.05.

NOTE: Standard errors have been adjusted for complex survey designs. Numbers may not sum to totals due to rounding. Sample sizes are smaller than those reported in table A.2 because observations with a sampling weight of zero were excluded from the tabulations. Multiple imputation used to account for missing data.

SOURCE: U.S. Department of Education, Chapter 1 Prospects Study.

## Table B.6—Comparison of black and white children in Prospects Cohort 1 with black and white children in NELS:88

| Sample definition and descriptive variables | Prospects Cohort 1 sample | | NELS:88 sample | | Difference-of-means (absent - present) | | Statistical significance |
|---|---|---|---|---|---|---|---|
| | Mean | Std. Error | Mean | Std. Error | Value | Std. Error | |
| Population of black and white children | (N=7542) | | (N=12,954) | | | | |
| Percentage black | 19.0 | 2.9 | 15.0 | 1.1 | -4.1 | 3.1 | |
| Population of white children | (N=5279) | | (N=11,386) | | | | |
| Percentage female | 48.9 | 0.9 | 49.9 | 0.7 | 1.0 | 1.1 | |
| Percentage attending high school in the Northeast | 7.3 | 2.3 | 21.0 | 1.9 | 13.8 | 3.0 | ** |
| Percentage attending high school in the Midwest | 28.3 | 6.4 | 31.4 | 1.9 | 3.1 | 6.7 | |
| Percentage attending high school in the South | 43.9 | 6.9 | 31.2 | 1.8 | -12.7 | 7.1 | |
| Percentage attending high school in the West | 20.5 | 5.2 | 16.4 | 1.5 | -4.1 | 5.4 | |
| Socioeconomic status | 0.165 | 0.052 | 0.095 | 0.020 | -0.070 | 0.056 | |
| Percentage in bottom SES quartile | 16.3 | 1.5 | 17.0 | 0.8 | 0.7 | 1.7 | |
| Percentage in lower-middle SES quartile | 26.0 | 1.6 | 25.0 | 0.7 | -0.9 | 1.8 | |
| Percentage in upper-middle SES quartile | 28.7 | 1.2 | 27.6 | 0.7 | -1.1 | 1.3 | |
| Percentage in top SES quartile | 29.1 | 2.5 | 30.4 | 1.1 | 1.3 | 2.7 | |
| Population of black children | (N=2263) | | (N=1568) | | | | |
| Percentage female | 49.3 | 2.4 | 51.7 | 2.1 | 2.5 | 3.2 | |
| Percentage attending high school in the Northeast | 15.9 | 6.3 | 15.7 | 2.8 | -0.2 | 6.8 | |
| Percentage attending high school in the Midwest | 9.5 | 4.2 | 13.0 | 2.1 | 3.5 | 4.7 | |
| Percentage attending high school in the South | 66.4 | 7.7 | 64.8 | 3.5 | -1.6 | 8.5 | |
| Percentage attending high school in the West | 8.2 | 3.0 | 6.5 | 1.3 | -1.7 | 3.3 | |
| Socioeconomic status | -0.563 | 0.094 | -0.387 | 0.041 | 0.176 | 0.102 | |
| Percentage in bottom SES quartile | 46.6 | 3.7 | 39.2 | 2.3 | -7.4 | 4.4 | |
| Percentage in lower-middle SES quartile | 21.7 | 1.5 | 26.5 | 2.0 | 4.8 | 2.5 | ** |
| Percentage in upper-middle SES quartile | 19.5 | 2.1 | 21.4 | 1.8 | 1.9 | 2.8 | |
| Percentage in top SES quartile | 12.1 | 2.7 | 12.9 | 2.0 | 0.8 | 3.3 | |
| Difference between black and white children | | | | | | | |
| Percentage female | 0.3 | 2.7 | 1.8 | 2.2 | 1.5 | 3.4 | |
| Percentage attending high school in the Northeast | 8.7 | 6.4 | -5.3 | 3.2 | -14.0 | 7.1 | ** |
| Percentage attending high school in the Midwest | -18.8 | 6.6 | -18.3 | 2.6 | 0.4 | 7.1 | |
| Percentage attending high school in the South | 22.5 | 8.6 | 33.6 | 3.6 | 11.1 | 9.3 | |
| Percentage attending high school in the West | -12.3 | 4.7 | -9.9 | 1.9 | 2.4 | 5.1 | |
| Socioeconomic status | -0.729 | 0.090 | -0.483 | 0.044 | 0.246 | 0.100 | ** |
| Percentage in bottom SES quartile | 30.4 | 3.5 | 22.2 | 2.4 | -8.1 | 4.3 | |
| Percentage in lower-middle SES quartile | -4.2 | 2.1 | 1.5 | 2.1 | 5.7 | 3.0 | ** |
| Percentage in upper-middle SES quartile | -9.2 | 2.2 | -6.2 | 1.9 | 2.9 | 2.9 | |
| Percentage in top SES quartile | -16.9 | 2.8 | -17.5 | 2.2 | -0.5 | 3.6 | |

** Difference-of-means between two groups is statistically significant at p<=.05.

NOTE: Standard errors have been adjusted for complex survey designs. Numbers may not sum to totals due to rounding. Sample sizes are smaller than those reported in table A.2 because observations with a sampling weight of zero were excluded from the tabulations. Multiple imputation used to account for missing data.

SOURCE: U.S. Department of Education, Chapter 1 Prospects Study and National Educational Longitudinal Study of 1988.

## Table B.7—Comparison of black and white children in Prospects Cohort 3 with black and white children in Prospects Cohort 7

| Sample definition and descriptive variables | Prospects Cohort 3 sample Mean | Std. Error | Prospects Cohort 7 sample Mean | Std. Error | Difference-of-means (absent - present) Value | Std. Error | Statistical significance |
|---|---|---|---|---|---|---|---|
| Population of black and white children | (N=11,017) | | (N=6654) | | | | |
| Percentage black | 15.9 | 2.0 | 16.7 | 2.5 | 0.8 | 3.2 | |
| Population of white children | (N=7872) | | (N=4951) | | | | |
| Percentage female | 49.7 | 0.9 | 48.1 | 1.1 | -1.6 | 1.4 | |
| Percentage attending high school in the Northeast | 16.1 | 4.1 | 14.2 | 4.3 | -1.9 | 5.9 | |
| Percentage attending high school in the Midwest | 26.4 | 5.3 | 27.7 | 6.3 | 1.2 | 7.7 | |
| Percentage attending high school in the South | 39.1 | 5.9 | 40.2 | 6.4 | 1.1 | 8.6 | |
| Percentage attending high school in the West | 18.3 | 4.4 | 17.9 | 4.7 | -0.4 | 6.3 | |
| Socioeconomic status | 0.148 | 0.051 | 0.159 | 0.048 | 0.011 | 0.069 | |
| Percentage in bottom SES quartile | 18.4 | 1.4 | 17.9 | 1.4 | -0.5 | 1.9 | |
| Percentage in lower-middle SES quartile | 25.6 | 1.5 | 26.3 | 1.2 | 0.6 | 1.9 | |
| Percentage in upper-middle SES quartile | 27.2 | 1.0 | 27.5 | 1.2 | 0.3 | 1.6 | |
| Percentage in top SES quartile | 28.7 | 2.6 | 28.3 | 2.4 | -0.4 | 3.5 | |
| Population of black children | (N=3145) | | (N=1703) | | | | |
| Percentage female | 50.3 | 1.3 | 51.6 | 1.7 | 1.3 | 2.1 | |
| Percentage attending high school in the Northeast | 22.4 | 6.8 | 14.0 | 4.9 | -8.4 | 8.3 | |
| Percentage attending high school in the Midwest | 10.2 | 3.7 | 17.2 | 7.3 | 7.0 | 8.2 | |
| Percentage attending high school in the South | 59.4 | 6.9 | 57.5 | 8.3 | -1.9 | 10.7 | |
| Percentage attending high school in the West | 8.0 | 2.3 | 11.3 | 4.0 | 3.3 | 4.6 | |
| Socioeconomic status | -0.471 | 0.081 | -0.474 | 0.085 | -0.003 | 0.117 | |
| Percentage in bottom SES quartile | 41.4 | 3.2 | 42.6 | 3.3 | 1.1 | 4.7 | |
| Percentage in lower-middle SES quartile | 24.5 | 1.5 | 21.2 | 1.8 | -3.3 | 2.4 | |
| Percentage in upper-middle SES quartile | 21.2 | 2.2 | 20.8 | 2.2 | -0.4 | 3.1 | |
| Percentage in top SES quartile | 12.9 | 2.0 | 15.5 | 2.2 | 2.6 | 2.9 | |
| Difference between black and white children | | | | | | | |
| Percentage female | 0.7 | 1.6 | 3.5 | 2.0 | 2.9 | 2.5 | |
| Percentage attending high school in the Northeast | 6.2 | 7.2 | -0.3 | 6.1 | -6.5 | 9.4 | |
| Percentage attending high school in the Midwest | -16.2 | 5.8 | -10.5 | 8.0 | 5.8 | 9.5 | |
| Percentage attending high school in the South | 20.3 | 7.7 | 17.3 | 8.9 | -3.0 | 11.6 | |
| Percentage attending high school in the West | -10.3 | 4.3 | -6.5 | 5.2 | 3.8 | 6.7 | |
| Socioeconomic status | -0.619 | 0.085 | -0.633 | 0.093 | -0.014 | 0.125 | |
| Percentage in bottom SES quartile | 23.0 | 3.2 | 24.7 | 3.5 | 1.6 | 4.8 | |
| Percentage in lower-middle SES quartile | -1.1 | 2.1 | -5.1 | 2.0 | -3.9 | 3.0 | |
| Percentage in upper-middle SES quartile | -6.0 | 2.4 | -6.7 | 2.5 | -0.7 | 3.5 | |
| Percentage in top SES quartile | -15.9 | 2.9 | -12.9 | 3.0 | 3.0 | 4.0 | |

** Difference-of-means between two groups is statistically significant at p<=.05.

NOTE: Standard errors have been adjusted for complex survey designs. Numbers may not sum to totals due to rounding. Sample sizes are smaller than those reported in table A.2 because observations with a sampling weight of zero were excluded from the tabulations. Multiple imputation used to account for missing data.

SOURCE: U.S. Department of Education, Chapter 1 Prospects Study.

