The Widening Academic Achievement Gap Between the Rich and the Poor:

New Evidence and Possible Explanations

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Abstract

In this chapter I examine whether and how the relationship between family socioeconomic characteristics and academic achievement has changed during the last fifty years. In particular, I investigate the extent to which the rising income inequality of the last four decades has been paralleled by a similar increase in the income achievement gradient. As the income gap between high- and low-income families has widened, has the achievement gap between children in high- and low-income families also widened?

The answer, in brief, is yes. The achievement gap between children from high- and low-income families is roughly 30 to 40 percent larger among children born in 2001 than among those born twenty-five years earlier. In fact, it appears that the income achievement gap has been growing for at least fifty years, though the data are less certain for cohorts of children born before 1970. In this chapter, I describe and discuss these trends in some detail. In addition to the key finding that the income achievement gap appears to have widened substantially, there are a number of other important findings.

First, the income achievement gap (defined here as the income difference between a child from a family at the 90th percentile of the family income distribution and a child from a family at the 10th percentile) is now nearly twice as large as the black-white achievement gap. Fifty years ago, in contrast, the black-white gap was one and a half to two times as large as the income gap. Second, as Greg Duncan and Katherine Magnuson note in chapter 3 of this volume, the income achievement gap is large when children enter kindergarten and does not appear to grow (or narrow) appreciably as children progress through school. Third, although rising income inequality may play a role in the growing income achievement gap, it does not appear to be the dominant

factor. The gap appears to have grown at least partly because of an increase in the association between family income and children's academic achievement for families above the median income level: a given difference in family incomes now corresponds to a 30 to 60 percent larger difference in achievement than it did for children born in the 1970s. Moreover, evidence from other studies suggests that this may be in part a result of increasing parental investment in children's cognitive development. Finally, the growing income achievement gap does not appear to be a result of a growing achievement gap between children with highly and less-educated parents. Indeed, the relationship between parental education and children's achievement has remained relatively stable during the last fifty years, whereas the relationship between income and achievement has grown sharply. Family income is now nearly as strong as parental education in predicting children's achievement.

Introduction

The socioeconomic status of a child's parents has always been one of the strongest predictors of the child's academic achievement and educational attainment. As Greg Duncan and Katherine Magnuson point out in chapter 3 in this volume, students in the bottom quintile of family socioeconomic status score more than a standard deviation below those in the top quintile on standardized tests of math and reading when they enter kindergarten. They note that these differences do not appear to narrow as children progress through school.

Duncan and Magnuson are not the first to point out this strong association. Almost fifty years ago, in 1966, the Coleman Report famously highlighted the relationship between family socioeconomic status and student achievement (Coleman et al. 1966). The federal Head Start program was started in the 1960s as part of the War on Poverty to reduce poverty and thus to weaken the link between family poverty and children's cognitive and social development (Kagan 2002; Zigler and Muenchow 1992). The relationship between family socioeconomic characteristics and student achievement is one of the most robust patterns in educational scholarship, yet the causes and mechanisms of this relationship have been the subject of considerable disagreement and debate (see, for example, Bowles and Gintis 1976, 2002; Brooks-Gunn and Duncan 1997; Duncan and Brooks-Gunn 1997; Duncan, Brooks Gunn, and Klebanov 1994; Herrnstein and Murray 1994; Jacoby and Glauberman 1995; Lareau 1989, 2003).

An ironic consequence of the regularity of this pattern is that we tend to think of the relationship between socioeconomic status and children's academic achievement as a sociological necessity, rather than as the product of a set of social conditions, policy choices, and educational practices. As a result, much of the scholarly research on the socioeconomic achievement gradient has focused largely on trying to understand the mechanisms through which socioeconomic differences among families—in income, parental educational attainment, family structure, neighborhood conditions, school quality, and parental preferences, investments, and choices— lead

to differences in children's academic and educational success. The bulk of this prior research has been based primarily on cross-sectional or single-cohort longitudinal studies. This research is less concerned with documenting the size of socioeconomic achievement gradients than with investigating the mechanisms that produce them.

As a result, we know little about the trends in socioeconomic achievement gaps over a lengthy period of time. We do not know, for example, if socioeconomic gaps are larger or smaller now than they were fifty years ago, or even twenty-five years ago. This is in contrast to what we know about the trends in racial-achievement gaps, particularly the black-white gap, which have received considerable scholarly and policy attention in the last decade or two (see, for example, Jencks and Phillips 1998; Magnuson and Waldfogel 2008). Trends in socioeconomic achievement gaps—the achievement disparities between children from high- and low-income families or between children from families with high or low levels of parental educational attainment—have received far less attention.

The question posed in this chapter is whether and how that relationship between family socioeconomic characteristics and academic achievement has changed during the last fifty years. In particular, I investigate the extent to which the rising income inequality of the last four decades has been paralleled by a similar increase in the income achievement gradient. As the income gap between high- and low-income families has widened, has the achievement gap between children in high- and low-income families also widened?

The answer, in brief, is yes. The achievement gap between children from high- and low-income families is roughly 30 to 40 percent larger among children born in 2001 than among those born twenty-five years earlier. In fact, it appears that the income achievement gap has been growing steadily for at least fifty years, though the data are less certain for cohorts of children born before 1970. In this chapter I describe and discuss these trends in some detail. In addition to the key finding that the income achievement gap appears to have widened substantially, there are a

number of other important findings.

First, the income achievement gap (defined here as the income difference between a child from a family at the 90th percentile of the family income distribution and a child from a family at the 10th percentile) is now more than twice as large as the black-white achievement gap. In contrast to this, fifty years ago the black-white gap was one and a half to two times as large as the income gap. Second, as Duncan and Magnuson (in chapter 3, this volume) note, the income achievement gap is large when children enter kindergarten and does not appear to grow (or narrow) appreciably as children progress through school. Third, although rising income inequality may play a role in the growing income achievement gap, it does not appear to be the dominant factor. The gap appears to have grown at least partly because of an increase in the association between family income and children's academic achievement for families above the median income level: a given difference in family incomes now corresponds to a 30 to 60 percent larger difference in achievement than it did for children born in the 1970s. Evidence from other studies suggests that this may be in part a result of increasing parental investment in children's cognitive development. Finally, the growing income achievement gap does not appear to be a result of a growing achievement gap between children with highly educated and less-educated parents. In fact, the relationship between parental education and children's achievement has remained relatively stable during the last fifty years, while the relationship between income and achievement has grown sharply. Family income is now nearly as strong as parental education in predicting children's achievement.

Data

Assembling information on trends in the relationship between socioeconomic status and academic achievement requires examination of multiple sources of data. In this chapter I use data from nineteen nationally representative studies, including studies conducted by the National

Center for Education Statistics (NCES), the Long-Term Trend and Main National Assessment of Educational Progress (NAEP) studies, U.S. components of international studies, and other studies with information on both family background and standardized-test scores.[1] Although these studies vary in a number of ways, each of them provides data on the math or reading skills, or both, of nationally representative samples of students, together with some data on students' family socioeconomic characteristics, such as family income, parental education, and parental occupation. Although the specific tests of reading and math skills used differ among the studies, they are similar enough to allow broad conclusions about the rough magnitude of achievement gaps. Online appendix table 5.A1 (available at: http://www.russellsage.org/duncan_murnane_online_appendix.pdf) lists the studies used here and several basic characteristics of each study, including the age and grade of students when tested, the year and subject in which they are tested, the approximate sample size, and whether or not the study includes data on family income.

Measuring Achievement Gaps

To compare the size of the achievement gap across studies, I report test-score differences between groups (for example, students from high- and low-income families) in standard-deviation units, adjusted for the estimated reliability of each test. This is standard practice when comparing achievement gaps measured with different tests (see, for example, Clotfelter, Ladd, and Vigdor 2006; Fryer and Levitt 2004, 2006; Grissmer, Flanagan, and Williamson 1998; Hedges and Nowell 1999; Neal 2006; Phillips et al. 1998; Reardon and Galindo 2009). So long as the true variance of achievement remains constant over time, this allows valid comparisons in the size of the gaps across different studies using different tests (see online appendix section 5.A2 for technical details of the computation of the achievement gaps reported here and for data on the reported reliabilities of the tests used).

Measures of Socioeconomic Status

In this chapter I rely on two key measures of socioeconomic status: family income and parental educational attainment. Each of the nineteen studies used includes information on parental educational attainment; twelve of the studies include information on family income. Nine of the studies include parent-reported family income: National Education Longitudinal Study (NELS), Education Longitudinal Study (ELS), Early Childhood Longitudinal Study, Kindergarten Cohort (ECLS-K), Early Childhood Longitudinal Study, Birth Cohort (ECLS-B), the 1979 and 1997 National Longitudinal Survey of Youth (NLSY79, NLSY97), National Longitudinal Study of Adolescent Health (Add Health), Prospects, and the Study of Early Child Care and Youth Development (SECCYD). Three include student-reported income: Project Talent, National Longitudinal Study (NLS), and High School and Beyond (HS&B).[2] In all studies, I adjust the estimated associations between family income and achievement for measurement error in family income. I do not adjust income for family size, as my interest here is in describing the simple association between family socioeconomic characteristics and student achievement, rather than an inferred association between income-to-needs ratio and achievement (though the latter is certainly worth investigating as well). Online appendix section 5.A2 describes in detail how I estimate income achievement gaps and adjust them for measurement error in family income and test scores.

Although each of the nineteen studies includes a measure of parental educational attainment, in some studies this is reported by students—National Assessment of Educational Progress, Long- Term Trends (NAEP-LTT), Main NAEP, Project Talent, NLS, Equality of Educational Opportunity study (EEO), HS&B, Trends in International Math and Science Study (TIMSS), Program for International Student Assessment (PISA), and the Progress in International Reading Literacy Study (PIRLS)—while in others it is reported by parents. Because reports of their parents' education are particularly unreliable for younger students, I include studies with student-reported parental education only if the students were in high school themselves when reporting their

parents' educational attainment. As a measure of parental educational attainment, I use the maximum of the mother's and father's attainment (or the attainment of the single parent in the home if both are not present). Online appendix section 5.A2 describes how I estimate the association between parental education and achievement.

Trends in Socioeconomic Status–Achievement Gradients

To begin with, consider the difference in achievement between children from high- and low-income families. One way to measure this difference is to compare the average math and reading skills of children from families with incomes at the 90th percentile of the family income distribution (about $160,000 in 2008) to those in families with incomes at the 10th percentile of the family income distribution (about $17,500 in 2008).[3] Hereafter I refer to this as the "90/10 income achievement gap."

