
The Race for Education

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The Widening Academic Achievement Gap Between the Rich and the Poor

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. 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 Glauber 1995; Lareau 1989, 2003).

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 [surprisingly little] attention.

The question 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?

Data

Assembling information on trends in the relationship between socioeconomic status and academic achievement requires examination of multiple sources of data. 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, US components of international studies, and other studies. 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.¹

Measuring Achievement Gaps

To compare the size of the achievement gap across studies, I report test-score differences between groups 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.) 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 for technical details).

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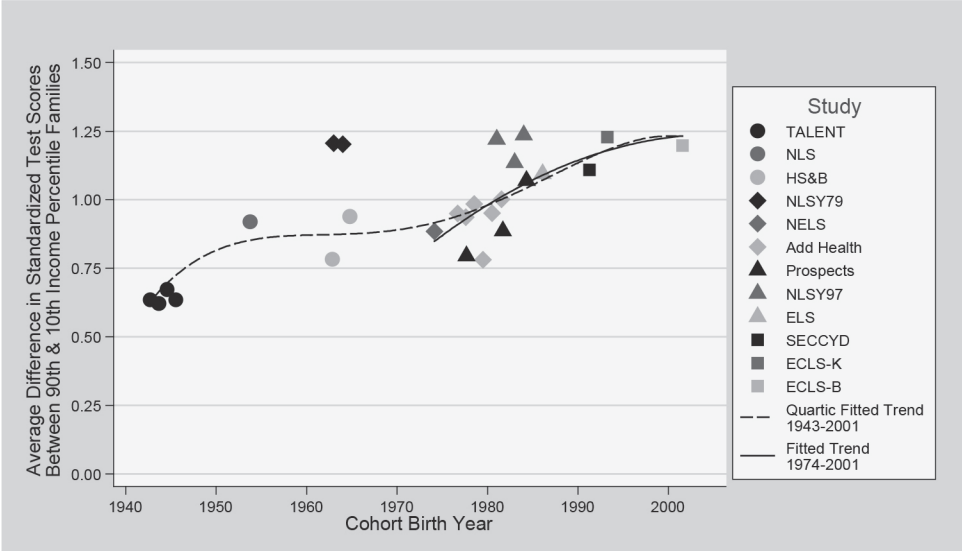


FIGURE 28.1 Trend in 90/10 Income Achievement Gap in Reading, by Birth Cohort (1943 to 2001 Cohorts)

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.

Measures of Socioeconomic Status

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, [and . . .] three include student-reported income.² In all studies, I adjust the estimated associations between family income and achievement for measurement error in family income.

Although each of the nineteen studies includes a measure of parental educational attainment, in some studies this is reported by students, 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).

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

Figures 28.1 and 28.2 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.

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

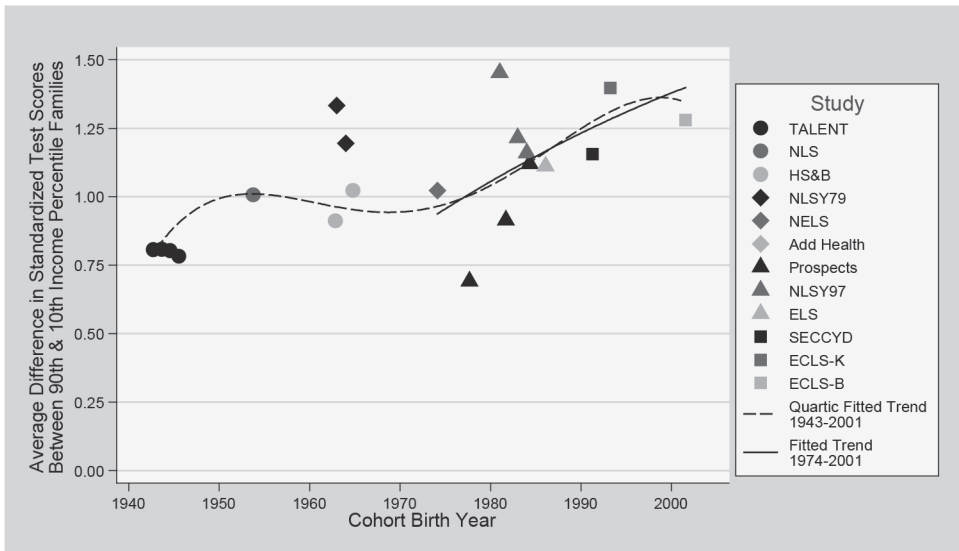


FIGURE 28.2 Trend in 90/10 Income Achievement Gap in Math, by Birth Cohort (1943 to 2001 Cohorts)

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 online appendix for further details.