## Table B.8—Comparison of black and white children in Prospects Cohort 3 with black and white children in NELS:88

| Sample definition and descriptive variables | Prospects Cohort 3 sample Mean | Prospects Cohort 3 sample Std. Error | NELS:88 sample Mean | NELS:88 sample Std. Error | Difference-of-means (absent - present) Value | Difference-of-means (absent - present) Std. Error | Statistical significance |
|---|---|---|---|---|---|---|---|
| Population of black and white children | (N=11,017) | | (N=12,954) | | | | |
| Percentage black | 15.9 | 2.0 | 15.0 | 1.1 | -0.9 | 2.3 | |
| Population of white children | (N=7872) | | (N=11,386) | | | | |
| Percentage female | 49.7 | 0.9 | 49.9 | 0.7 | 0.3 | 1.2 | |
| Percentage attending high school in the Northeast | 16.1 | 4.1 | 21.0 | 1.9 | 4.9 | 4.5 | |
| Percentage attending high school in the Midwest | 26.4 | 5.3 | 31.4 | 1.9 | 4.9 | 5.6 | |
| Percentage attending high school in the South | 39.1 | 5.9 | 31.2 | 1.8 | -7.9 | 6.2 | |
| Percentage attending high school in the West | 18.3 | 4.4 | 16.4 | 1.5 | -1.9 | 4.6 | |
| Socioeconomic status | 0.148 | 0.051 | 0.095 | 0.020 | -0.052 | 0.055 | |
| Percentage in bottom SES quartile | 18.4 | 1.4 | 17.0 | 0.8 | -1.5 | 1.6 | |
| Percentage in lower-middle SES quartile | 25.6 | 1.5 | 25.0 | 0.7 | -0.6 | 1.7 | |
| Percentage in upper-middle SES quartile | 27.2 | 1.0 | 27.6 | 0.7 | 0.4 | 1.2 | |
| Percentage in top SES quartile | 28.7 | 2.6 | 30.4 | 1.1 | 1.7 | 2.8 | |
| Population of black children | (N=3145) | | (N=1568) | | | | |
| Percentage female | 50.3 | 1.3 | 51.7 | 2.1 | 1.4 | 2.4 | |
| Percentage attending high school in the Northeast | 22.4 | 6.8 | 15.7 | 2.8 | -6.7 | 7.4 | |
| Percentage attending high school in the Midwest | 10.2 | 3.7 | 13.0 | 2.1 | 2.8 | 4.2 | |
| Percentage attending high school in the South | 59.4 | 6.9 | 64.8 | 3.5 | 5.4 | 7.7 | |
| Percentage attending high school in the West | 8.0 | 2.3 | 6.5 | 1.3 | -1.5 | 2.7 | |
| Socioeconomic status | -0.471 | 0.081 | -0.387 | 0.041 | 0.084 | 0.090 | |
| Percentage in bottom SES quartile | 41.4 | 3.2 | 39.2 | 2.3 | -2.2 | 3.9 | |
| Percentage in lower-middle SES quartile | 24.5 | 1.5 | 26.5 | 2.0 | 2.0 | 2.5 | |
| Percentage in upper-middle SES quartile | 21.2 | 2.2 | 21.4 | 1.8 | 0.2 | 2.8 | |
| Percentage in top SES quartile | 12.9 | 2.0 | 12.9 | 2.0 | 0.0 | 2.8 | |
| Difference between black and white children | | | | | | | |
| Percentage female | 0.7 | 1.6 | 1.8 | 2.2 | 1.1 | 2.7 | |
| Percentage attending high school in the Northeast | 6.2 | 7.2 | -5.3 | 3.2 | -11.6 | 7.9 | |
| Percentage attending high school in the Midwest | -16.2 | 5.8 | -18.3 | 2.6 | -2.1 | 6.3 | |
| Percentage attending high school in the South | 20.3 | 7.7 | 33.6 | 3.6 | 13.3 | 8.5 | |
| Percentage attending high school in the West | -10.3 | 4.3 | -9.9 | 1.9 | 0.4 | 4.7 | |
| Socioeconomic status | -0.619 | 0.085 | -0.483 | 0.044 | 0.136 | 0.096 | |
| Percentage in bottom SES quartile | 23.0 | 3.2 | 22.2 | 2.4 | -0.8 | 4.0 | |
| Percentage in lower-middle SES quartile | -1.1 | 2.1 | 1.5 | 2.1 | 2.6 | 3.0 | |
| Percentage in upper-middle SES quartile | -6.0 | 2.4 | -6.2 | 1.9 | -0.2 | 3.0 | |
| Percentage in top SES quartile | -15.9 | 2.9 | -17.5 | 2.2 | -1.6 | 3.7 | |

** Difference-of-means between two groups is statistically significant at p<=.05.

NOTE: Standard errors have been adjusted for complex survey designs. Numbers may not sum to totals due to rounding. Sample sizes are smaller than those reported in table A.2 because observations with a sampling weight of zero were excluded from the tabulations. Multiple imputation used to account for missing data.

SOURCE: U.S. Department of Education, Chapter 1 Prospects Study and National Educational Longitudinal Study of 1988.

## Table B.9—Comparison of black and white children in Prospects Cohort 7 with black and white children in NELS:88

| Sample definition and descriptive variables | Prospects Cohort 7 sample Mean | Prospects Cohort 7 sample Std. Error | NELS:88 sample Mean | NELS:88 sample Std. Error | Difference-of-means (absent - present) Value | Difference-of-means (absent - present) Std. Error | Statistical significance |
|---|---|---|---|---|---|---|---|
| Population of black and white children | (N=6654) | | (N=12,954) | | | | |
| Percentage black | 16.7 | 2.5 | 15.0 | 1.1 | -1.7 | 2.7 | |
| Population of white children | (N=4951) | | (N=11,386) | | | | |
| Percentage female | 48.1 | 1.1 | 49.9 | 0.7 | 1.8 | 1.3 | |
| Percentage attending high school in the Northeast | 14.2 | 4.3 | 21.0 | 1.9 | 6.8 | 4.7 | |
| Percentage attending high school in the Midwest | 27.7 | 6.3 | 31.4 | 1.9 | 3.7 | 6.6 | |
| Percentage attending high school in the South | 40.2 | 6.4 | 31.2 | 1.8 | -9.0 | 6.6 | |
| Percentage attending high school in the West | 17.9 | 4.7 | 16.4 | 1.5 | -1.4 | 4.9 | |
| Socioeconomic status | 0.159 | 0.048 | 0.095 | 0.020 | -0.064 | 0.052 | |
| Percentage in bottom SES quartile | 17.9 | 1.4 | 17.0 | 0.8 | -1.0 | 1.6 | |
| Percentage in lower-middle SES quartile | 26.3 | 1.2 | 25.0 | 0.7 | -1.2 | 1.4 | |
| Percentage in upper-middle SES quartile | 27.5 | 1.2 | 27.6 | 0.7 | 0.1 | 1.4 | |
| Percentage in top SES quartile | 28.3 | 2.4 | 30.4 | 1.1 | 2.1 | 2.6 | |
| Grade 8 mathematics score | 0.2 | 0.0 | 0.2 | 0.0 | 0.1 | 0.0 | |
| Grade 8 reading score | 0.2 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | |
| Population of black children | (N=1703) | | (N=1568) | | | | |
| Percentage female | 51.6 | 1.7 | 51.7 | 2.1 | 0.1 | 2.7 | |
| Percentage attending high school in the Northeast | 14.0 | 4.9 | 15.7 | 2.8 | 1.7 | 5.6 | |
| Percentage attending high school in the Midwest | 17.2 | 7.3 | 13.0 | 2.1 | -4.2 | 7.6 | |
| Percentage attending high school in the South | 57.5 | 8.3 | 64.8 | 3.5 | 7.3 | 9.0 | |
| Percentage attending high school in the West | 11.3 | 4.0 | 6.5 | 1.3 | -4.8 | 4.3 | |
| Socioeconomic status | -0.474 | 0.085 | -0.387 | 0.041 | 0.086 | 0.094 | |
| Percentage in bottom SES quartile | 42.6 | 3.3 | 39.2 | 2.3 | -3.4 | 4.0 | |
| Percentage in lower-middle SES quartile | 21.2 | 1.8 | 26.5 | 2.0 | 5.3 | 2.7 | ** |
| Percentage in upper-middle SES quartile | 20.8 | 2.2 | 21.4 | 1.8 | 0.6 | 2.8 | |
| Percentage in top SES quartile | 15.5 | 2.2 | 12.9 | 2.0 | -2.5 | 3.0 | |
| Grade 8 mathematics score | -0.3 | 0.1 | -0.5 | 0.0 | -0.2 | 0.1 | |
| Grade 8 reading score | -0.4 | 0.1 | -0.5 | 0.0 | 0.0 | 0.1 | |
| Difference between black and white children | | | | | | | |
| Percentage female | 3.5 | 2.0 | 1.8 | 2.2 | -1.7 | 2.9 | |
| Percentage attending high school in the Northeast | -0.3 | 6.1 | -5.3 | 3.2 | -5.1 | 6.8 | |
| Percentage attending high school in the Midwest | -10.5 | 8.0 | -18.3 | 2.6 | -7.8 | 8.4 | |
| Percentage attending high school in the South | 17.3 | 8.9 | 33.6 | 3.6 | 16.3 | 9.5 | |
| Percentage attending high school in the West | -6.5 | 5.2 | -9.9 | 1.9 | -3.4 | 5.5 | |
| Socioeconomic status | -0.633 | 0.093 | -0.483 | 0.044 | 0.150 | 0.102 | |
| Percentage in bottom SES quartile | 24.7 | 3.5 | 22.2 | 2.4 | -2.4 | 4.2 | |
| Percentage in lower-middle SES quartile | -5.1 | 2.0 | 1.5 | 2.1 | 6.6 | 2.9 | ** |
| Percentage in upper-middle SES quartile | -6.7 | 2.5 | -6.2 | 1.9 | 0.4 | 3.2 | |
| Percentage in top SES quartile | -12.9 | 3.0 | -17.5 | 2.2 | -4.6 | 3.7 | |
| Grade 8 mathematics score | -0.5 | 0.1 | -0.8 | 0.0 | -0.3 | 0.1 | |
| Grade 8 reading score | -0.6 | 0.1 | -0.7 | 0.0 | 0.0 | 0.1 | |

** Difference-of-means between two groups is statistically significant at p<=.05.

NOTE: Standard errors have been adjusted for complex survey designs. Numbers may not sum to totals due to rounding. Sample sizes are smaller than those reported in table A.2 because observations with a sampling weight of zero were excluded from the tabulations. Multiple imputation used to account for missing data.

SOURCE: U.S. Department of Education, Chapter 1 Prospects Study and National Educational Longitudinal Study of 1988.

# APPENDIX C. ANALYSIS METHODOLOGY

## I. APPROACH TO ESTIMATION OF BLACK-WHITE DIFFERENCES IN OUTCOMES

Chapters 2, 3, and 4 involve the analysis of black-white differences in outcomes for individuals similar in terms of prior educational achievement and/or other factors. In general, this approach involves estimating a series of linear regressions for the same set of observations, of the form:

$$OUTCOME_i = b_{11} + b_{12} * BLACK_i + e_{1i} \quad (1)$$

where $OUTCOME_i$ is the outcome value for student $i$ (for example, growth in educational achievement between two grades); $BLACK_i$ is a variable set equal to one if student $i$ is black and zero if student $i$ is white; the $b$'s are individual parameters to be estimated; and $e_{1i}$ is an error term for student $i$.

For each of the five datasets containing imputed values, we estimated black-white differences in outcomes. Equation (1) estimates the difference of the outcome for blacks and whites ($b_{12}$). This difference is compared with the black-white difference in the outcome for individuals with similar levels of prior educational achievement.

The propensity score approach described by Rosenbaum and Rubin (1984) and Rubin (1997) was used to account for prior educational achievement. Essentially, this method accounts for differences between two groups of individuals by classifying them into five groups, based on their propensity of being in the same group. Propensity scores were used to classify each sample into five groups based on the likelihood of individuals being black. Separate logistic regressions of race on prior achievement and prior achievement squared were estimated for males and females. The estimated propensity score is defined as the predicted probability of being black from this logistic regression. Propensity score quintiles were identified from the weighted distribution of the propensity scores for whites, and blacks were placed in one of the five groups depending on their propensity scores. A linear regression of the outcome variable on race was fit separately to data in each of the five groups:

$$OUTCOME_{ij} = b_{21ij} + b22_{ij} * BLACK_{ij} + e_{2ij} \quad (2)$$

where $j$=1 to 5 indexes the 5 subgroups defined by propensity score quintiles. The black-white difference for the outcome in question, after adjusting for achievement, ($b_{22}$) is estimated by the simple average of the five race coefficients $b_{221}$ through $b_{225}$. The variance of this black-white difference was estimated as 1/25 of the sum of the variances of

the five race coefficients (since the variance of the average of five independent coefficients equals 1/25 of the sum of the variances of each coefficient).