Figures 5.1 and 5.2 present the estimated 90/10 income achievement gap for cohorts of students born from the mid-1940s through 2001.[4] These estimates are derived from the twelve nationally representative studies available that include family income as well as reading and/or math scores for school-age children.

Figures 5.1 & 5.2 here

Although the tests used are not exactly comparable across all the studies included, both figures show a clear trend of increasing income achievement gaps across cohorts born over a nearly sixty-year period. The estimated income achievement gaps among children born in 2001 are roughly 75 percent larger than the estimated gaps among children born in the early 1940s. The gap appears to have grown among cohorts born in the 1940s and early 1950s, stabilized for cohorts born from the 1950s through the mid-1970s, and then grown steadily since the mid-1970s.

There are, however, several reasons to suspect that the trend in the estimated gaps for the earliest cohorts, those born before 1970, is not as accurately estimated as the later trend. For one

thing, the quality of the achievement tests used in the early studies may not have been as good as those used in the more recent studies. In addition, as I have noted, family income was reported by students rather than by a parent in three of the early studies (Project Talent, NLS, and HS&B). Furthermore, because Project Talent, NLS, and HS&B are school-based samples of students in high school, they exclude dropouts, who are disproportionately low-income and low-achieving students. Each of these factors might lead the gaps to be underestimated in the early cohorts relative to later cohorts.

Despite each of these concerns, there is also some evidence to suggest that they may not substantially bias the estimated trend in income achievement gaps. First, the estimated gaps are adjusted for the estimated reliabilities of the achievement test and the family income measures. Second, an assessment of the impact of excluding dropouts using data from the NELS, in which dropouts were tested, shows that excluding dropouts from the sample introduces at most a trivial amount of bias in the estimates (see online appendix section 5.A4). Third, if we focus only on the trend in the income gap in studies conducted by the National Center for Education Statistic (NCES), which use similar types of achievement tests (and many of the same test items), and ask parents to report their income in a similar way (except for NLS and HS&B, in which students reported their family income), the trend in the 90/10 achievement gap is clearly upward for cohorts born from the mid-1970s through at least the mid-1990s (see online appendix section 5.A4 and appendix table 5.A1 for details). And although the two NLSY studies suggest that the income achievement gap as measured in the NLSY97 cohort is virtually identical to the gap in the NLSY79 cohort, born twenty years earlier, the NLSY97 cohort was born in the early 1980s, just as the trend evident in the NCES studies appears to begin. Thus, the lack of an apparent trend in the income achievement gap in the NLSY studies does not clearly contradict the evidence in the NCES studies of a rising gap among the 1980s and 1990s cohorts.

In sum, although the trend in achievement gaps prior to 1970 is somewhat unclear, the

trend from the mid-1970s to 2001 appears relatively clear. Figures 5.1 and 5.2 include fitted trend lines from 1974 to 2001 (the solid lines); these indicate that the income achievement gap has grown by roughly 40 to 50 percent within twenty-five years, a very sizable increase.

One important question is whether the trend in the income achievement gap is driven by the changing racial and ethnic composition of the U.S. population. In additional analyses not shown here (see online appendix 5.A4), I find that the income achievement gap grew within the white, black, and Hispanic student populations separately, as well as within the population as a whole. For whites and Hispanics, the income achievement gap appears relatively stable through the mid-1970s and begins to grow rapidly thereafter; for blacks, the gap appears to grow steadily from the 1940s through 2001.

In chapter 6 in this volume, Martha J. Bailey and Susan M. Dynarski show that the association between family income and college completion grew very sharply between cohorts of women born in the 1960s and cohorts born in the early 1980s, but did not grow substantially among men in the same cohorts. One possible explanation for this pattern is that the association between income and achievement grew most sharply for women during this same time period. However, when I examine the income achievement gap trend separately for male and female students, I find virtually identical trends (see online appendix 5.A4). There is no evidence that the trend in the income achievement gradient varies by gender.

How Large Are These Gaps?

Figures 5.1 and 5.2 report income gaps in standard-deviation units. Although this is a metric familiar to researchers and one that is useful for comparing the size of gaps across studies using different tests, it may not be immediately obvious how large these gaps are in substantive terms. One way to get a sense of the size of the gaps is to compare them to the amount that an average student learns during the course of a year. Data from the NAEP indicate that the average student

gains 1.2 to 1.5 standard deviations in math and reading between fourth and eighth grade and between 0.6 and 0.7 standard deviations in math and reading between eighth and twelfth grade.[5] Thus, a gap of 1 standard deviation is substantively very large, corresponding to roughly 3 to 6 years of learning in middle or high school.

Another way of getting a sense of how large these gaps are (and how meaningful their trend is) is to compare the income achievement gaps to contemporaneous black-white achievement gaps. The black-white achievement gap narrowed substantially among cohorts born from the mid-1950s through the mid-1970s—by roughly one-half a standard deviation—according to NAEP data (Grissmer et al. 1998; Hedges and Nowell 1998, 1999; Magnuson and Waldfogel 2008; Neal 2006). Other data show that black-white differences in IQ and adult vocabulary narrowed by a comparable amount over the same cohorts as well (Huang and Hauser 2001; Murray 2007).

Figures 5.3 and 5.4 display both the 90/10 income gaps (as shown in figures 5.1 and 5.2) and the black-white achievement gaps as estimated from the same samples.[6] In each figure the solid line indicates the fitted trend of the 90/10 income achievement gap. For comparison, the estimated black-white achievement gap from each study is displayed in the figure (the hollow circles), along with a fitted line (the dark dashed line) describing the trend in the black-white achievement gap during the same time period. For comparison, a third trend line is included in the figure—the estimated trend in black-white gaps as estimated from NAEP data. Because the NAEP-LTT tests are consistent over time (and the Main NAEP tests are relatively consistent over time), trends in the black-white gap estimated from NAEP data provide a more reliable trend than do the twelve studies that are used to estimate the income-gap trend.

Figures 5.3 & 5.4 here

Both the NAEP data and the data from the twelve studies with income data show that the black-white gap narrowed in reading and math for cohorts born prior to the mid-1970s. Following the mid-1970s, the reading gap, as measured by NAEP, has remained relatively constant (see online

appendix section 5.A5 for some discussion of why the reading gap in the twelve income studies appears to decline more in recent years than indicated by NAEP data). In math, both the NAEP data and the data from the studies used to estimate the income gaps show a continued decline in black-white achievement gaps among cohorts born in more recent years. The similarity of the black-white trends estimated from NAEP and from the twelve studies used in the income-gap analysis suggests that the tests used in the income studies are comparable to the NAEP tests, a finding that lends increased credence to the estimated income-gap trends.

The striking feature of figures 5.3 and 5.4, however, is not so much the well-known trends in the black-white gaps but the difference between the trends in the income gaps and the black-white gaps. For cohorts born in the 1940s to the 1960s, the black-white achievement gap was substantially larger than the 90/10 income achievement gap, particularly in reading. For cohorts born in the 1970s and later, however, the opposite is true. Among children born in the last two decades (those cohorts currently in school), the 90/10 income gap at kindergarten entry was two to three times larger than the black-white gap at the same time.

The Development of Income achievement Gaps as Students Age

Figures 5.1 to 5.4 display the magnitude of the income achievement gaps in relation to the year students were born. The early studies focused largely on high school–age students (for example, Talent, NLS, HS&B, and NLSY79 are all high school samples). However, many of the later studies include younger students (ECLS-K, ECLS-B, SECCYD, and Prospects). As a result, it is possible that the trends displayed in figures 5.1 and 5.2 confound trends across cohorts with developmental changes as children age.

Figure 5.5 uses data from the eight cohorts of students (from six of the twelve studies) for whom longitudinal data are available to examine the extent to which the income achievement gaps change over time within individual cohorts. With the exception of the Prospects third-grade cohort,

none of the samples shows evidence of a narrowing of the income achievement gap as children age. In fact, the income achievement gradient is remarkably stable across age within study samples. Figure 5.5 provides no evidence to support the hypothesis that the trends evident in figures 5.1 and 5.2 are artifacts of the inclusion of younger students in the more recent studies (this is tested more formally in online appendix section 5.A4; again there is no evidence that the varying age of the samples confounds the estimated trends).

Figure 5.5 here

The cohort trend in the size of the gap can be seen in the six studies with students ages fourteen to eighteen. Among these studies, the gaps are smallest in the early studies (HS&B, a cohort born in 1964; NELS, a cohort born in 1974) and largest in the studies from later cohorts (ELS, a cohort born in 1986; SECCYD, a cohort born in 1990; and ECLS-K, a cohort born in 1992).[7]

Why Has the Income Achievement Gap Grown?

The evidence thus far indicates that the relationship between a family's position in the income distribution and their children's academic achievement has grown substantially stronger during the last half-century. In the following section I discuss four broad possible explanations for this increase: (1) income inequality has grown during the last forty years, meaning that the income difference between families at the 90th and 10th percentiles of the income distribution has grown; (2) family investment patterns have changed differentially during the last half-century, so that high-income families now invest relatively more time and resources in their children's cognitive development than do lower-income families; (3) income has grown more strongly correlated with other socioeconomic characteristics of families, meaning that high-income families increasingly have greater socioeconomic and social resources that may benefit their children; and (4) increasing income segregation has led to greater differentiation in school quality and schooling opportunities between the rich and the poor.

Rising Income Inequality

After decades of decline, income inequality in the United States has grown substantially in the last four decades and as of 2007 was at a level similar to the levels in 1925 to 1940, when U.S. income inequality was at its twentieth-century peak (Burkhauser et al. 2009; Piketty and Saez 2003, 2008).[8] Rising income inequality may affect income achievement gaps, though I am aware of no existing research investigating this using U.S. data (one study looking at the relationship between income inequality and educational attainment gaps in the United States is Mayer 2001). Existing cross-national studies show little or no relationship between national income inequality and socioeconomic achievement gaps, though this research typically is based on samples with little variance in income inequality and weak measures of family socioeconomic status (Dupriez and Dumay 2006; Dura-Bellat and Suchaut 2005; Marks 2005).