Estimates of black-white differences for individuals with similar levels of prior achievement plus similar levels of other factors were obtained in a similar fashion. Propensity scores were estimated from a logistic regression of race on prior achievement, prior achievement squared, and other factors. In the analysis of labor market outcomes, the other factors include educational attainment and work experience; in the analyses of educational attainment and achievement outcomes, the other factors include parental socioeconomic status (in both linear and quadratic terms) and census region of residence. After classifying the sample into five subgroups on the basis of the propensity score quintiles, black-white differences were estimated for each subgroup using equation (3):

$$OUTCOME_i = b_{31k} + b_{32k} * BLACK_i + e_{3ik} \quad (3)$$

where $k$=1 to 5 indexes the 5 subgroups defined by propensity score quintiles based on achievement and other factors. The overall estimate of black-white difference after adjusting for achievement and other factors, $b_{32}$, is the simple average of the five race coefficients $b_{321}$ through $b_{325}$. The variance of this black-white difference was estimated as 1/25 of the sum of the variances of the five race coefficients.

Two sorts of statistical tests were performed to analyze the black-white differences estimated in equations (1) through (3). First, t-tests were performed to see whether each estimated black-white difference ($b_{12}$, $b_{22}$, and $b_{32}$)—averaged across quintiles—was statistically different from zero. Next, tests were performed to see whether the addition of a particular set of variables to the outcome equation changed the estimate of black-white differences in outcomes. In particular, to test whether the addition of prior educational achievement changes the estimated difference in outcomes, a test was performed to determine whether the difference ($b_{22}$–$b_{12}$) was significantly different from zero. Following the work of Clogg, Petkova, and Cheng (1995), the unconditional variance of ($b_{22}$–$b_{12}$), which we denote as $s^2_u(b_{22}–b_{12})$, was estimated as follows:

$$s^2_u(b_{22}–b_{12}) = s^2(b_{22}) + s^2(b_{12}) – 2s^2(b_{12}) * (\mathrm{MSE}_2/\mathrm{MSE}_1) \quad (4)$$

where $s^2(b_{22})$ and $s^2(b_{12})$ are the variances of $b_{22}$ and $b_{12}$ , respectively, and $MSE_1$ and $MSE_2$ are the mean-squared errors from equations (1) and (2), respectively. $\mathrm{MSE}_2$ is estimated by calculating the variance of the residuals in each of the five propensity score subgroups and taking the simple average of the results. The variance estimate is unconditional since it allows the predictor variables (for example, *BLACK* and *ACHIEVE*) to include random components (that is, it does not treat the predictor variables as fixed).

The use of the Clogg/Petkova/Cheng unconditional variance estimator placed certain constraints on the estimation of equations predicting educational and economic outcomes. First, since the estimator was only provided for linear regression models, binary outcome equations were estimated as linear probability models rather than using probit or logit maximum likelihood procedures. Second, because the estimator tests the difference of individual regression coefficients only, outcome equations were estimated pooling blacks and whites rather than separately by race. The test of black-white equality in outcomes was therefore the test of black-white equality in the constant term in outcome equations; other coefficients in these equations (such as those capturing the

relationship between achievement and the outcome variable) were assumed to be the same for blacks and whites.[1]

The Clogg/Petkova/Cheng test for estimating the unconditional variance of regression coefficients was used to perform a t-test of whether ($b_{22}$–$b_{12}$) was significantly different from zero. A similar test was also performed to determine whether the addition of other factors to prior educational achievement changed the black-white difference estimated including prior achievement only; this test examined the significance of the difference ($b_{32}$–$b_{22}$).

In all instances, black-white differences were calculated jointly for males and females as well as separately by sex. When differences were calculated jointly, equations (1) through (3) were estimated for the full sample of men and women. In the joint model, black-white differences were constrained to be the same for males and females (that is, $b_{12}$ , $b_{22}$ , and $b_{32}$ were not allowed to vary by sex), but the contributions of achievement and other explanatory variables to the propensity score were allowed to vary by sex. When analyses were performed separately by sex, equations (1), (2), and (3) were estimated separately for men and for women, and *all* of the parameters in the propensity score equations were allowed to vary by sex. Testing the equality of black-white differences for men and women was equivalent to testing whether the parameters $b_{12}$ , $b_{22}$ , or $b_{32}$ differed for men and for women.

These results were estimated separately for each of the five datasets containing imputed values. Equations developed by Rubin (1987) were used to combine the estimates and standard errors of the regression coefficients. For each estimate of a value Q with variance V using i = 1 to m iterations of imputed data, the following quantities were calculated, using notation based on that employed by Schafer and Olsen (1998):

the mean estimate:

$$E(Q) = \Sigma_m Qi / m \quad (5)$$

the within–imputation variance:

$$W = \Sigma_m Vi / m \quad (6)$$

the between-imputation variance:

$$B = \Sigma_m (Qi - E(Q))^2 / (m - 1) = (\Sigma_m Qi\ 2 - m\ E(Q)^2 ) / (m - 1) \quad (7)$$

the total variance:

$$T = W + (1 + 1/m)\ B \quad (8)$$

The small-sample degrees of freedom for t-tests were calculated from the observed-data degrees of freedom as specified by Rubin (1987) and repeated by Schafer and Olsen (1998):

[1] Despite this restriction, black-white differences estimated under this strategy are similar in magnitude to those estimated using separate outcome equations for blacks and whites.

$$dfO = (m - 1)\,[1 + mW / (m + 1) / B]^{2} \quad (9)$$

where m, W, and B are defined above.

Defining gamma as 1 / (1 + mW / (m+1) / B) we can see that

$$\text{observed-data degrees of freedom: } dfO = (m - 1)\,\text{gamma}^{-2} \quad (10)$$

Following Barnard and Rubin (1999), the small-sample degrees of freedom (dfS) were defined as:

$$dfS = dfC / (1 / \text{lambda} / (1 - \text{gamma}) + dfC / dfO) \quad (11)$$

where dfC = the complete-data degrees of freedom and lambda = (dfC +1) / (dfC + 3). Significance tests were performed by comparing the ratio $E(Q)/\sqrt{T}$ to a Student's t-distribution with degrees of freedom dfS.

## II. EFFECTS OF SAMPLE SELECTION ON ESTIMATES OF BLACK-WHITE DIFFERENCES

The estimation of outcome equations did not include corrections for sample selection bias. While selection bias arising from missing data was corrected for through multiple imputation, other selection bias arises from the definition of the outcome itself (for example, college completion for the sample of college attendees, or earnings for individuals with positive earnings). Sample selection models require the identification of factors influencing selection into the sample but not the outcome itself, and these factors are typically difficult to isolate. As long as selection into a sample is random, estimated black-white differences should be similar to those differences for the population as a whole. To the extent that selection into the sample is nonrandom, estimated black-white differences are valid in describing the population over which the estimation occurs, and reflect black-white differences in selection into the sample.

## III. EFFECTS OF MEASUREMENT ERROR ON ESTIMATES OF BLACK-WHITE DIFFERENCES

Because test scores are an imperfect measure of actual educational achievement, and SES values are an imperfect measure of actual socioeconomic status, it is likely that measurement error affects the estimates of the propensity scores described above. However, it is unlikely that this measurement error has a large effect on estimated black-white differences. The propensity scoring method divides cases into subgroups on the basis of their estimated propensity scores. Even though measurement error in educational achievement and SES result in less precise estimates of the propensity scores, this only affects the estimation of black-white differences to the extent that it distorts the rank order of the cases by the estimated propensity score. A few cases with propensity scores close to the subgroup cutoffs may be placed in the wrong subgroup, but otherwise the measurement error does not affect the estimation of black-white differences.

# APPENDIX D: SAMPLE SIZES AND STANDARD ERRORS FOR TABLES IN CHAPTERS 2, 3, AND 4

This appendix presents tables of sample sizes and standard errors corresponding to the results presented in chapters 2, 3, and 4. The standard errors were calculated accounting for the sample designs of the datasets studied. In particular, adjustments were made for the clustering of sample observations in the Primary Sampling Units (PSUs) included in each survey. The "linearization" approach was used, employing a first-order Taylor expansion to estimate the variance of the parameters of each linear regression equation.[1] Because of limited information on the stratification of PSUs in the NLSY and Prospects samples, no adjustments were made for stratification of PSUs (or of observations within PSUs). However, comparison of standard errors in the NELS:88 sample with adjustments for clustering only, and with adjustments for both clustering and stratification, indicated that adding adjustments for stratification increased sample design effects by no more than 0.2 percent, making it unlikely that the results of any hypothesis tests would differ if stratification were accounted for.

[1] Details of the estimation procedure used are discussed in the *Stata Reference Manual,* Release 5, Volume 3, P–Z, pp. 427–429.

## Table D.1—Standard errors for Table 2.1: Black-white differences in labor force participation rates for young adults in 4 samples, 1979-1992

| Description of sample of young adults, source of data, and sex of subgroup | Sample size | S.E. of black-white difference adjusting for (1) no variables | (2) achievement only | (3) multiple factors+ | S.E. of change in black-white difference: difference between (2) and (1) | difference between (3) and (1) | difference between (3) and (2) |
|---|---|---|---|---|---|---|---|
| **High school seniors, 7 years later** | | | | | | | |
| **In 1979 (from the NLS-72)** | | | | | | | |
| Men and women combined | 12243 | 0.97 | 1.78 | 1.49 | 1.50 | 1.12 | 1.15 |
| Men only | 5791 | 1.16 | 3.01 | 1.43 | 2.78 | 0.84 | 2.67 |
| Women only | 6452 | 1.43 | 1.89 | 2.20 | 1.23 | 1.61 | 1.24 |
| Difference between men and women | 12243 | 1.84 | 3.53 | 2.62 | 3.02 | 1.81 | 2.69 |
| **In 1983-1989 (from the NLSY)** | | | | | | | |
| Men and women combined | 6893 | 1.21 | 1.60 | 1.67 | 1.07 | 1.18 | 0.58 |
| Men only | 3303 | 1.29 | 1.94 | 1.89 | 1.48 | 1.46 | 0.63 |
| Women only | 3590 | 1.86 | 2.57 | 2.76 | 1.80 | 2.06 | 0.98 |
| Difference between men and women | 6893 | 2.28 | 3.24 | 3.36 | 2.33 | 2.51 | 0.98 |
| **Difference between 1983-1989 and 1979 samples** | | | | | | | |
| Men and women combined | 19136 | 1.55 | 2.40 | 2.24 | 1.84 | 1.63 | 1.29 |
| Men only | 9094 | 1.74 | 3.59 | 2.38 | 3.15 | 1.68 | 2.75 |
| Women only | 10042 | 2.35 | 3.19 | 3.53 | 2.18 | 2.61 | 1.58 |
| Difference between men and women | 19136 | 2.93 | 4.79 | 4.26 | 3.82 | 3.10 | 2.86 |
| **High school sophomores, 12 years later** | | | | | | | |
| **In 1986-1992 (from the NLSY)** | | | | | | | |
| Men and women combined | 8838 | 1.14 | 1.17 | 1.66 | 0.33 | 1.20 | 1.17 |
| Men only | 4368 | 1.30 | 1.31 | 1.20 | 0.61 | 0.82 | 0.66 |
| Women only | 4470 | 1.69 | 1.84 | 3.15 | 0.80 | 2.70 | 2.59 |
| Difference between men and women | 8838 | 2.15 | 2.24 | 3.33 | 0.89 | 2.63 | 2.53 |
| **In 1992 (from HSB)** | | | | | | | |
| Men and women combined | 10857 | 1.61 | 1.34 | 1.33 | 0.88 | 0.91 | 0.62 |
| Men only | 5302 | 2.48 | 2.07 | 1.76 | 1.51 | 1.74 | 1.10 |
| Women only | 5555 | 1.89 | 1.82 | 1.87 | 0.69 | 0.62 | 0.61 |
| Difference between men and women | 10857 | 3.09 | 2.90 | 2.53 | 1.51 | 1.64 | 1.24 |
| **Difference between 1992 and 1986-1992 samples** | | | | | | | |
| Men and women combined | 19695 | 1.98 | 1.78 | 2.13 | 0.94 | 1.51 | 1.33 |
| Men only | 9670 | 2.81 | 2.45 | 2.13 | 1.62 | 1.93 | 1.29 |
| Women only | 10025 | 2.53 | 2.59 | 3.67 | 1.06 | 2.78 | 2.66 |
| Difference between men and women | 19695 | 3.77 | 3.66 | 4.18 | 1.75 | 3.10 | 2.82 |

+ = Multiple factors include educational achievement, educational attainment, and length of work experience

NOTE: Difference between group X and group Y refers to the mean for group X minus the mean for group Y. S.E. = standard error. Standard errors have been adjusted for complex survey designs. Samples restricted to civilians. Multiple imputation used to account for missing data.

SOURCE: U.S. Department of Education, National Center for Education Statistics, National Longitudinal Study of the High School Class of 1972

(NLS-72), High School and Beyond (HSB); and U.S. Department of Labor, Bureau of Labor Statistics, National Longitudinal Survey of Youth (NLSY).

## Table D.2—Standard errors for Table 2.2: Black-white differences in unemployment rates for young adults in 4 samples, 1979-1992

| Description of sample of young adults, source of data, and sex of subgroup | Sample size | S.E. of black-white difference adjusting for (1) no variables | (2) achievement only | (3) multiple factors+ | S.E. of change in black-white difference: difference between (2) and (1) | difference between (3) and (1) | difference between (3) and (2) |
|---|---|---|---|---|---|---|---|
| **High school seniors, 7 years later** | | | | | | | |
| **In 1979 (from the NLS-72)** | | | | | | | |
| Men and women combined | 10581 | 0.75 | 0.82 | 0.93 | 0.34 | 0.57 | 0.45 |
| Men only | 5501 | 1.06 | 1.32 | 1.52 | 0.80 | 1.10 | 0.75 |
| Women only | 5080 | 1.08 | 0.84 | 0.66 | 0.66 | 0.85 | 0.54 |
| Difference between men and women | 10581 | 1.51 | 1.57 | 1.66 | 0.48 | 0.72 | 0.53 |
| **In 1983-1989 (from the NLSY)** | | | | | | | |
| Men and women combined | 5966 | 1.10 | 1.30 | 1.08 | 0.71 | 0.34 | 0.71 |
| Men only | 3062 | 1.68 | 2.00 | 1.24 | 1.08 | 1.05 | 1.50 |
| Women only | 2904 | 1.52 | 1.60 | 1.80 | 0.55 | 1.01 | 0.85 |
| Difference between men and women | 5966 | 2.30 | 2.62 | 2.22 | 1.24 | 0.57 | 1.24 |
| **Difference between 1983-1989 and 1979 samples** | | | | | | | |
| Men and women combined | 16547 | 1.33 | 1.54 | 1.43 | 0.79 | 0.67 | 0.84 |
| Men only | 8563 | 1.98 | 2.40 | 1.96 | 1.35 | 1.52 | 1.68 |
| Women only | 7984 | 1.86 | 1.81 | 1.92 | 0.86 | 1.33 | 1.00 |
| Difference between men and women | 16547 | 2.75 | 3.06 | 2.77 | 1.33 | 0.92 | 1.35 |
| **High school sophomores, 12 years later** | | | | | | | |
| **In 1986-1992 (from the NLSY)** | | | | | | | |
| Men and women combined | 7425 | 1.37 | 1.64 | 1.46 | 1.07 | 0.97 | 0.77 |
| Men only | 3890 | 2.02 | 2.43 | 2.13 | 1.71 | 1.58 | 0.94 |
| Women only | 3535 | 1.57 | 1.60 | 1.56 | 0.38 | 0.46 | 0.50 |
| Difference between men and women | 7425 | 2.44 | 2.89 | 2.63 | 1.73 | 1.58 | 1.07 |
| **In 1992 (from HSB)** | | | | | | | |
| Men and women combined | 9189 | 1.21 | 1.22 | 1.12 | 0.69 | 0.78 | 0.44 |
| Men only | 4884 | 1.45 | 1.47 | 1.21 | 0.78 | 0.86 | 0.78 |
| Women only | 4305 | 1.81 | 1.86 | 1.21 | 1.02 | 1.34 | 1.24 |
| Difference between men and women | 9189 | 2.23 | 2.22 | 1.47 | 1.17 | 1.61 | 1.57 |
| **Difference between 1992 and 1986-1992 samples** | | | | | | | |
| Men and women combined | 16614 | 1.83 | 2.05 | 1.84 | 1.27 | 1.24 | 0.88 |
| Men only | 8774 | 2.48 | 2.84 | 2.45 | 1.88 | 1.80 | 1.22 |
| Women only | 7840 | 2.40 | 2.45 | 1.97 | 1.08 | 1.41 | 1.34 |
| Difference between men and women | 16614 | 3.31 | 3.64 | 3.01 | 2.09 | 2.25 | 1.90 |

+ = Multiple factors include educational achievement, educational attainment, and length of work experience

NOTE: Difference between group X and group Y refers to the mean for group X minus the mean for group Y. S.E. = standard error. Standard errors have been adjusted for complex survey designs. Samples restricted to civilian labor force participants. Multiple imputation used to account for missing data.

SOURCE: U.S. Department of Education, National Center for Education Statistics, National Longitudinal Study of the High School Class of 1972 (NLS-72), High School and Beyond (HSB); and U.S. Department of Labor, Bureau of Labor Statistics, National Longitudinal Survey of Youth (NLSY).

## Table D.3—Standard errors for Table 2.3: Black-white differences in average annual earnings for young adults in 4 samples, 1979-1992

| Description of sample of young adults, source of data, and sex of subgroup | Sample size | S.E. of black-white difference adjusting for (1) no variables | (2) achievement only | (3) multiple factors+ | S.E. of change in black-white difference: difference between (2) and (1) | difference between (3) and (1) | difference between (3) and (2) |
|---|---|---|---|---|---|---|---|
| **High school seniors, 7 years later** | | | | | | | |
| **In 1979 (from the NLS-72)** | | | | | | | |
| Men and women combined | 11,162 | 0.034 | 0.043 | 0.040 | 0.028 | 0.023 | 0.018 |
| Men only | 5,834 | 0.044 | 0.064 | 0.058 | 0.050 | 0.041 | 0.033 |
| Women only | 5,328 | 0.047 | 0.053 | 0.047 | 0.026 | 0.016 | 0.024 |
| Difference between men and women | 11,162 | 0.064 | 0.083 | 0.073 | 0.057 | 0.042 | 0.042 |
| **In 1983-1989 (from the NLSY)** | | | | | | | |
| Men and women combined | 6,095 | 0.044 | 0.044 | 0.054 | 0.015 | 0.038 | 0.034 |
| Men only | 3,102 | 0.055 | 0.063 | 0.072 | 0.034 | 0.054 | 0.040 |
| Women only | 2,993 | 0.053 | 0.065 | 0.082 | 0.041 | 0.066 | 0.052 |
| Difference between men and women | 6,095 | 0.076 | 0.090 | 0.110 | 0.053 | 0.085 | 0.065 |
| **Difference between 1983-1989 and 1979 samples** | | | | | | | |
| Men and women combined | 17,257 | 0.055 | 0.062 | 0.067 | 0.031 | 0.044 | 0.039 |
| Men only | 8,936 | 0.071 | 0.090 | 0.093 | 0.061 | 0.067 | 0.052 |
| Women only | 8,321 | 0.071 | 0.084 | 0.095 | 0.049 | 0.068 | 0.057 |
| Difference between men and women | 17,257 | 0.100 | 0.123 | 0.133 | 0.077 | 0.095 | 0.077 |
| **High school sophomores, 12 years later** | | | | | | | |
| **In 1986-1992 (from the NLSY)** | | | | | | | |
| Men and women combined | 6,666 | 0.041 | 0.048 | 0.059 | 0.024 | 0.045 | 0.041 |
| Men only | 3,459 | 0.050 | 0.056 | 0.059 | 0.029 | 0.037 | 0.022 |
| Women only | 3,207 | 0.059 | 0.063 | 0.100 | 0.029 | 0.084 | 0.080 |
| Difference between men and women | 6,666 | 0.077 | 0.084 | 0.115 | 0.042 | 0.090 | 0.082 |
| **In 1992 (from HSB)** | | | | | | | |
| Men and women combined | 9,592 | 0.036 | 0.039 | 0.045 | 0.015 | 0.022 | 0.018 |
| Men only | 5,002 | 0.045 | 0.046 | 0.046 | 0.021 | 0.021 | 0.022 |
| Women only | 4,590 | 0.054 | 0.058 | 0.075 | 0.026 | 0.044 | 0.031 |
| Difference between men and women | 9,592 | 0.073 | 0.071 | 0.081 | 0.034 | 0.042 | 0.035 |
| **Difference between 1992 and 1986-1992 samples** | | | | | | | |
| Men and women combined | 16,258 | 0.055 | 0.062 | 0.075 | 0.028 | 0.050 | 0.045 |
| Men only | 8,461 | 0.067 | 0.072 | 0.075 | 0.036 | 0.042 | 0.031 |
| Women only | 7,797 | 0.080 | 0.085 | 0.125 | 0.039 | 0.094 | 0.085 |
| Difference between men and women | 16,258 | 0.106 | 0.110 | 0.141 | 0.054 | 0.100 | 0.090 |

+ = Multiple factors include educational achievement, educational attainment, and length of work experience

NOTE: Difference between group X and group Y refers to the mean for group X minus the mean for group Y. S.E. = standard error of the log of annual earnings. Standard errors have been adjusted for complex survey designs. Samples restricted to employed civilians. Multiple imputation used to account for missing data.

SOURCE: U.S. Department of Education, National Center for Education Statistics, National Longitudinal Study of the High School Class of 1972 (NLS-72), High School and Beyond (HSB); and U.S. Department of Labor, Bureau of Labor Statistics, National Longitudinal Survey of Youth (NLSY).