Figure 5.6 here

If rising income inequality is responsible for the growth in the income achievement gap, we would expect to see that gap grow in a pattern similar to the growth in income inequality. To investigate this, consider the trends in measures of family income inequality illustrated in figure 5.6, which shows the changes in the 90/10 family income ratio (the ratio of the family income of the child at the 90th percentile of the family income distribution to that of the child at the 10th percentile), the 90/50 family income ratio, and the 50/10 family income ratio among school-age children from 1967 to 2008.[9]

Several key trends are evident in figure 5.6. First, the 90/10 family income ratio grew rapidly from 1967 to the early 1990s, more than doubling in twenty-five years. In 1967, the family income of the child at the 90th percentile of the family income distribution was 4.6 times greater than that of the child at the 10th percentile; in 1993 this 90/10 ratio was 9.9. After 1993, the 90/10 ratio declined to 8.6 in 2000 before climbing again to 9.9 by 2005. Second, the growth in the ratio of

the incomes in the 90th to those in the 10th percentiles from 1967 to 1993 was driven largely by a rapid increase in the 50/10 family income ratio, which grew from 2.5 in 1967 to 4.1 in 1987, a 64 percent increase in twenty years. After the late 1980s, however, the 50/10 family income ratio leveled off and then declined to 3.6 by 2002. Third, the ratio between the 90th and the 50th family income percentiles grew steadily from the early 1970s through 2008, increasing from 1.8 in 1974 to 2.5 in 2005, an increase of 36 percent. Thus, from the late 1960s through the late 1980s, the increase in lower-tail family income inequality was largely responsible for the increase in the ratio between the incomes of the 90th and 10th percentiles. After the late 1980s, however, increasing upper-tail inequality and decreasing lower-tail inequality largely offset one another for the next twenty years.

If the increasing income achievement gap is driven by increasing income inequality, we would expect that gap to grow most sharply between students at the 50th and 10th percentiles of the family income distribution from the 1960s through the 1980s (or for cohorts born in these years), and then to grow among those at the high end of the income distribution after that. Moreover, because the 50/10 ratio is larger than the 90/50 ratio, we might expect the 50/10 income achievement gap to be larger than the 90/50 income achievement gap as well.[10] Figures 5.7 and 5.8 display the estimated 90/50 and 50/10 income achievement gaps for each of the studies with income data.

Figures 5.7 & 5.8 here

Figures 5.7 and 5.8 do not exactly conform to what we would expect if the growing income achievement gap were simply due to rising income inequality among families with school-age children. Although the 50/10 income achievement gap in reading is generally larger than the 90/50 income achievement gap for cohorts born before 1990, the gaps are roughly similar in size in math, and the 90/50 gap is actually equal or larger than the 50/10 gap in the most recent cohorts. Moreover, the 90/50 gap appears to have grown faster than the 50/10 gap during the 1970s and

1980s, the opposite of what we would predict on the basis of the rates of growth of the 90/50 and 50/10 income ratios (indeed, the 50/10 gap in reading appears to have been basically flat through this time period, when the 50/10 income ratio was growing most rapidly). In sum, figures 5.7 and 5.8 do not provide much support for the idea that the growing income achievement gap is attributable to rising income inequality, at least not in any simple sense. Nor, however, do they rule out the possibility that rising income inequality has contributed to the rising income achievement gap.

One complexity in investigating the relationship between income inequality and income achievement gaps is that it is unclear how the relationships among income, achievement, and income inequality unfold through childhood and adolescence. Moreover, few of the studies I use have information on family income throughout a child's life, so I cannot disentangle the associations among family income and income inequality during childhood, family income and income inequality at the age when a child is tested, and a student's test scores. Rather, the trends described here are best understood as a set of repeated cross-sectional snapshots of the association between a child's current family income and his or her current academic achievement. Certainly, a more thorough understanding of the relationship between family income during different phases of childhood and later achievement would add to our understanding of the trends evident above, but the data available do not permit such an analysis.

In addition, the analyses presented here show the association between a child's family income rank (as opposed to income measured in dollars) and his or her academic achievement. Given that income inequality has risen for the last thirty to forty years, a given difference in income ranks corresponds to a much larger difference in actual income (whether measured in dollars or logged dollars), as is evident in figure 5.6. Thus, if achievement were a constant function of dollars, we would expect a growing 90/10 income achievement gap even if the association between income (measured in dollars or logged dollars) remained constant. In online appendix sections 5.A6 and

5.A7, I describe a set of analyses designed to determine to what extent the growth of the income achievement gap is due to rising income inequality and to what extent it is due to the increasing association between income and achievement. That is, I investigate whether the children of the rich score higher than the children of the poor because the income difference between the rich and poor is so much larger than it used to be, or because the relationship between achievement and dollars of income has grown stronger. Does a dollar buy more achievement than it did before, or do the rich just have more dollars than they did before?

These analyses, although not conclusive, suggest that the growth of the income achievement gap is not explained solely by rising income inequality. Rather, the association if achievement with family income (in logged dollars) has grown stronger over time, particularly among families in the upper half of the income distribution. That is, the average difference in academic achievement between two children from above-median income families whose family incomes differ by a factor of 2 has grown substantially (by 30 to 60 percent) over the last several decades. Moreover, in regression models that estimate the trend in the 90/10 income achievement gap, the time trend remains roughly constant in size, albeit with a larger standard error, regardless of whether or how I control for income inequality. Together, these analyses suggest that it is not rising income inequality per se that has caused the income achievement gap; rather, a dollar of income (or factors correlated with income) appears to buy more academic achievement than it did several decades ago.

Differential Investments in Children's Cognitive Development

The evidence showing that the returns to income have grown, at least among higher-income families, suggests that families may be changing how they invest in their children's cognitive development. If so, this may explain some of the rising income achievement gap. Sociologists and historians of the family have argued that parents, particularly those in the middle class, have

become increasingly focused on children's cognitive development during the last fifty years (Lareau 1989; Schaub 2010; Wrigley 1989). Evidence for this shift is necessarily indirect, yet it is fairly compelling. Julia Wrigley (1989), for example, examined the types of parenting advice contained in 1,017 articles published in popular magazines between 1900 and 1985 to assess whether societal notions of childhood and the role of parents had changed during the twentieth century. She found that articles published in the early part of the century were largely written by medical doctors and focused overwhelmingly on medical and nutritional advice. Prior to 1930, fewer than one in six of the articles Wrigley addressed the issue of intellectual stimulation of babies, and many of these argued that intellectual stimulation was actually harmful. Children were seen in these articles as largely "vegetative" beings, and the primary role of parents was to keep them healthy and quiet. Wrigley found that a focus on the intellectual development of children became much more prominent beginning in 1960s. Almost half of all parenting articles published in popular magazines between 1960 and 1985 discuss the intellectual development of children, more than double the proportion in the 1950s. Although some of this shift was driven by the era's interest in social inequality and the need for compensatory preschool education for poor children, Wrigley argues that children's cognitive development quickly became a concern of middle-class parents as well, as these parents increasingly saw education as essential for later economic success.

Another factor that may contribute to parents' increasing focus on their children's cognitive development is the rise of test-based accountability systems in education. Although some forms of standardized testing, including IQ tests and the SAT, have been prevalent for much of the twentieth century (Lemann 1999), standardized achievement testing has become much more common with the rise of the accountability movement following the 1983 publication of *A Nation at Risk* (National Commission on Excellence in Education 1983). The combination of the increasing importance of educational success in determining earnings (Levy and Murnane 1992) and the increasing importance of test scores in defining educational success may have caused parents to focus more on

their children's cognitive development.

Although both middle-class and low-income parents may have become increasingly aware of the intellectual development of their children, Annette Lareau (1989, 2003) argues that middle- and upper-class parents engage much more commonly in what she calls "concerted cultivation"—the deliberate organization of childhood around intellectual and socioemotional development. If this concerted cultivation is effective at improving children's intellectual skills— at least, those measured by standardized tests—then this may contribute to the rising income achievement gap. If middle- and upper-income families are increasingly likely to invest in their children's cognitive development, we would expect to see evidence of this in the trends in parental investment in children's child care, education, and education-related activities. There is, however, little available evidence with which to test this hypothesis. Studies of parental time use show that highly educated and higher-income parents spend more time in child-care activities with their children than do less-educated and lower-income children (Guryan, Hurst, and Kearney 2008; Ramey and Ramey 2010). Moreover, the amount of time parents spend in child-care activities (broadly defined) has increased from 1965 to 2008 and has increased more for college-educated parents than for less-educated parents (Bianchi 2000; Ramey and Ramey 2010). In addition, in a recent paper using data from the Consumer Expenditure Survey, Sabino Kornrich and Frank Furstenburg (2010) find that families' spending on children increased substantially from 1972 to 2007, particularly among high-income and college-educated families. Spending increases were particularly sharp among families with preschool-age children. Consistent with this is evidence that the relationship between family income and preschool enrollment among three- and four-year-old children grew from the late 1960s to the late 1980s (Bainbridge et al. 2005). These patterns are broadly consistent with the hypothesis that the rising income achievement gap is at least partly driven by the increasing investment of upper-income families in their children's cognitive development, particularly during the preschool years, though the evidence is far from conclusive on this point.

Changes in the Relationships among Family Income, Family Socioeconomic Characteristics, and Children's Achievement

Another possible explanation for the rising income achievement gap is that high-income families not only have more income than low-income families but also have access to a range of other family and social resources. On average, families with higher incomes tend to be those in which the parent(s) are highly educated. This has long been true, though the link between parental educational attainment and family income has grown stronger in recent decades, as the wage returns to educational attainment have increased since 1979 (Levy and Murnane 1992). Because highly educated parents are more able and more likely than less-educated parents to provide resources and opportunities for their children to develop cognitive and academic skills in both the preschool years and the school-age years (Lareau 1989), children of parents with college degrees may have higher academic achievement, on average, than children of parents with lower levels of education, all else being equal. Thus, the income achievement gap may be partly a result of the effects of parental educational attainment.

This argument suggests two possible explanations for the rising income achievement gap. First, the trend may result from an increase in the correlation between parental educational attainment and family income—which would mean that high- and low-income families are increasingly differentiated by education levels, leading to larger differences in children's achievement. Second, the trend may derive from an increase in the achievement returns to parental education, net of income. This would mean that children of highly educated parents benefit more from their parents' educational attainment than they did in the past.

The trend in the correlation between family income and parental education is illustrated in figure 5.9, which shows a relatively unambiguous trend of increasing correlation between parental education and family income across cohorts.[11] There are several possible explanations for this trend. First, as Frank Levy and Richard Murnane (1992) point out, changes in the structure of the

economy and the composition of the labor force during the 1970s and 1980s, along with declines in the real minimum wage and the weakening of unions, resulted in a decline in the real wages of those with only a high-school degree and an increase in the wage premium for a college degree. These changes would be reflected in the studies of cohorts born in the 1950s through the 1970s because these students and their parents were surveyed in the 1970s and 1980s. It is not clear, however, whether this explanation can account for the continued increase in the correlation between income and education for studies conducted after the 1980s.