## Table D.4—Standard errors for Table 2.4: Black-white differences in hourly wages for young adults in 3 samples, 1979-1992

| Description of sample of young adults, source of data, and sex of subgroup | Sample size | S.E. of black-white difference adjusting for (1) no variables | (2) achievement only | (3) multiple factors+ | S.E. of change in black-white difference: difference between (2) and (1) | difference between (3) and (1) | difference between (3) and (2) |
|---|---|---|---|---|---|---|---|
| **High school seniors, 7 years later** | | | | | | | |
| **In 1979 (from the NLS-72)** | | | | | | | |
| Men and women combined | 10106 | 0.018 | 0.037 | 0.032 | 0.032 | 0.025 | 0.016 |
| Men only | 5333 | 0.030 | 0.064 | 0.046 | 0.055 | 0.035 | 0.037 |
| Women only | 4773 | 0.020 | 0.028 | 0.027 | 0.021 | 0.020 | 0.011 |
| Difference between men and women | 10106 | 0.036 | 0.069 | 0.054 | 0.060 | 0.042 | 0.038 |
| **In 1983-1989 (from the NLSY)** | | | | | | | |
| Men and women combined | 5441 | 0.020 | 0.028 | 0.028 | 0.021 | 0.021 | 0.005 |
| Men only | 2794 | 0.025 | 0.046 | 0.046 | 0.039 | 0.040 | 0.011 |
| Women only | 2647 | 0.025 | 0.037 | 0.036 | 0.029 | 0.028 | 0.013 |
| Difference between men and women | 5441 | 0.036 | 0.059 | 0.061 | 0.049 | 0.049 | 0.017 |
| **Difference between 1983-1989 and 1979 samples** | | | | | | | |
| Men and women combined | 15547 | 0.027 | 0.046 | 0.042 | 0.038 | 0.033 | 0.017 |
| Men only | 8127 | 0.039 | 0.078 | 0.066 | 0.068 | 0.053 | 0.038 |
| Women only | 7420 | 0.032 | 0.046 | 0.045 | 0.036 | 0.034 | 0.017 |
| Difference between men and women | 15547 | 0.051 | 0.091 | 0.081 | 0.077 | 0.064 | 0.042 |
| **High school sophomores, 12 years later** | | | | | | | |
| **In 1986-1992 (from the NLSY)** | | | | | | | |
| Men and women combined | 6170 | 0.023 | 0.026 | 0.033 | 0.015 | 0.025 | 0.019 |
| Men only | 3291 | 0.027 | 0.041 | 0.047 | 0.033 | 0.039 | 0.021 |
| Women only | 2879 | 0.030 | 0.031 | 0.041 | 0.015 | 0.031 | 0.027 |
| Difference between men and women | 6170 | 0.040 | 0.051 | 0.062 | 0.036 | 0.050 | 0.034 |

+ = Multiple factors include educational achievement, educational attainment, and length of work experience

NOTE: Difference between group X and group Y refers to the mean for group X minus the mean for group Y. S.E. = standard error of the log of hourly wage. Standard errors have been adjusted for complex survey designs. Samples restricted to employed civilians. Multiple imputation used to account for missing data.

SOURCE: U.S. Department of Education, National Center for Education Statistics, National Longitudinal Study of the High School Class of 1972 (NLS-72); and U.S. Department of Labor, Bureau of Labor Statistics, National Longitudinal Survey of Youth (NLSY).

## Table D.5—Standard errors for Table 3.1: Black-white differences in high school/GED completion rates for young adults in 3 samples, 1983-1992

| Description of sample of young adults, source of data, and sex of subgroup | Sample size | S.E. of black-white difference adjusting for (1) no variables | (2) achievement only | (3) multiple factors+ | S.E. of change in black-white difference: difference between (2) and (1) | difference between (3) and (1) | difference between (3) and (2) |
|---|---|---|---|---|---|---|---|
| **High school seniors, 7 years later** | | | | | | | |
| **In 1983-1989 (from the NLSY)** | | | | | | | |
| Men and women combined | 7424 | 0.97 | 1.29 | 1.46 | 0.89 | 1.12 | 0.69 |
| Men only | 3636 | 1.43 | 1.26 | 1.43 | 0.63 | 0.36 | 0.72 |
| Women only | 3788 | 1.18 | 2.12 | 2.53 | 1.78 | 2.26 | 1.43 |
| Difference between men and women | 7424 | 1.85 | 2.46 | 2.92 | 1.67 | 2.29 | 1.57 |
| **High school sophomores, 12 years later** | | | | | | | |
| **In 1986-1992 (from the NLSY)** | | | | | | | |
| Men and women combined | 8998 | 1.22 | 0.93 | 1.07 | 0.66 | 0.40 | 0.53 |
| Men only | 4506 | 1.70 | 1.33 | 1.70 | 0.81 | 0.76 | 1.04 |
| Women only | 4492 | 1.54 | 1.09 | 1.26 | 0.93 | 0.75 | 0.61 |
| Difference between men and women | 8998 | 2.29 | 1.72 | 2.11 | 1.23 | 0.51 | 1.20 |
| **In 1992 (from HSB)** | | | | | | | |
| Men and women combined | 10929 | 1.02 | 0.66 | 0.70 | 0.80 | 0.70 | 0.41 |
| Men only | 5367 | 1.66 | 1.05 | 1.31 | 1.15 | 0.78 | 0.82 |
| Women only | 5562 | 1.55 | 1.01 | 0.69 | 1.15 | 1.24 | 0.61 |
| Difference between men and women | 10929 | 2.55 | 1.46 | 1.59 | 1.68 | 1.58 | 0.72 |
| **Difference between 1992 and 1986-1992 samples** | | | | | | | |
| Men and women combined | 19927 | 1.59 | 1.14 | 1.28 | 1.04 | 0.80 | 0.68 |
| Men only | 9873 | 2.38 | 1.70 | 2.14 | 1.41 | 1.09 | 1.32 |
| Women only | 10054 | 2.18 | 1.48 | 1.44 | 1.48 | 1.45 | 0.87 |
| Difference between men and women | 19927 | 3.43 | 2.26 | 2.64 | 2.09 | 1.66 | 1.40 |

+ = Multiple factors include educational achievement, parental socioeconomic status, and Census region

NOTE: Difference between group X and group Y refers to the mean for group X minus the mean for group Y. S.E. = standard error. Standard errors have been adjusted for complex survey designs. Multiple imputation used to account for missing data.

SOURCE: U.S. Department of Education, National Center for Education Statistics, High School and Beyond (HSB); and U.S. Department of Labor, Bureau of Labor Statistics, National Longitudinal Survey of Youth (NLSY).

## Table D.6—Standard errors for Table 3.2: Black-white differences in college attendance rates for young adults in 4 samples, 1979-1992

| Description of sample of young adults, source of data, and sex of subgroup | Sample size | S.E. of black-white difference adjusting for (1) no variables | (2) achievement only | (3) multiple factors+ | S.E. of change in black-white difference: difference between (2) and (1) | difference between (3) and (1) | difference between (3) and (2) |
|---|---|---|---|---|---|---|---|
| **High school seniors, 7 years later** | | | | | | | |
| **In 1979 (from the NLS-72)** | | | | | | | |
| Men and women combined | 12577 | 1.77 | 1.25 | 1.19 | 0.71 | 0.82 | 0.50 |
| Men only | 6078 | 2.47 | 1.85 | 1.84 | 0.64 | 0.95 | 0.83 |
| Women only | 6499 | 2.16 | 1.87 | 2.84 | 0.61 | 2.28 | 2.20 |
| Difference between men and women | 12577 | 3.29 | 2.64 | 3.37 | 0.46 | 2.17 | 2.16 |
| **In 1983-1989 (from the NLSY)** | | | | | | | |
| Men and women combined | 7424 | 2.00 | 1.85 | 2.34 | 0.96 | 1.64 | 1.36 |
| Men only | 3636 | 2.44 | 2.13 | 2.68 | 1.08 | 1.87 | 1.54 |
| Women only | 3788 | 2.54 | 2.97 | 3.47 | 2.20 | 2.74 | 1.54 |
| Difference between men and women | 7424 | 3.53 | 3.66 | 4.39 | 2.51 | 3.36 | 2.20 |
| **Difference between 1983-1989 and 1979 samples** | | | | | | | |
| Men and women combined | 20001 | 2.67 | 2.23 | 2.62 | 1.19 | 1.84 | 1.45 |
| Men only | 9714 | 3.48 | 2.83 | 3.25 | 1.26 | 2.10 | 1.75 |
| Women only | 10287 | 3.33 | 3.51 | 4.48 | 2.29 | 3.56 | 2.68 |
| Difference between men and women | 20001 | 4.82 | 4.51 | 5.54 | 2.55 | 4.00 | 3.09 |
| **High school sophomores, 12 years later** | | | | | | | |
| **In 1986-1992 (from the NLSY)** | | | | | | | |
| Men and women combined | 7344 | 2.22 | 1.56 | 1.89 | 1.02 | 0.65 | 1.09 |
| Men only | 3534 | 2.67 | 2.12 | 2.17 | 0.45 | 0.64 | 0.61 |
| Women only | 3810 | 2.65 | 1.97 | 2.14 | 0.85 | 0.77 | 0.55 |
| Difference between men and women | 7344 | 3.76 | 2.89 | 3.05 | 0.85 | 0.96 | 0.60 |
| **In 1992 (from HSB)** | | | | | | | |
| Men and women combined | 10278 | 1.99 | 2.33 | 2.96 | 1.81 | 2.47 | 1.72 |
| Men only | 5015 | 2.76 | 3.48 | 4.43 | 2.61 | 3.64 | 2.55 |
| Women only | 5263 | 2.71 | 2.54 | 2.67 | 1.47 | 1.68 | 1.24 |
| Difference between men and women | 10278 | 3.85 | 4.21 | 5.24 | 2.87 | 4.03 | 3.20 |
| **Difference between 1992 and 1986-1992 samples** | | | | | | | |
| Men and women combined | 17622 | 2.98 | 2.81 | 3.51 | 2.08 | 2.56 | 2.04 |
| Men only | 8549 | 3.85 | 4.08 | 4.93 | 2.65 | 3.69 | 2.63 |
| Women only | 9073 | 3.79 | 3.22 | 3.42 | 1.70 | 1.85 | 1.36 |
| Difference between men and women | 17622 | 5.38 | 5.11 | 6.06 | 3.00 | 4.15 | 3.25 |

+ = Multiple factors include educational achievement, parental socioeconomic status, and Census region

NOTE: Difference between group X and group Y refers to the mean for group X minus the mean for group Y. S.E. = standard error. Standard errors have been adjusted for complex survey designs. Sophomore samples restricted to high school graduates. Multiple imputation used to account for missing data.

SOURCE: U.S. Department of Education, National Center for Education Statistics, National Longitudinal Study of the High School Class of 1972 (NLS-72), High School and Beyond (HSB); and U.S. Department of Labor, Bureau of Labor Statistics, National Longitudinal Survey of Youth (NLSY).

## Table D.7—Standard errors for Table 3.3: Black-white differences in college completion rates for young adults in 4 samples, 1979-1992

| Description of sample of young adults, source of data, and sex of subgroup | Sample size | S.E. of black-white difference adjusting for (1) no variables | (2) achievement only | (3) multiple factors+ | S.E. of change in black-white difference: difference between (2) and (1) | difference between (3) and (1) | difference between (3) and (2) |
|---|---|---|---|---|---|---|---|
| **High school seniors, 7 years later** | | | | | | | |
| **In 1979 (from the NLS-72)** | | | | | | | |
| Men and women combined | 7899 | 1.92 | 3.77 | 4.69 | 3.42 | 4.395 | 2.82 |
| Men only | 3965 | 2.71 | 5.11 | 7.54 | 4.55 | 7.17 | 5.61 |
| Women only | 3934 | 2.50 | 5.26 | 5.98 | 4.80 | 5.58 | 2.89 |
| Difference between men and women | 7899 | 3.68 | 7.28 | 9.47 | 6.52 | 8.92 | 6.30 |
| **In 1983-1989 (from the NLSY)** | | | | | | | |
| Men and women combined | 3807 | 2.31 | 4.40 | 4.92 | 3.95 | 4.48 | 1.75 |
| Men only | 1776 | 3.03 | 5.65 | 6.46 | 5.01 | 5.84 | 2.64 |
| Women only | 2031 | 3.05 | 5.76 | 6.68 | 5.25 | 6.22 | 3.15 |
| Difference between men and women | 3807 | 4.30 | 8.09 | 9.29 | 7.28 | 8.55 | 3.56 |
| **Difference between 1983-1989 and 1979 samples** | | | | | | | |
| Men and women combined | 11706 | 3.01 | 5.79 | 6.80 | 5.22 | 6.28 | 3.32 |
| Men only | 5741 | 4.06 | 7.62 | 9.93 | 6.77 | 9.25 | 6.20 |
| Women only | 5965 | 3.94 | 7.80 | 8.97 | 7.12 | 8.36 | 4.27 |
| Difference between men and women | 11706 | 5.66 | 10.88 | 13.27 | 9.78 | 12.35 | 7.24 |
| **High school sophomores, 12 years later** | | | | | | | |
| **In 1986-1992 (from the NLSY)** | | | | | | | |
| Men and women combined | 4300 | 2.28 | 3.98 | 4.54 | 3.54 | 4.11 | 1.90 |
| Men only | 2011 | 2.92 | 5.34 | 6.32 | 4.80 | 5.77 | 2.67 |
| Women only | 2289 | 2.85 | 4.36 | 5.52 | 3.77 | 4.98 | 3.03 |
| Difference between men and women | 4300 | 4.08 | 6.82 | 8.38 | 6.04 | 7.63 | 4.08 |
| **In 1992 (from HSB)** | | | | | | | |
| Men and women combined | 6835 | 2.09 | 2.60 | 2.83 | 1.85 | 2.17 | 1.31 |
| Men only | 3263 | 3.01 | 3.59 | 4.06 | 2.42 | 2.98 | 2.32 |
| Women only | 3572 | 2.66 | 3.97 | 3.72 | 3.02 | 3.19 | 2.19 |
| Difference between men and women | 6835 | 4.04 | 5.56 | 5.60 | 3.92 | 4.52 | 3.66 |
| **Difference between 1992 and 1986-1992 samples** | | | | | | | |
| Men and women combined | 11135 | 3.10 | 4.76 | 5.35 | 4.00 | 4.64 | 2.31 |
| Men only | 5274 | 4.19 | 6.44 | 7.51 | 5.38 | 6.50 | 3.54 |
| Women only | 5861 | 3.90 | 5.89 | 6.66 | 4.83 | 5.92 | 3.74 |
| Difference between men and women | 11135 | 5.74 | 8.80 | 10.08 | 7.20 | 8.86 | 5.48 |

+ = Multiple factors include educational achievement, parental socioeconomic status, and Census region

NOTE: Difference between group X and group Y refers to the mean for group X minus the mean for group Y. S.E. = standard error. Standard errors have been adjusted for complex survey designs. Sophomore samples are restricted to persons who have attended some college. Multiple imputation used to account for missing data.

SOURCE: U.S. Department of Education, National Center for Education Statistics, National Longitudinal Study of the High School Class of 1972 (NLS-72), High School and Beyond (HSB); and U.S. Department of Labor, Bureau of Labor Statistics, National Longitudinal Survey of Youth (NLSY).

## Table D.8—Standard errors for Table 4.1: Black-white differences in average mathematics achievement in grades 1 to 2 and 3 to 5 for 2 samples of children, 1991-1993

| Description of source of data, grade and outcome, and sex of subgroup | Sample size | S.E. of black-white difference adjusting for (1) no variables | (2) achievement only | (3) multiple factors+ | S.E. of change in black-white difference: difference between (2) and (1) | difference between (3) and (1) | difference between (3) and (2) |
|---|---|---|---|---|---|---|---|
| **Prospects Cohort 1 (1992-1993)** | | | | | | | |
| **Grade 1 mathematics achievement** | | | | | | | |
| Boys and girls combined | 7542 | 0.176 | —— | —— | —— | —— | —— |
| Boys only | 3829 | 0.202 | —— | —— | —— | —— | —— |
| Girls only | 3713 | 0.158 | —— | —— | —— | —— | —— |
| Difference between boys and girls | 7542 | 0.254 | —— | —— | —— | —— | —— |
| **Grade 2 mathematics achievement** | | | | | | | |
| Boys and girls combined | 7542 | 0.117 | 0.072 | 0.116 | 0.033 | 0.065 | 0.057 |
| Boys only | 3829 | 0.112 | 0.096 | 0.201 | 0.070 | 0.156 | 0.135 |
| Girls only | 3713 | 0.145 | 0.078 | 0.132 | 0.043 | 0.091 | 0.069 |
| Difference between boys and girls | 7542 | 0.180 | 0.120 | 0.237 | 0.096 | 0.177 | 0.151 |
| **Growth between grades 1 and 2** | | | | | | | |
| Boys and girls combined | 7542 | 0.130 | 0.068 | 0.078 | 0.081 | 0.099 | 0.027 |
| Boys only | 3829 | 0.165 | 0.088 | 0.119 | 0.116 | 0.141 | 0.068 |
| Girls only | 3713 | 0.116 | 0.080 | 0.117 | 0.055 | 0.080 | 0.062 |
| Difference between boys and girls | 7542 | 0.187 | 0.113 | 0.166 | 0.131 | 0.173 | 0.106 |
| **Prospects Cohort 3 (1991-1993)** | | | | | | | |
| **Grade 3 mathematics achievement** | | | | | | | |
| Boys and girls combined | 11017 | 0.067 | —— | —— | —— | —— | —— |
| Boys only | 5553 | 0.099 | —— | —— | —— | —— | —— |
| Girls only | 5464 | 0.065 | —— | —— | —— | —— | —— |
| Difference between boys and girls | 11017 | 0.123 | —— | —— | —— | —— | —— |
| **Grade 5 mathematics achievement** | | | | | | | |
| Boys and girls combined | 11017 | 0.060 | 0.034 | 0.082 | 0.022 | 0.064 | 0.070 |
| Boys only | 5553 | 0.066 | 0.045 | 0.154 | 0.041 | 0.140 | 0.154 |
| Girls only | 5464 | 0.071 | 0.044 | 0.084 | 0.028 | 0.053 | 0.055 |
| Difference between boys and girls | 11017 | 0.096 | 0.067 | 0.182 | 0.046 | 0.156 | 0.163 |
| **Growth between grades 3 and 5** | | | | | | | |
| Boys and girls combined | 11017 | 0.107 | 0.073 | 0.118 | 0.062 | 0.110 | 0.103 |
| Boys only | 5553 | 0.180 | 0.105 | 0.153 | 0.131 | 0.196 | 0.112 |
| Girls only | 5464 | 0.101 | 0.089 | 0.199 | 0.048 | 0.156 | 0.144 |
| Difference between boys and girls | 11017 | 0.216 | 0.149 | 0.286 | 0.151 | 0.261 | 0.190 |

+ = Multiple factors include achievement (average of math and reading scores from initial grade), parental socioeconomic status, and Census region

—— = Not applicable because of absence of information on math or reading achievement prior to the initial grade for each sample

NOTE: Difference between group X and group Y refers to the mean for group X minus the mean for group Y. Standard errors have been adjusted for complex survey designs. 8th Grade SDUs = eighth-grade standard deviation units; 8th grade score is normalized to have mean of zero and standard deviation of 1.00. Multiple imputation used to account for missing data.

SOURCE: U.S. Department of Education, Chapter 1 Prospects Study.

## Table D.9—Standard errors for Table 4.2: Black-white differences in average mathematics achievement in grades 7 to 9 and 10 to 12 for 2 samples of children, 1990-1993

| Description of source of data, grade and outcome, and sex of subgroup | Sample size | S.E. of black-white difference adjusting for (1) no variables | (2) achievement only | (3) multiple factors+ | S.E. of change in black-white difference: difference between (2) and (1) | difference between (3) and (1) | difference between (3) and (2) |
|---|---|---|---|---|---|---|---|
| **Prospects Cohort 7 (1991-1993)** | | | | | | | |
| **Grade 7 mathematics achievement** | | | | | | | |
| Boys and girls combined | 6654 | 0.056 | —— | —— | —— | —— | —— |
| Boys only | 3419 | 0.066 | —— | —— | —— | —— | —— |
| Girls only | 3235 | 0.087 | —— | —— | —— | —— | —— |
| Difference between boys and girls | 6654 | 0.114 | —— | —— | —— | —— | —— |
| **Grade 9 mathematics achievement** | | | | | | | |
| Boys and girls combined | 6654 | 0.076 | 0.060 | 0.081 | 0.044 | 0.056 | 0.058 |
| Boys only | 3419 | 0.089 | 0.069 | 0.111 | 0.050 | 0.086 | 0.082 |
| Girls only | 3235 | 0.095 | 0.103 | 0.117 | 0.072 | 0.086 | 0.049 |
| Difference between boys and girls | 6654 | 0.134 | 0.128 | 0.167 | 0.085 | 0.121 | 0.099 |
| **Growth between grades 7 and 9** | | | | | | | |
| Boys and girls combined | 6654 | 0.111 | 0.118 | 0.152 | 0.081 | 0.094 | 0.109 |
| Boys only | 3419 | 0.146 | 0.138 | 0.205 | 0.072 | 0.106 | 0.135 |
| Girls only | 3235 | 0.167 | 0.197 | 0.240 | 0.125 | 0.171 | 0.132 |
| Difference between boys and girls | 6654 | 0.237 | 0.243 | 0.323 | 0.121 | 0.197 | 0.187 |
| **NELS:88 (1990-1992)** | | | | | | | |
| **Grade 8 mathematics achievement** | | | | | | | |
| Boys and girls combined | 12954 | 0.046 | —— | —— | —— | —— | —— |
| Boys only | 6409 | 0.058 | —— | —— | —— | —— | —— |
| Girls only | 6545 | 0.060 | —— | —— | —— | —— | —— |
| Difference between boys and girls | 12954 | 0.083 | —— | —— | —— | —— | —— |
| **Grade 12 mathematics achievement** | | | | | | | |
| Boys and girls combined | 12954 | 0.065 | 0.039 | 0.060 | 0.061 | 0.059 | 0.054 |
| Boys only | 6409 | 0.077 | 0.048 | 0.083 | 0.074 | 0.083 | 0.055 |
| Girls only | 6545 | 0.089 | 0.063 | 0.076 | 0.087 | 0.074 | 0.105 |
| Difference between boys and girls | 12954 | 0.117 | 0.083 | 0.106 | 0.112 | 0.094 | 0.106 |
| **Growth between grades 8 and 12** | | | | | | | |
| Boys and girls combined | 12954 | 0.155 | 0.153 | 0.163 | 0.083 | 0.157 | 0.100 |
| Boys only | 6409 | 0.154 | 0.163 | 0.275 | 0.112 | 0.253 | 0.180 |
| Girls only | 6545 | 0.247 | 0.244 | 0.203 | 0.102 | 0.216 | 0.189 |
| Difference between boys and girls | 12954 | 0.274 | 0.304 | 0.315 | 0.104 | 0.168 | 0.165 |

+ = Multiple factors include achievement (average of math and reading scores from initial grade), parental socioeconomic status, and Census region

—— = Not applicable because of absence of information on math or reading achievement prior to the initial grade for each sample

NOTE: Difference between group X and group Y refers to the mean for group X minus the mean for group Y. Standard errors have been adjusted for complex survey designs. 8th Grade SDUs = eighth-grade standard deviation units; 8th grade score is normalized to have mean of zero and standard deviation of 1.00. Multiple imputation used to account for missing data.