Figure 5.9 here

A second possible reason for increasing correlation between parental education and income is the increasing polarization of families. Sara McLanahan (2004) argues that trends since 1960 in family structure and composition have led to an increasingly polarized distribution of family contexts for children—mothers with low levels of education are increasingly likely to be young, unemployed, and single or divorced; mothers with high levels of education are, conversely, increasingly likely to be older, employed, and married. As a result, the correlation of parental education and income among families with children is likely to increase with time. Moreover, McLanahan argues, this polarization in family structure implies a corresponding polarization in key resources (income, parental time) available for children, which may have important implications for the distribution of children's academic achievement.

Related to this argument is the fact that marital homogamy (the tendency for individuals to marry those with similar levels of educational attainment) has increased substantially since 1960 (Schwartz and Mare 2005). As a result, in two-parent families, the educational attainment of the higher-educated parent is increasingly predictive of the educational attainment of the less educated spouse. This trend, coupled with the increasing disparity in single parenthood and employment between mothers with high and low levels of education described by McLanahan, and the increasing wage premium to education described by Levy and Murnane, implies that children with

one highly educated parent are increasingly likely to have two highly educated, married parents and a high family income, while children with one less-educated parent are increasingly likely to live either with a single mother or with two parents, both with low levels of education and low wages.

Given the increasing correlation of parental educational attainment and family income, we might expect the association between parental education and children's achievement to grow with time in the same way that the income achievement gap does. This does not, however, appear to be the case. Online appendix section 5.A8 describes a set of analyses of the trends in the association between parental educational attainment and math and reading scores from all available studies. On the whole, the data suggest that the association between parental educational attainment and student achievement has not changed dramatically during the last fifty years, though there is some evidence that it may be increasing in recent decades.

Because income and parental education are correlated, and increasingly so with time, as shown in figure 5.9, I conduct a set of analyses to determine whether the growth in the income achievement gap is due to increases in the association between income and achievement or parental education and achievement. For each study with measures of both family income and parental education, I estimate the association between income and achievement, controlling for parental education, and the association between parental education and achievement, controlling for family income (see online appendix section 5.A8). These partial associations are shown in figures 5.10 and 5.11.

The key result evident in figures 5.10 and 5.11 is that the income coefficient grew steeply for cohorts born from the 1940s to 2000. The income coefficient for reading increased fourfold during this period, and it more than doubled for math. At the same time, the parental-education coefficient has been generally unchanged during the six decades of cohorts in the studies. Even if we focus only on the cohorts born since the mid-1970s, the income coefficient has increased

substantially, more than doubling in reading and increasing more than 50 percent in math. In this same time period, the coefficient on educational attainment appears to have grown as well, albeit at a slower rate.

Figures 5.10 & 5.11 here

It is instructive to compare the trends in figures 5.10 and 5.11 with those in figures 5.1 and 5.2 and those in online appendix figures 5.A19 and 5.A20; because each of these figures reports estimated gaps between a child at the 90th and 10th percentiles of the income or educational-attainment distribution, the magnitudes of the coefficients can be directly compared. First, note that income accounts for relatively little of the gap in achievement between children from families with more- and less-educated parents (this is evident by comparing the unadjusted gaps in figures A19 and A20 to the adjusted gaps in figures 5.10 and 5.11). For cohorts from the 1940s through 2001, family income and race together account for generally less than 20 percent of the association between parental education and achievement. Parental education, however, accounts for a large proportion of the association between income and achievement in the early cohorts, but that proportion declines across cohorts (this is evident by comparing the unadjusted gaps in figures 5.1 and 5.2 to the adjusted gaps in figures 5.10 and 5.11). In reading, for example, parental education accounts for roughly 60 to 80 percent of the income achievement gap in the studies of cohorts born in the 1940s, 1950s, and 1960s. But among cohorts born between 1980 and 2001, parental education and race explain only 40 to 60 percent of the income gap. The trend is similar, but weaker, for math. This pattern is at odds with the explanation that the growing income gap is due to the increasing correlation of income and parental education: all else being equal, we would expect the increasing correlation between the two to mean that education should explain more of the income gap over time, not less.

A second lesson evident in figures 5.10 and 5.11 is that the association between parental education and children's academic achievement, controlling for family income and race, remains

larger than the association between family income and achievement, controlling for parental education and race. That is, although the association between income and achievement has grown rapidly during the last fifty years, parental educational attainment is still a more powerful predictor of student achievement than is family income.[12]

Increased Segregation by Income

A final possible explanation for the rising income achievement gap is the pattern of increasing income segregation during the last forty years. Several recent studies have found that residential segregation by income increased from 1970 to 2000, partly as a result of rising income inequality and likely partly as a result of low-income housing policy (Jargowsky 1996; Reardon and Bischoff 2011; Watson 2009). In particular, rising income inequality has led to the increasing segregation of high-income families from middle- and low-income families; high-income families increasingly live spatially far from the middle class (Reardon and Bischoff 2011). Because residential patterns are closely linked to school-attendance patterns, the rise of residential income segregation has likely led to a concurrent rise in school segregation by income, though there is little empirical evidence on this.[13] Because the growth in income segregation has been largely a result of increasing segregation of the affluent, this might explain the pattern of the rising association between income and achievement among higher-income families.

Greater residential income segregation may affect the school-quality differential between high- and low-income students, because high-income parents are better able to garner resources for their schools. Likewise, increased income segregation may lead to less variance of test scores within schools and more variance of test scores between schools, given that higher-income students generally have higher scores than lower-income students.[14]

It is not clear, however, that these factors would lead to increases in the income achievement gap. The evidence on the effects of school socioeconomic composition is somewhat

weak, though a new study taking advantage of quasi-random variation in school poverty rates experienced by low-income students in Montgomery County, Maryland, finds evidence that low-income students perform better on math tests after moving to low-poverty schools (Schwartz 2010). Likewise, some studies of peer effects find evidence that the academic-achievement level of one's classmates may impact one's own achievement (for recent evidence, see Lavy, Silma, and Weinhardt 2009). Nonetheless, the evidence is far from clear if, how, and how much differences among schools in peers and school quality may affect achievement. As a result, there is little evidence to answer the question of whether rising income segregation has played a role in the increasing income achievement gap.

Conclusion

Most, but not all, of the evidence presented in this chapter suggests that the achievement gap between children from high- and low-income families has grown substantially in recent decades. The income achievement gap is now considerably larger than the black-white gap, a reversal of the pattern fifty years ago. In some ways, this is not surprising. The 1950s and 1960s were characterized by historically low levels of income inequality and high levels of racial inequality, not only in educational achievement and attainment but in access to educational opportunity, labor markets, housing markets, and health care. Beginning in the 1970s, this pattern began to reverse. Efforts to desegregate schools and hospitals, affirmative-action programs, enforcement of fair housing laws, and gradual but important changes in racial attitudes all led to reductions in the stark racial disparities of the 1950s and 1960s. Although racial disparities are still manifestly evident in many aspects of U.S. society, these disparities are considerably smaller in many ways than they were fifty years ago.

At the same time, however, income inequality in the United States began to grow sharply in the 1970s, a trend that continues to the present. The gap between the rich and the poor has

widened significantly, particularly among families with children. Moreover, the Reagan-era changes in social policy—particularly changes in housing policies, income-support policies, and other social safety nets for low-income families (Katz 1989, 1995)—have made life much more difficult for low-income families. Not only do the poor have less money than they did before, they may have fewer social support systems as well.

It is tempting to read this chapter as evidence of a profound shift from a society in which race is more consequential than family income to one in which family income appears more determinative than race. Certainly the trends in the income- and racial-achievement gaps are consistent with this explanation. The fact that the relationship between parental education and achievement has changed relatively little during the same time period is consistent with this as well, suggesting that income, not human capital (at least as measured by parental education), is the important socioeconomic factor at work.

However, many of the other patterns in this chapter are not fully consistent with the simple explanation that income inequality has driven these trends. First, the analyses described in the chapter and the online appendix show that the income achievement gaps do not grow in the ways that would be predicted by the changes in income inequality. Although income inequality grew sharply for families with below-median incomes during the 1970s and 1980s, the income achievement gap among children from these families was largely unchanged. The achievement gap did grow among children from above-median-income families, but this appears to be better explained by an increase in the association between income and achievement, not by increases in income inequality. Evidence from other studies suggests that parental investment in their children's cognitive development has grown during the last half-century, particularly for higher-income families, a pattern that may explain the growing returns to income during this time period.

There are a number of other possible explanations for the evident trends in the income achievement gap. Education policy increasingly focuses on standardized-test scores as outcome

measures for schools; as these scores become more important, families may be increasingly likely to invest in improving their children's scores. Likewise, cultural perceptions of the role of parents have changed throughout the twentieth century to focus increasingly on early-childhood cognitive and psychological development, which may lead parents with resources to invest more in their young children's development.

In sum, the forces at work behind the rising income achievement gap are likely complex and interconnected. Certainly more research to understand the causes of these trends is necessary. Equally important, however, is research to understand the consequences of these patterns.
At the same time that family income has become more predictive of children's academic achievement, so have educational attainment and cognitive skills become more predictive of adults' earnings. The combination of these trends creates a feedback mechanism that may decrease intergenerational mobility. As the children of the rich do better in school, and those who do better in school are more likely to become rich, we risk producing an even more unequal and economically polarized society.

Notes

Online appendix available at: http://www.russellsage.org/duncan_murnane_online_appendix.pdf.

1. The included NCES studies are the National Longitudinal Study (NLS), High School and Beyond (HS&B), the National Education Longitudinal Study (NELS), the Education Longitudinal Study (ELS), the Early Childhood Longitudinal Study, Kindergarten Cohort (ECLS-K), and the Early Childhood Longitudinal Study, Birth Cohort (ECLS-B). The included international studies are the Third International Mathematics and Science Study (TIMSS), the Program of International Assessment (PISA), and the Progress in International Reading Study (PIRLS). The additional included studies are the National Longitudinal Survey of Youth: 1979 (NLSY79), the National Longitudinal Survey of Youth: 1997 (NLSY97), Prospects: The Congressionally Mandated Study of Educational Growth and Opportunity (Prospects), the National Longitudinal Study of Adolescent Health (Add Health), the Longitudinal Survey of American Youth (LSAY), the NICHD Study of Early Child Care and Youth Development (SECCYD), the Equality of Educational Opportunity study (EEO), and Project Talent.

2. The names of these studies are provided in full in note 1. Although HS&B includes parent-reported family income for a subsample of roughly 15 percent of the full sample, the measure of family income appears highly unreliable (see online appendix 5.A2 for detail). I rely instead on the student-reported family income measure for HS&B, as described in online appendix 5.A2. NLSY79 includes parent-reported income for subjects who live with their parents; I use only the sample of sixteen- to eighteen-year-olds from NLSY79 for this reason.