SOURCE: U.S. Department of Education, Chapter 1 Prospects Study, and National Educational Longitudinal Study of 1988 (NELS:88).

## Table D.10—Standard errors for Table 4.3: Black-white differences in average mathematics achievement in grades 2, 5, 9, and 12 for 4 samples of children, 1992-1993

| Description of sample(s), year(s) of data, and grades for which differences are calculated | Sample size | Standard error of difference between blacks and whites (in 8th grade SDUs) for boys and girls combined | boys only | girls only | difference of boys and girls |
|---|---|---|---|---|---|
| Grade 2—Prospects Cohort 1 data (observed 1993) | 4474 | 0.00 | 0.27 | 0.23 | 0.13 |
| Grade 5—Prospects Cohort 3 data (observed 1993) | 4224 | 0.00 | 0.11 | 0.09 | 0.09 |
| Grade 5 math gap minus Grade 2 math gap | 8698 | 0.26 | 0.29 | 0.23 | 0.16 |
| Grade 5—Prospects Cohort 3 data (observed 1993) | 4224 | 0.00 | 0.11 | 0.09 | 0.09 |
| Grade 9—Prospects Cohort 7 data (observed 1993) | 2332 | 0.00 | 0.13 | 0.11 | 0.14 |
| Grade 9 math gap minus Grade 5 math gap | 6556 | 0.13 | 0.17 | 0.14 | 0.16 |
| Grade 9—Prospects Cohort 7 data (observed 1993) | 2332 | 0.00 | 0.13 | 0.11 | 0.14 |
| Grade 12—NELS:88 data (observed 1992) | 9571 | 0.00 | 0.08 | 0.07 | 0.10 |
| Grade 12 math gap minus Grade 9 math gap | 11903 | 0.11 | 0.15 | 0.13 | 0.17 |
| Grade 2—Prospects Cohort 1 data (observed 1993) | 4474 | 0.00 | 0.27 | 0.23 | 0.13 |
| Grade 9—Prospects Cohort 7 data (observed 1993) | 2332 | 0.00 | 0.13 | 0.11 | 0.14 |
| Grade 9 math gap minus Grade 2 math gap | 6806 | 0.26 | 0.30 | 0.25 | 0.19 |
| Grade 2—Prospects Cohort 1 data (observed 1993) | 4474 | 0.00 | 0.27 | 0.23 | 0.13 |
| Grade 12—NELS:88 data (observed 1992) | 9571 | 0.00 | 0.08 | 0.07 | 0.10 |
| Grade 12 math gap minus Grade 2 math gap | 14045 | 0.25 | 0.28 | 0.24 | 0.16 |

NOTE: Difference between group X and group Y refers to the mean for group X minus the mean for group Y. Standard errors have been adjusted for complex survey designs. 8th Grade SDUs = eighth-grade standard deviation units; 8th grade score is normalized to have mean of zero and standard deviation of 1.00. Multiple imputation has been used to account for missing data.

SOURCE: U.S. Department of Education, Chapter 1 Prospects Study, and National Educational Longitudinal Study of 1988 (NELS:88).

## Table D.11—Standard error for Table 4.4: Black-white differences in average reading achievement in grades 1 to 2 and 3 to 5 for 2 samples of children, 1991-1993

| Description of source of data, grade and outcome, and sex of subgroup | Sample size | S.E. of black-white difference adjusting for (1) no variables | (2) achievement only | (3) multiple factors+ | S.E. of change in black-white difference: difference between (2) and (1) | difference between (3) and (1) | difference between (3) and (2) |
|---|---|---|---|---|---|---|---|
| **Prospects Cohort 1 (1992-1993)** | | | | | | | |
| **Grade 1 reading achievement** | | | | | | | |
| Boys and girls combined | 7542 | 0.165 | —— | —— | —— | —— | —— |
| Boys only | 3829 | 0.180 | —— | —— | —— | —— | —— |
| Girls only | 3713 | 0.151 | —— | —— | —— | —— | —— |
| Difference between boys and girls | 7542 | 0.234 | —— | —— | —— | —— | —— |
| **Grade 2 reading achievement** | | | | | | | |
| Boys and girls combined | 7542 | 0.174 | 0.070 | 0.144 | 0.055 | 0.115 | 0.099 |
| Boys only | 3829 | 0.224 | 0.097 | 0.181 | 0.095 | 0.133 | 0.108 |
| Girls only | 3713 | 0.124 | 0.071 | 0.118 | 0.067 | 0.073 | 0.068 |
| Difference between boys and girls | 7542 | 0.255 | 0.092 | 0.180 | 0.107 | 0.089 | 0.119 |
| **Growth between grades 1 and 2** | | | | | | | |
| Boys and girls combined | 7542 | 0.068 | 0.065 | 0.086 | 0.035 | 0.055 | 0.053 |
| Boys only | 3829 | 0.099 | 0.084 | 0.118 | 0.067 | 0.073 | 0.073 |
| Girls only | 3713 | 0.086 | 0.069 | 0.081 | 0.042 | 0.051 | 0.052 |
| Difference between boys and girls | 7542 | 0.122 | 0.085 | 0.141 | 0.077 | 0.089 | 0.098 |
| **Prospects Cohort 3 (1991-1993)** | | | | | | | |
| **Grade 3 reading achievement** | | | | | | | |
| Boys and girls combined | 11017 | 0.071 | —— | —— | —— | —— | —— |
| Boys only | 5553 | 0.105 | —— | —— | —— | —— | —— |
| Girls only | 5464 | 0.072 | —— | —— | —— | —— | —— |
| Difference between boys and girls | 11017 | 0.130 | —— | —— | —— | —— | —— |
| **Grade 5 reading achievement** | | | | | | | |
| Boys and girls combined | 11017 | 0.071 | 0.055 | 0.101 | 0.065 | 0.106 | 0.068 |
| Boys only | 5553 | 0.083 | 0.087 | 0.171 | 0.101 | 0.186 | 0.127 |
| Girls only | 5464 | 0.085 | 0.059 | 0.087 | 0.051 | 0.062 | 0.043 |
| Difference between boys and girls | 11017 | 0.111 | 0.109 | 0.210 | 0.110 | 0.202 | 0.136 |
| **Growth between grades 3 and 5** | | | | | | | |
| Boys and girls combined | 22034 | 0.099 | 0.159 | 0.237 | 0.147 | 0.228 | 0.143 |
| Boys only | 11106 | 0.156 | 0.295 | 0.416 | 0.251 | 0.372 | 0.195 |
| Girls only | 10928 | 0.133 | 0.113 | 0.171 | 0.048 | 0.127 | 0.123 |
| Difference between boys and girls | 11017 | 0.218 | 0.341 | 0.491 | 0.242 | 0.393 | 0.251 |

+ = Multiple factors include achievement (average of math and reading scores from initial grade), parental socioeconomic status, and Census region

—— = Not applicable because of absence of information on math or reading achievement prior to the initial grade for each sample

NOTE: Difference between group X and group Y refers to the mean for group X minus the mean for group Y. Standard errors have been adjusted for complex survey designs. 8th Grade SDUs = eighth-grade standard deviation units; 8th grade score is normalized to have mean of zero and standard deviation of 1.00. Multiple imputation used to account for missing data.

SOURCE: U.S. Department of Education, Chapter 1 Prospects Study.

## Table D.12—Standard errors for Table 4.5: Black-white differences in average reading achievement in grades 7 to 9 and 10 to 12 for 2 samples of children, 1990-1993

| Description of source of data, grade and outcome, and sex of subgroup | Sample size | S.E. of black-white difference adjusting for (1) no variables | (2) achievement only | (3) multiple factors+ | S.E. of change in black-white difference: difference between (2) and (1) | difference between (3) and (1) | difference between (3) and (2) |
|---|---|---|---|---|---|---|---|
| **Prospects Cohort 7 (1991-1993)** | | | | | | | |
| **Grade 7 reading achievement** | | | | | | | |
| Boys and girls combined | 6654 | 0.066 | —— | —— | —— | —— | —— |
| Boys only | 3419 | 0.079 | —— | —— | —— | —— | —— |
| Girls only | 3235 | 0.086 | —— | —— | —— | —— | —— |
| Difference between boys and girls | 6654 | 0.114 | —— | —— | —— | —— | —— |
| **Grade 9 reading achievement** | | | | | | | |
| Boys and girls combined | 6654 | 0.066 | 0.060 | 0.104 | 0.047 | 0.078 | 0.067 |
| Boys only | 3419 | 0.099 | 0.096 | 0.187 | 0.064 | 0.138 | 0.126 |
| Girls only | 3235 | 0.084 | 0.085 | 0.101 | 0.072 | 0.070 | 0.056 |
| Difference between boys and girls | 6654 | 0.136 | 0.132 | 0.222 | 0.094 | 0.155 | 0.131 |
| **Growth between grades 7 and 9** | | | | | | | |
| Boys and girls combined | 6654 | 0.066 | 0.063 | 0.104 | 0.038 | 0.070 | 0.067 |
| Boys only | 3419 | 0.096 | 0.096 | 0.187 | 0.044 | 0.127 | 0.126 |
| Girls only | 3235 | 0.082 | 0.073 | 0.097 | 0.041 | 0.040 | 0.050 |
| Difference between boys and girls | 6654 | 0.132 | 0.119 | 0.219 | 0.041 | 0.128 | 0.138 |
| **NELS:88 (1990-1992)** | | | | | | | |
| **Grade 8 reading achievement** | | | | | | | |
| Boys and girls combined | 12954 | 0.048 | —— | —— | —— | —— | —— |
| Boys only | 6409 | 0.073 | —— | —— | —— | —— | —— |
| Girls only | 6545 | 0.057 | —— | —— | —— | —— | —— |
| Difference between boys and girls | 12954 | 0.091 | —— | —— | —— | —— | —— |
| **Grade 12 reading achievement** | | | | | | | |
| Boys and girls combined | 12954 | 0.070 | 0.058 | 0.066 | 0.049 | 0.055 | 0.051 |
| Boys only | 6409 | 0.100 | 0.061 | 0.103 | 0.076 | 0.085 | 0.084 |
| Girls only | 6545 | 0.094 | 0.079 | 0.077 | 0.070 | 0.060 | 0.064 |
| Difference between boys and girls | 12954 | 0.138 | 0.083 | 0.139 | 0.108 | 0.105 | 0.066 |
| **Growth between grades 8 and 12** | | | | | | | |
| Boys and girls combined | 12954 | 0.236 | 0.254 | 0.181 | 0.074 | 0.149 | 0.160 |
| Boys only | 6409 | 0.205 | 0.255 | 0.293 | 0.165 | 0.245 | 0.209 |
| Girls only | 6545 | 0.370 | 0.306 | 0.248 | 0.126 | 0.196 | 0.115 |
| Difference between boys and girls | 12954 | 0.376 | 0.311 | 0.384 | 0.177 | 0.223 | 0.162 |

+ = Multiple factors include achievement (average of math and reading scores from initial grade), parental socioeconomic status, and Census region

—— = Not applicable because of absence of information on math or reading achievement prior to the initial grade for each sample

NOTE: Difference between group X and group Y refers to the mean for group X minus the mean for group Y. Standard errors have been adjusted for complex survey designs. 8th Grade SDUs = eighth-grade standard deviation units; 8th grade score is normalized to have mean of zero and standard deviation of 1.00. Multiple imputation used to account for missing data.

SOURCE: U.S. Department of Education, Chapter 1 Prospects Study, and National Educational Longitudinal Study of 1988 (NELS:88).

## Table D.13—Standard errors for Table 4.6: Black-white differences in average reading achievement in grades 2, 5, 9, and 12 for 4 samples of children, 1992-1993

| Description of sample(s), year(s) of data, and grades for which differences are calculated | Sample size | Standard error of difference between blacks and whites (in 8th grade SDUs) for boys and girls combined | boys only | girls only | difference of boys and girls |
|---|---|---|---|---|---|
| Grade 2—Prospects Cohort 1 data (observed 1993) | 4474 | 0.21 | 0.21 | 0.20 | 0.15 |
| Grade 5—Prospects Cohort 3 data (observed 1993) | 4224 | 0.10 | 0.13 | 0.12 | 0.15 |
| Grade 5 reading gap minus Grade 2 reading gap | 8698 | 0.21 | 0.25 | 0.20 | 0.21 |
| Grade 5—Prospects Cohort 3 data (observed 1993) | 4224 | 0.10 | 0.13 | 0.12 | 0.15 |
| Grade 9—Prospects Cohort 7 data (observed 1993) | 2332 | 0.09 | 0.13 | 0.12 | 0.17 |
| Grade 9 reading gap minus Grade 5 reading gap | 6556 | 0.13 | 0.18 | 0.17 | 0.22 |
| Grade 9—Prospects Cohort 7 data (observed 1993) | 2332 | 0.09 | 0.13 | 0.12 | 0.17 |
| Grade12—NELS:88 data (observed 1992) | 9571 | 0.05 | 0.08 | 0.06 | 0.09 |
| Grade 12 reading gap minus Grade 9 reading gap | 11903 | 0.10 | 0.15 | 0.13 | 0.20 |
| Grade 2—Prospects Cohort 1 data (observed 1993) | 4474 | 0.21 | 0.21 | 0.20 | 0.15 |
| Grade 9—Prospects Cohort 7 data (observed 1993) | 9571 | 0.05 | 0.08 | 0.06 | 0.09 |
| Grade 9 reading gap minus Grade 2 reading gap | 6806 | 0.23 | 0.25 | 0.23 | 0.23 |
| Grade 2—Prospects Cohort 1 data (observed 1993) | 4474 | 0.21 | 0.21 | 0.20 | 0.15 |
| Grade12—NELS:88 data (observed 1992) | 9571 | 0.05 | 0.08 | 0.06 | 0.09 |
| Grade 12 reading gap minus Grade 2 reading gap | 14045 | 0.22 | 0.23 | 0.21 | 0.17 |

NOTE: Difference between group X and group Y refers to the mean for group X minus the mean for group Y. Standard errors have been adjusted for complex survey designs. 8th Grade SDUs = eighth-grade standard deviation units; 8th grade score is normalized to have mean of zero and standard deviation of 1.00. Multiple imputation used to account for missing data.

SOURCE: U.S. Department of Education, Chapter 1 Prospects Study, and National Educational Longitudinal Study of 1988 (NELS:88).

# APPENDIX E: THE SENSITIVITY OF BLACK-WHITE DIFFERENCES IN HIGH SCHOOL COMPLETION TO VARIABLE AND SAMPLE DEFINITIONS

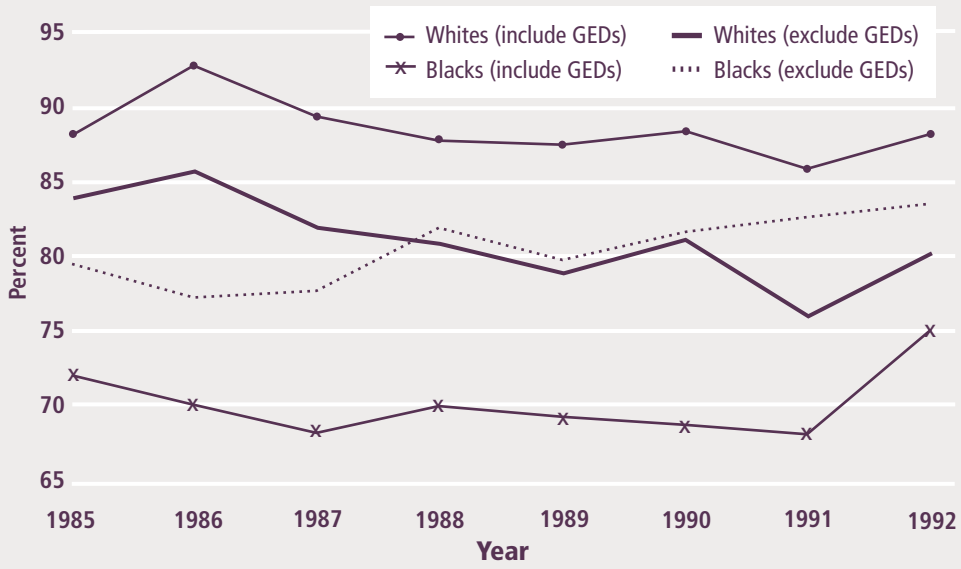
The analyses in this appendix, based on two samples of young adults,[1] investigate the sensitivity of black-white differences in high school completion to variable and sample definitions. First, evidence is presented on whether the black-white gaps in high school completion are different from black-white gaps in high school/GED completion. Second, evidence is presented on whether black-white gaps in high school/GED completion rates differ when prisoners and other institutionalized persons are included in the sample.

## I. HIGH SCHOOL COMPLETION RATES WHEN GEDS ARE NOT COUNTED AS HIGH SCHOOL EQUIVALENTS

When comparing black-white gaps in high school completion rates, it is important to recognize the possible sensitivity of results to variable definitions, and in particular, to the treatment of General Educational Development certificates (GEDs) as equivalent to high school diplomas. As noted in chapter 1, research by Cameron and Heckman (1991) suggests that high school diplomas and GEDs differ in many important ways, such that GEDs may not represent true equivalents to high school diplomas.

[1] The first sample used for these analyses is a sample of young adults in the National Longitudinal Survey of Youth, observed between 1985 and 1992, during the calendar year when they turn 28. (Note that this sample was not "freshened" with recent immigrants to the United States, so it does not represent the full population of 28-year-olds in each year.) The second sample used for these analyses is a sample of 25- to 34-year-olds in the National Adult Literacy Survey, observed in 1992.

**Figure E.1—High school completion rates for 28-year-olds (distinguishing high school diplomas from GEDs)**




SOURCE: National Longitudinal Survey of Youth, 1985-1992.

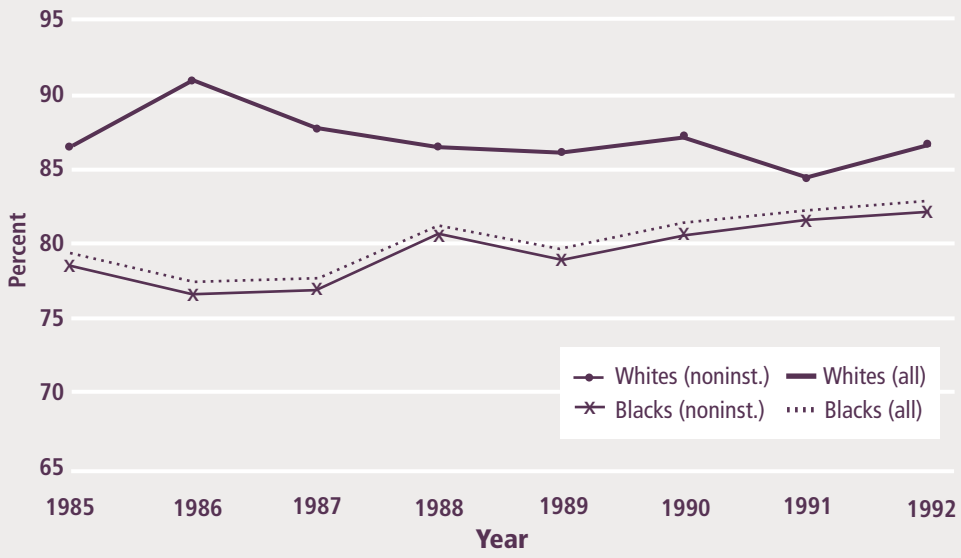
Distinguishing high school diplomas from GEDs alters the magnitude, but not the trend, in the black-white gap in high school completion between 1985 and 1992 (figure E.1). When GEDs are no longer counted as equivalent to a high school diploma, the average black-white gap in high school completion rates over this period increases by 36 percent, from 8 percentage points to 11 percentage points. However, black-white gaps in high school completion rates narrowed at about the same annual rate between 1985 and 1992, regardless of whether GEDs are treated as true high school equivalents. Over this period, the black-white gap in the completion of high school diplomas or GEDs by 28-year-olds narrowed at an average rate of 1.2 percentage points per year, while the black-white gap in the completion of high school diplomas narrowed at an average rate of 1.1 percentage points per year.

## II. HIGH SCHOOL/GED COMPLETION RATES INCLUDING INSTITUTIONALIZED PERSONS

Another factor that may influence reported trends in high school completion is the exclusion of institutionalized persons from the sample over which high school completion is being calculated. Most statistics on the high school completion rates of blacks and whites are calculated using household or school-based surveys that exclude institutionalized persons, such as prisoners. If blacks represent a disproportionate share of the institutionalized population, and institutionalized persons are less likely to have high school diplomas (or GEDs), statistics on high school completion reported from civilian, noninstitutional surveys may understate the true magnitude of black-white gaps in the completion rates of high school diplomas and GEDs.

Analysis of high school/GED completion rates in two samples reveals that including prisoners or other institutionalized persons in the sample changes black-white gaps in

**Figure E.2—High school/GED completion rates for 28-year-olds (with and without institutionalized persons)**




SOURCE: National Longitudinal Survey of Youth, 1985-1992.

high school/GED completion rates by very little. While black youth and young adults are more likely than white youth and young adults to be incarcerated, and prisoners are less likely than nonprisoners to have high school diplomas or GEDs, the proportion of the black population that is in prison is about 5 percent for 16- to 24-year-old blacks and about 6 percent for 25- to 34-year-old blacks. Because prisoners represent only a small fraction of the total population, the black-white gap in high school/GED completion rate is about the same (11 percentage points for 16- to 24-year-olds and 12 percentage points for 25- to 34-year olds), regardless of whether prisoners are included in the sample.

Including prisoners and other institutionalized persons in the sample does little to alter trends in black-white differences in high school/GED completion between 1985 and 1992 (figure E.2). Between these two years, the black-white gap in high school/GED completion rates of 28-year-olds narrowed at a rate of approximately 1.2 percentage points per year for the noninstitutionalized population, and at a rate of approximately 8.0 percentage points per year for the institutionalized population. While these two rates are noticeably different, the fact that institutionalized persons represent a small fraction of the overall population means that the rate of convergence in the high school/GED completion rates of all 28-year-old blacks and whites was about the same as for the non-institutionalized population only: 1.2 percentage points per year.

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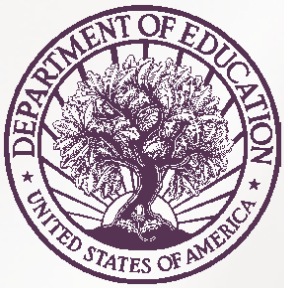
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