3. My calculations, based on 2009 Current Population Survey data. See online appendix section 5.A3 for details.

4. Figures 5.1 and 5.2 display estimated 90/10 income achievement gaps from all available nationally representative studies that include reading- or math-achievement test scores for school-age children and family income. Labels indicate the modal grade in which students were tested in a given sample. For most of the longitudinal studies (HS&B, NELS, Prospects, ELS, and ECLS-K), only estimates from the initial wave of the study are included. ECLS-B estimates come from wave 4, when children were five years old and tested on school readiness; SECCYD come from wave 5, when children were in third grade and were first administered a broad academic achievement test. The quartic fitted regression line is weighted by the inverse of the sampling variance of each estimate. Included studies are Project Talent, NLS, HS&B, NLSY79, NELS, Add Health (reading only), Prospects, NLSY97, ELS, SECCYD, ECLS-K, and ECLS-B. Family income is student-reported in Project Talent, NLS, and HS&B. See online appendix for details on computation of 90/10 gaps.

5. My calculations, based on Main NAEP math and reading scores. See National Center for Education Statistics website, available at: http://nces.ed.gov/nationsreportcard/naepdata/dataset.aspx (accessed March 7, 2011).

6. Figures 5.3 and 5.4 show estimated 90/10 income gaps (solid symbols) and estimated black-white gaps (hollow symbols) based on the twelve studies with family income data. The estimated trends in the income and black-white gaps are fitted lines (quartic for income gaps, quadratic for black-white gaps), weighted by the inverse of the sampling variance of each estimate. The estimated black-white gap trend from NAEP is a fitted line (quartic for reading,

cubic for math) through all available NAEP-LTT and Main NAEP black-white gap estimates. The NAEP trend is adjusted for the age of the NAEP samples and the difference between Main and LTT NAEP (the line is the predicted trend for thirteen-year-old students in NAEP-LTT). See appendix section 5.A5 for details.

7. The exception here is the Prospects seventh-grade cohort (born roughly 1978), for whom the estimated gaps are much smaller than the NELS cohort (born roughly 1974), particularly in math. The magnitude of the estimated gaps from the Prospects study—especially the Prospects math gaps in the third- and seventh-grade cohorts—is generally not consistent with the size of the estimated gaps from other contemporaneous studies. Moreover, it is difficult to find documentation on the content and psychometric properties of the Prospects tests. These tests may be much less reliable than other tests; as a result, I am inclined to discount their importance in describing the trends.

8. Figure 5.A12 in the online appendix displays the trend in U.S. income inequality throughout the last century.

9. My calculations, based on Current Population Survey, 1968–2009. See appendix section 5.A3 for details.

10. We would expect this if we thought the relationship between achievement and log income was linear, which may not be the case. See online appendix section 5.A6 for discussion.

11. The same trend is evident if the correlations are plotted against the year of the study rather than against birth year.

12. The income coefficients displayed in figures 5.9 and 5.10 are roughly 20 to 40 percent the size of the parental-education coefficients in the earliest cohorts, but they are 60 to 90 percent the size of the parental-education coefficients in the later cohorts. The income coefficients here are adjusted for the estimated reliability of family income, so these differences in the magnitudes of the income and education coefficients are likely not substantially biased by the less reliable measurement of family income. Figure 5.9 shows the Spearman rank-order correlation between parental educational attainment (coded as the maximum level of educational attainment of both parents, if two are present in the home) and family income. Because both income and parental education are measured by ordered categories in most studies (parental education is measured in four to eight categories; income in five to fifteen categories), I compute the rank-order correlation between income and parental education for each of the twelve studies with measures of both income and parental education. Correlations are disattenuated for estimated measurement error in both family income and parental educational attainment. Note that because these are rank-order correlations, they are not directly comparable to standard (Pearson) correlation coefficients.

13. Because of the relatively small within-school samples in many of the studies that include measures of family income, it is difficult to assess the trends in school income segregation using the data available.

14. An examination (not shown) of the intracluster correlations of test scores from the school-based studies included in this chapter provides some evidence that the intracluster correlation has grown with time, but these estimates are very noisy because of the small sample sizes within each school in most of the studies.

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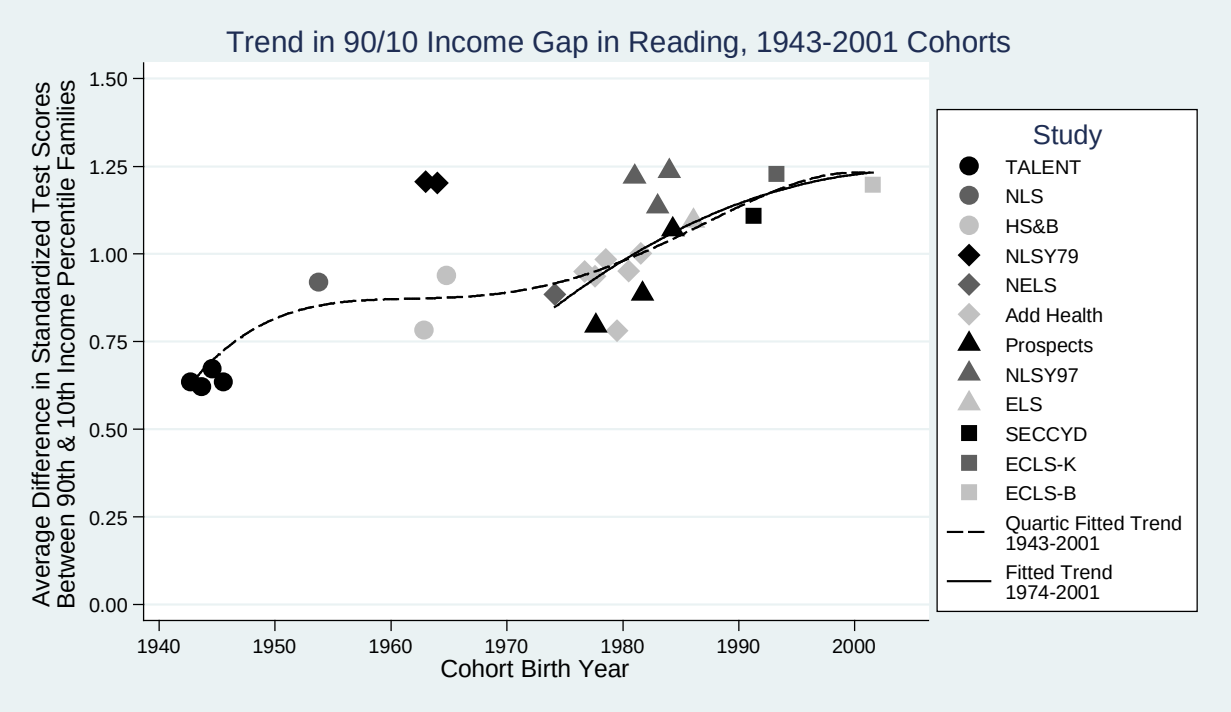
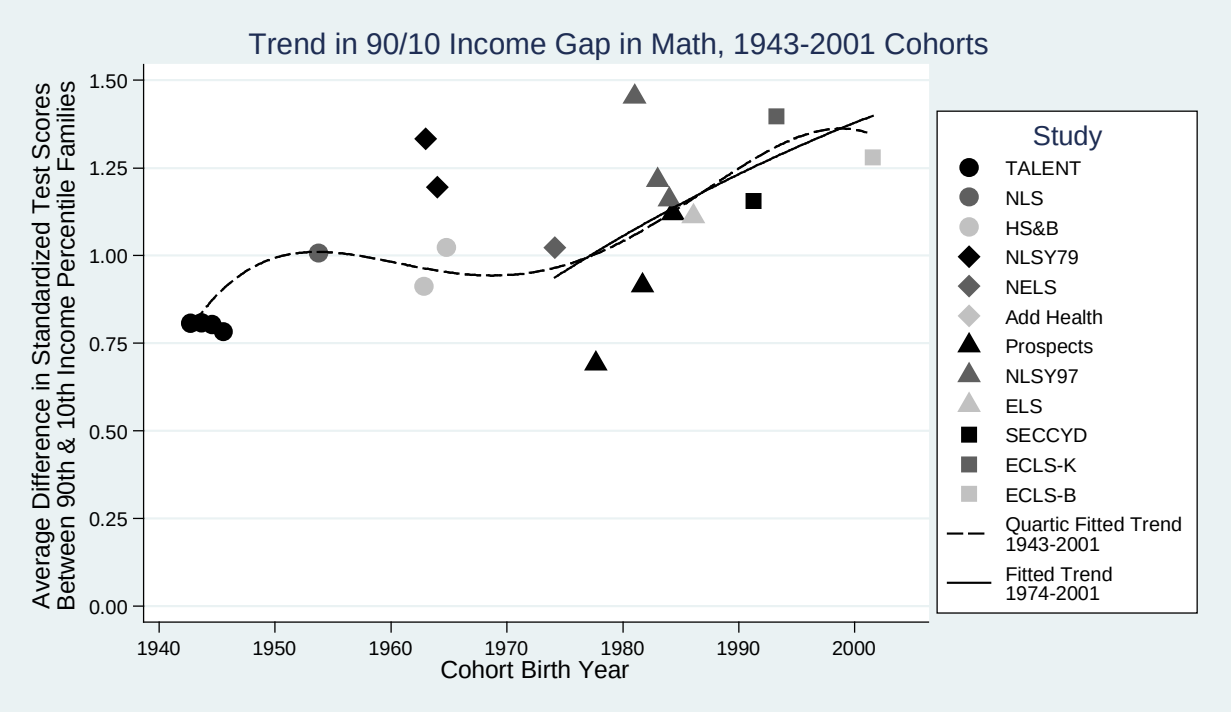
FIGURE 5.1 *Trend in 90/10 Income Achievement Gap in Reading, by Birth Cohort (1943 to 2001 Cohorts)*



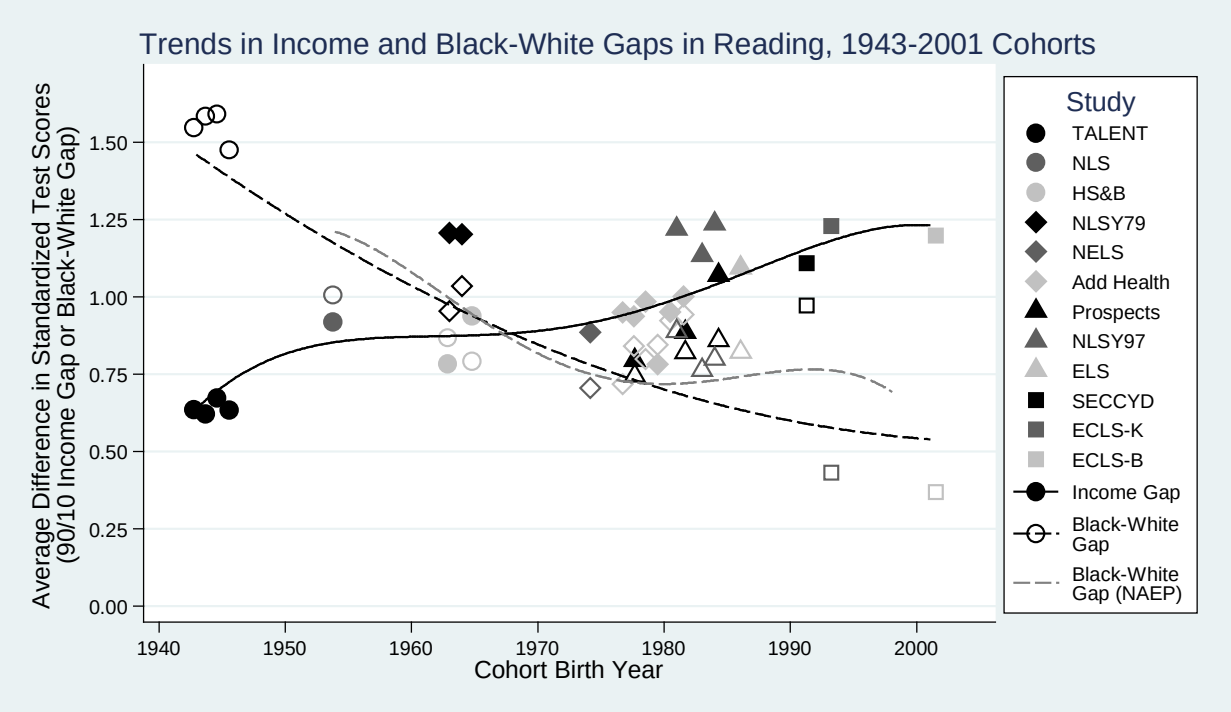
Source: Author's compilation based on data from Project Talent (Flanagan et al. n.d.); NLS, HS&B, NELS, ELS, ECLS-K, ECLS-B (U.S. Department of Education, Center for Education Statistics 1999, 2000, 2001, 2004, 2009, 2010); Prospects (U.S. Department of Education 1995); NLSY79, NLSY97 (U.S. Bureau of Labor Statistics 1980, 1999); SECCYD (National Institute of Child Health and Human Development 2010); and Add Health (Harris 2009, reading only).
Note: See note 4 and online appendix for further details.

FIGURE 5.2 *Trend in 90/10 Income Achievement Gap in Math, by Birth Cohort (1943 to 2001 Cohorts)*



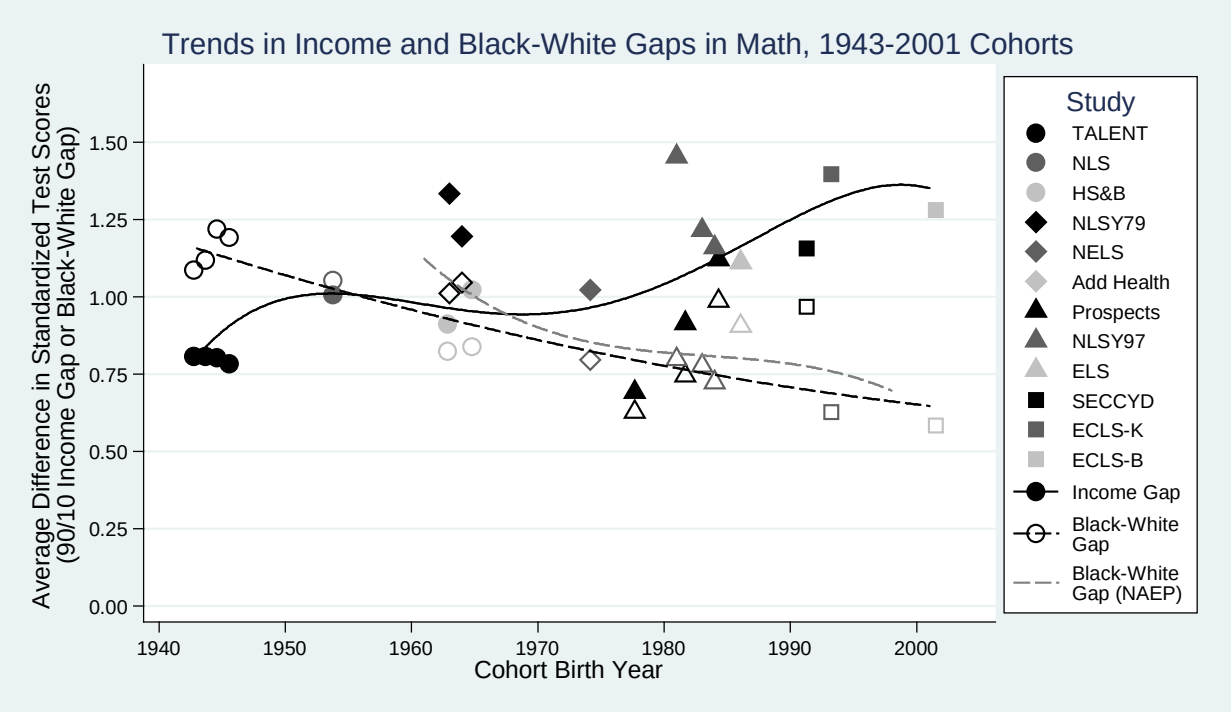
Source: Author's compilation based on data from Project Talent (Flanagan et al. n.d.); NLS, HS&B, NELS, ELS, ECLS-K, ECLS-B (U.S. Department of Education, Center for Education Statistics 1999, 2000, 2001, 2004, 2009, 2010); Prospects (U.S. Department of Education 1995); NLSY79, NLSY97 (U.S. Bureau of Labor Statistics 1980, 1999); and SECCYD (National Institute of Child Health and Human Development 2010).
Note: See note 4 and online appendix for further details.

FIGURE 5.3 *Comparison of Income and Black-White Reading-Gap Trends (1943 to 2001 Cohorts)*



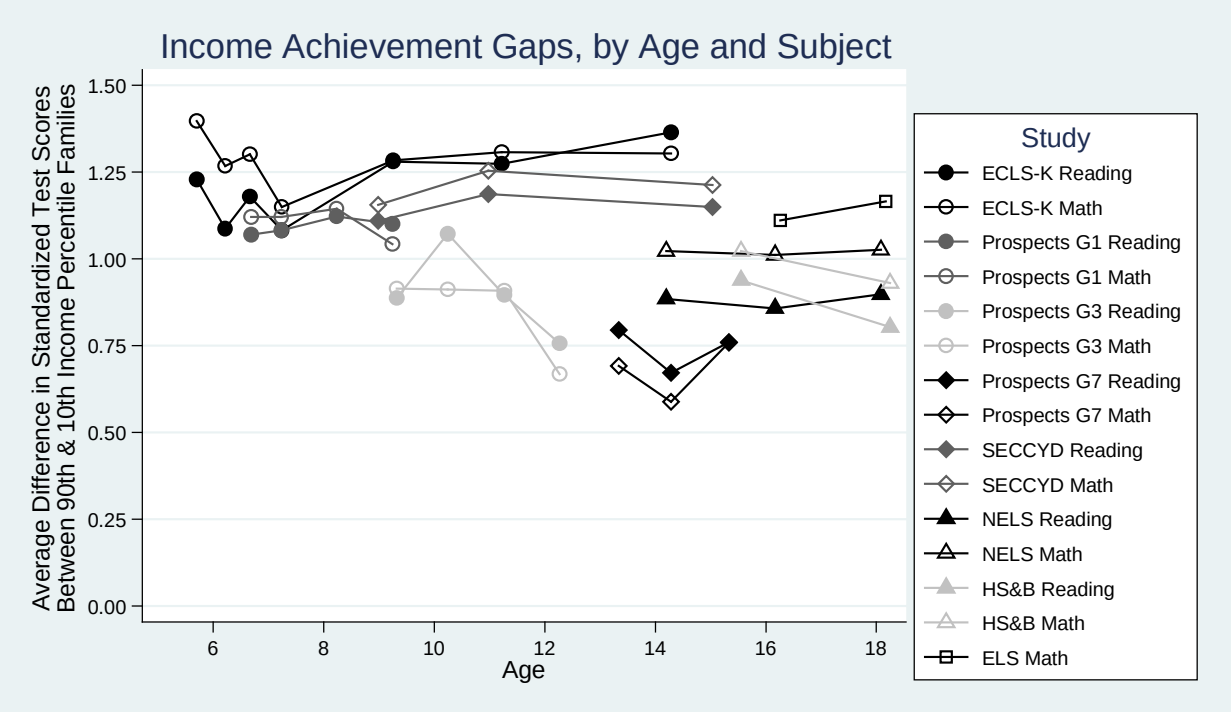
Source: Author's compilation based on data from Project Talent (Flanagan et al. n.d.); NLS, NAEP, HS&B, NELS, ELS, ECLS-K, ECLS-B (U.S. Department of Education, Center for Education Statistics n.d., 1999, 2000, 2001, 2004, 2005, 2009, 2010); Prospects (U.S. Department of Education 1995); NLSY79, NLSY97 (U.S. Bureau of Labor Statistics 1980, 1999); SECCYD (National Institute of Child Health and Human Development 2010); and Add Health (Harris 2009, reading only).
Note: Solid symbols represent 90/10 income achievement gaps; hollow symbols denote black-white achievement gaps. See note 6 and online appendix section 5.A5 for further details.

FIGURE 5.4 *Comparison of Income and Black-White Math-Gap Trends (1943 to 2001 Cohorts)*



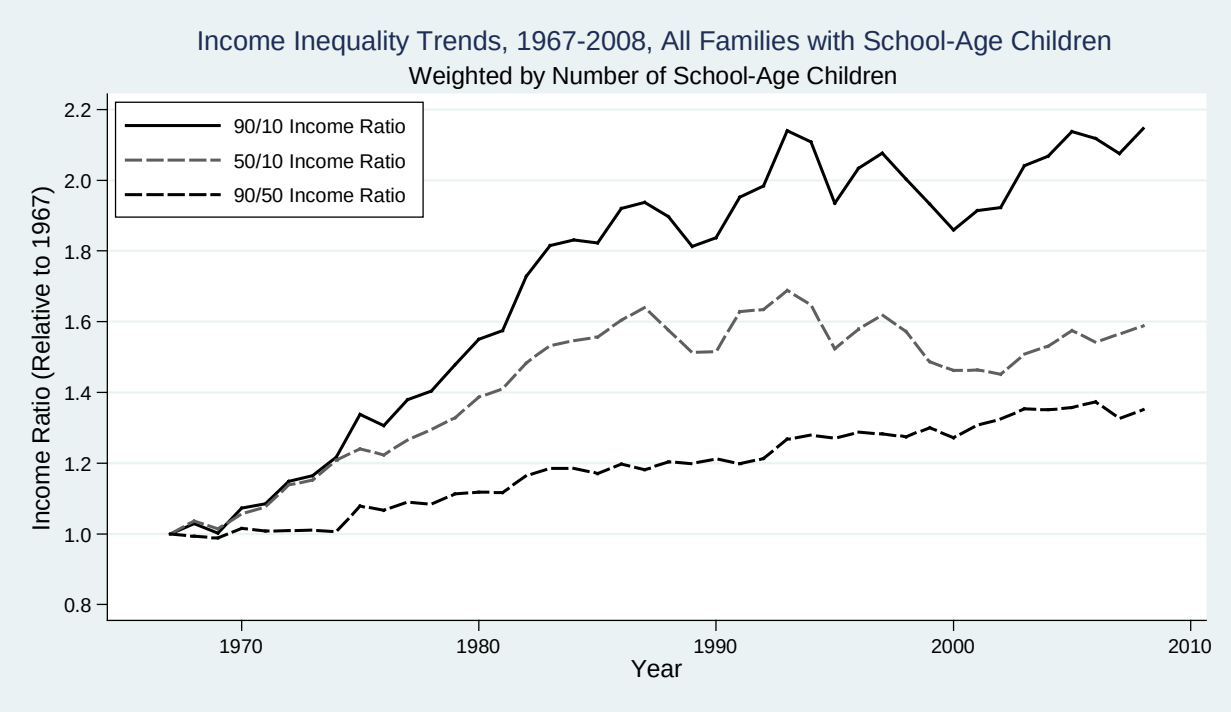
Source: Author's compilation based on data from Project Talent (Flanagan et al. n.d.); NLS, NAEP, HS&B, NELS, ELS, ECLS-K, ECLS-B (U.S. Department of Education, Center for Education Statistics n.d., 1999, 2000, 2001, 2004, 2005, 2009, 2010); Prospects (U.S. Department of Education 1995); NLSY79, NLSY97 (U.S. Bureau of Labor Statistics 1980, 1999); SECCYD (National Institute of Child Health and Human Development 2010); and Add Health (Harris 2009, reading only).
Note: Solid symbols represent 90/10 income achievement gaps; hollow symbols denote black-white achievement gaps. See note 6 and online appendix section 5.A5 for further details.

FIGURE 5.5 *Income achievement Gradient, by Age and Subject, All Longitudinal Studies*



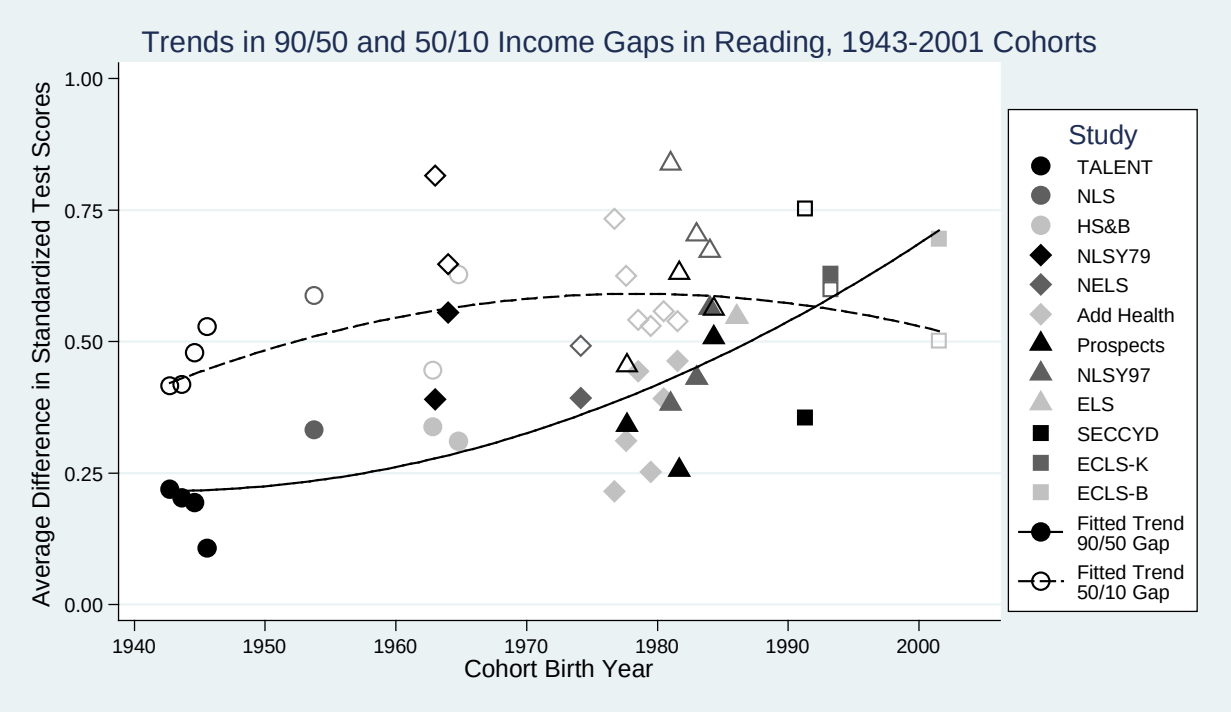
Source: Author's compilation based on data from HS&B, NELS, ELS, ECLS-K (U.S. Department of Education, Center for Education Statistics 2000, 2001, 2004, 2010); Prospects (U.S. Department of Education 1995); and SECCYD (National Institute of Child Health and Human Development 2010).

FIGURE 5.6 *Trends in Family-Income Inequality Among School-Age Children, 1967 to 2008 (Weighted by Number of School-Age Children)*



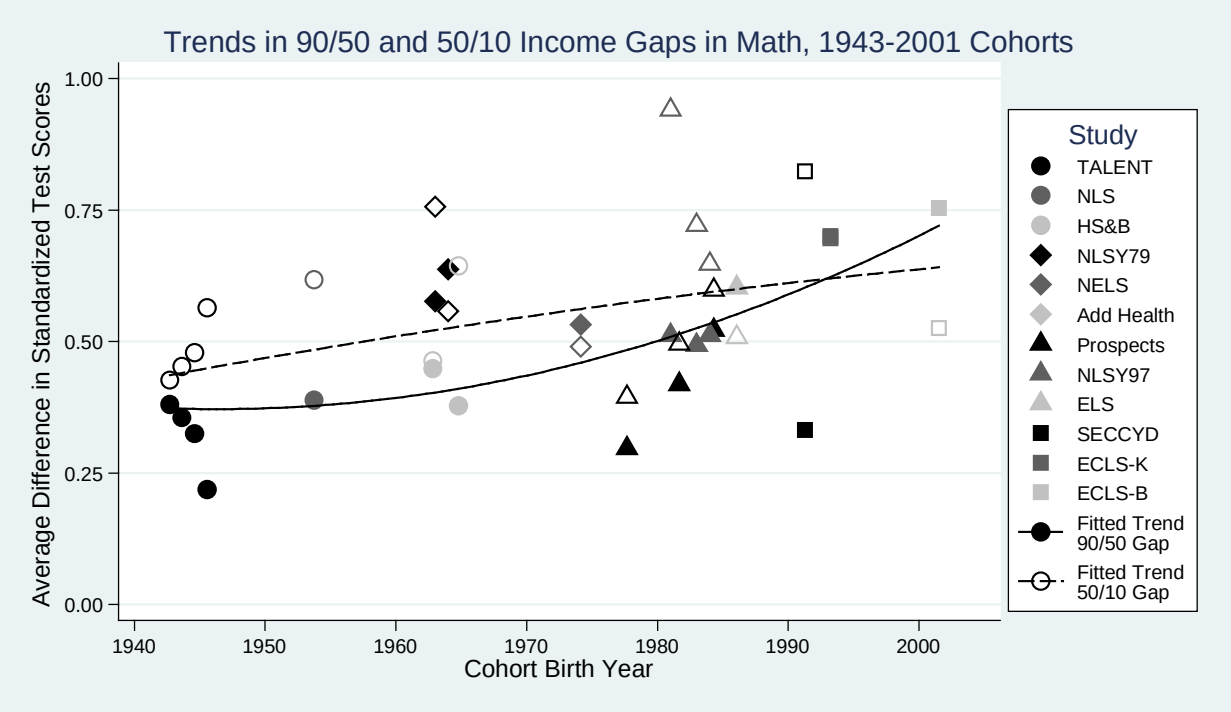
Source: Author's calculations, based on U.S. Bureau of the Census (King et al. 2010).
Note: Each line shows the trends in the ratio of household incomes at two percentiles of the income distribution. All trends are divided by their value in 1967 in order to put the trends on a common scale.

FIGURE 5.7 *Trend in 90/50 and 50/10 Income Achievement Gap, Reading, by Birth Year (1943 to 2001 Cohorts)*



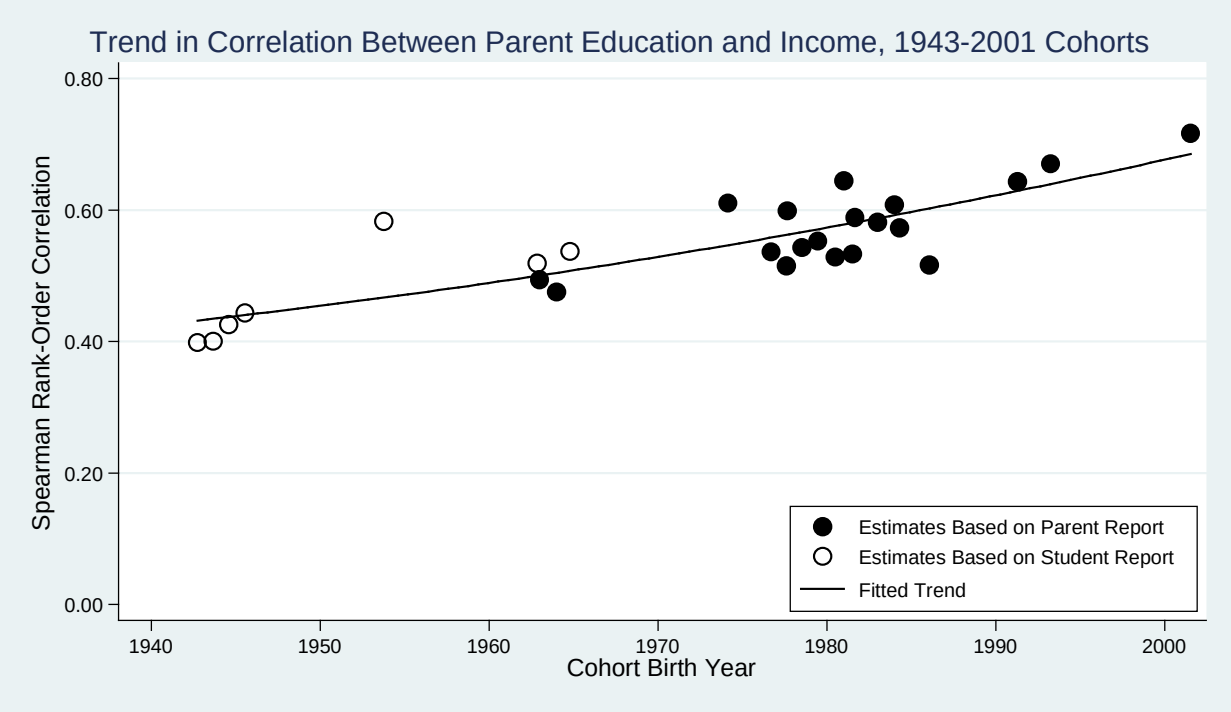
Source: Author's compilation based on data from Project Talent (Flanagan et al. n.d.); NLS, HS&B, NELS, ELS, ECLS-K, ECLS-B (U.S. Department of Education, Center for Education Statistics 1999, 2000, 2001, 2004, 2009, 2010); Prospects (U.S. Department of Education 1995); NLSY79, NLSY97 (U.S. Bureau of Labor Statistics 1980, 1999); SECCYD (National Institute of Child Health and Human Development 2010); and Add Health (Harris 2009, reading only).
Note: Solid symbols represent 90/50 income achievement gaps; hollow symbols represent 50/10 income achievement gaps.

FIGURE 5.8 *Trends in 90/50 and 50/10 Income Achievement Gap in Math, by Birth Year (1943 to 2001 Cohorts)*



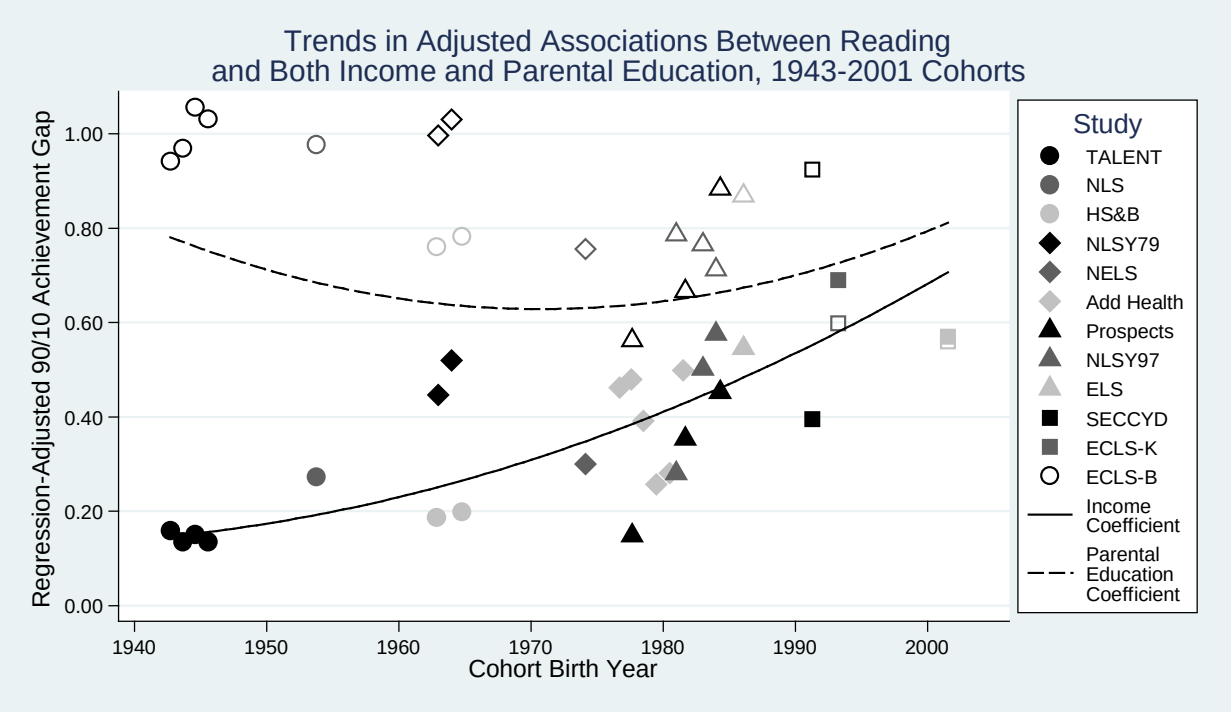
Source: Author's compilation based on data from Project Talent (Flanagan et al. n.d.); NLS, HS&B, NELS, ELS, ECLS-K, ECLS-B (U.S. Department of Education, Center for Education Statistics 1999, 2000, 2001, 2004, 2009, 2010); Prospects (U.S. Department of Education 1995); NLSY79, NLSY97 (U.S. Bureau of Labor Statistics 1980, 1999); and SECCYD (National Institute of Child Health and Human Development 2010).
Note: Solid symbols represent 90/50 income achievement gaps; hollow symbols represent 50/10 income achievement gaps.

FIGURE 5.9 *Trend in Correlation Between Parental Education and Family Income (1943 to 2001 Cohorts)*



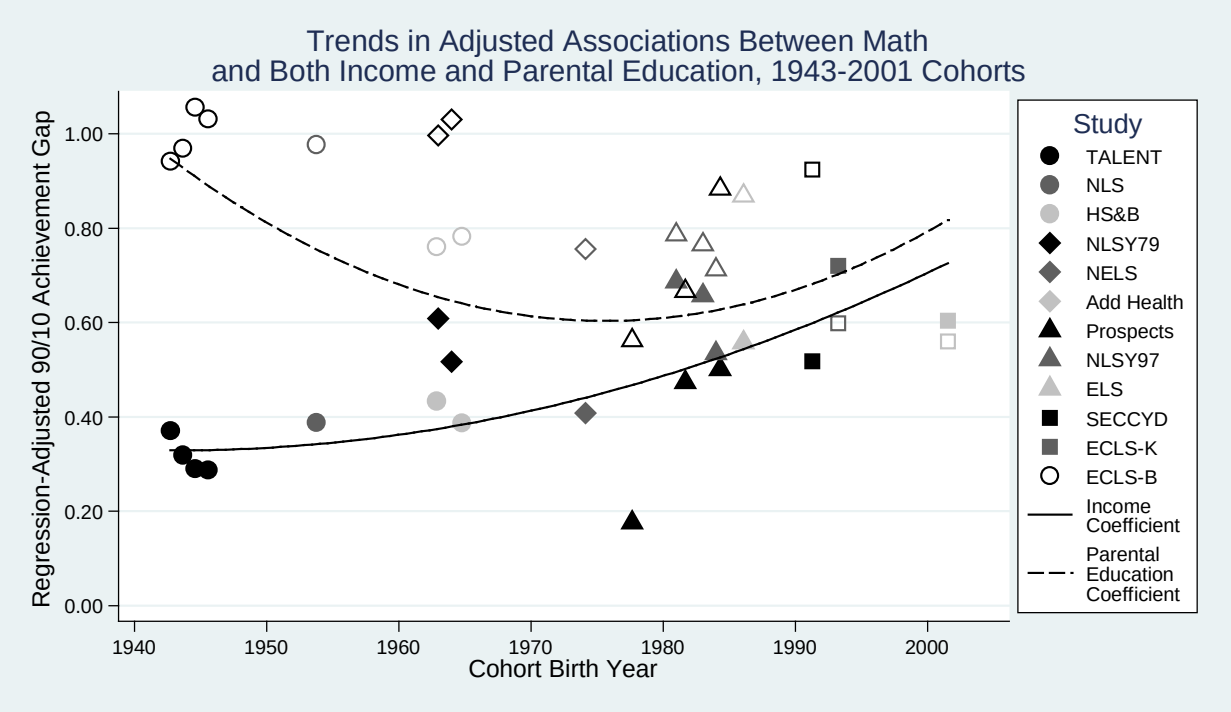
Source: Author's compilation based on data from Project Talent (Flanagan et al. n.d.); NLS, HS&B, NELS, ELS, ECLS-K, ECLS-B (U.S. Department of Education, Center for Education Statistics 1999, 2000, 2001, 2004, 2009, 2010); Prospects (U.S. Department of Education 1995); NLSY79, NLSY97 (U.S. Bureau of Labor Statistics 1980, 1999); SECCYD (National Institute of Child Health and Human Development 2010); and Add Health (Harris 2009, reading only).
Note: See note 12 for further details.

FIGURE 5.10 *Estimated Partial Associations Between Reading Test Scores and Both Income and Parental Education, by Birth Cohort (1943 to 2001 Cohorts)*



Source: Author's compilation based on data from Project Talent (Flanagan et al. n.d.); NLS, HS&B, NELS, ELS, ECLS-K, ECLS-B (U.S. Department of Education, Center for Education Statistics 1999, 2000, 2001, 2004, 2009, 2010); Prospects (U.S. Department of Education 1995); NLSY79, NLSY97 (U.S. Bureau of Labor Statistics 1980, 1999); and SECCYD (National Institute of Child Health and Human Development 2010).
Note: Solid symbols represent regression-adjusted 90/10 income coefficients; hollow symbols represent regression-adjusted parental education coefficients. See note 12 for further details.

FIGURE 5.11 *Estimated Partial Associations Between Math Test Scores and Both Income and Parental Education, by Birth Cohort (1943 to 2001 Cohorts)*



Source: Author's compilation based on data from Project Talent (Flanagan et al. n.d.); NLS, HS&B, NELS, ELS, ECLS-K, ECLS-B (U.S. Department of Education, Center for Education Statistics 1999, 2000, 2001, 2004, 2009, 2010); Prospects (U.S. Department of Education 1995); NLSY79, NLSY97 (U.S. Bureau of Labor Statistics 1980, 1999); and SECCYD (National Institute of Child Health and Human Development 2010).
Note: Solid symbols represent regression-adjusted 90/10 income coefficients; hollow symbols represent regression-adjusted parental education coefficients. See note 12 for further details.