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. Furthermore, [these studies] exclude [high school] 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.

Although the trend in achievement gaps prior to 1970 is somewhat unclear, the trend from the mid-1970s to 2001 appears relatively clear. Figures 28.1 and 28.2 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.

How Large Are These Gaps?

Figures 28.1 and 28.2 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. . . .

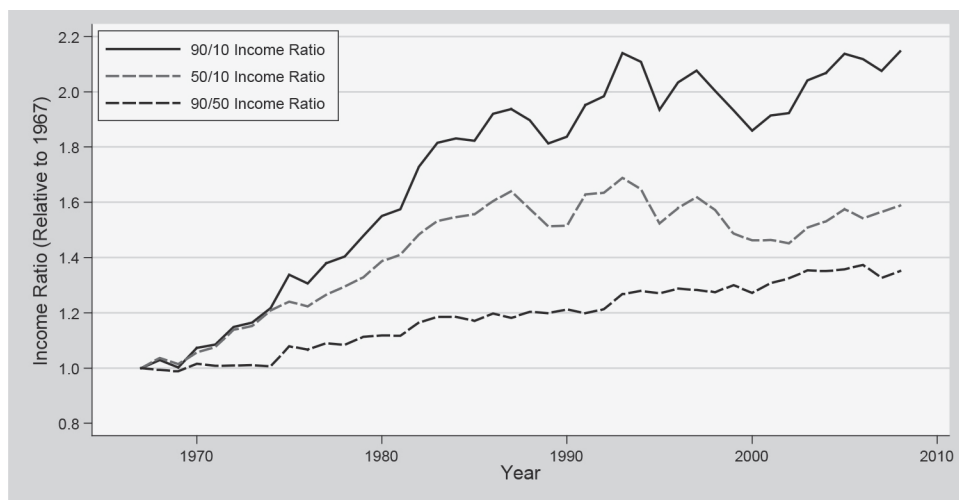


FIGURE 28.3 Trends in Family-Income Inequality Among School-Age Children, 1967 to 2008 (Weighted by Number of School-Age Children)

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.

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

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 US income inequality was at its twentieth-century peak (Burkhauser et al. 2009; Piketty and Saez 2003, 2008).⁶ 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 28.3, 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 2008.⁷ Several key trends are evident in Figure 28.3. 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

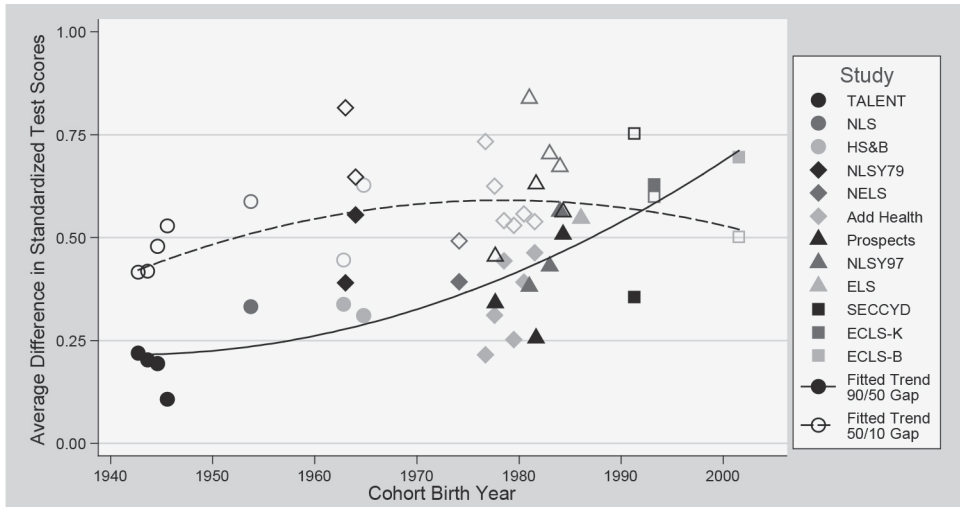


FIGURE 28.4 Trend in 90/50 and 50/10 Income Achievement Gap, Reading, by Birth Year (1943 to 2001 Cohorts)

Source: Author's compilation based on data from Project Talent (Flanagan et al. n.d.); NLS, HS&B, NELS, ELS, ECIS-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.

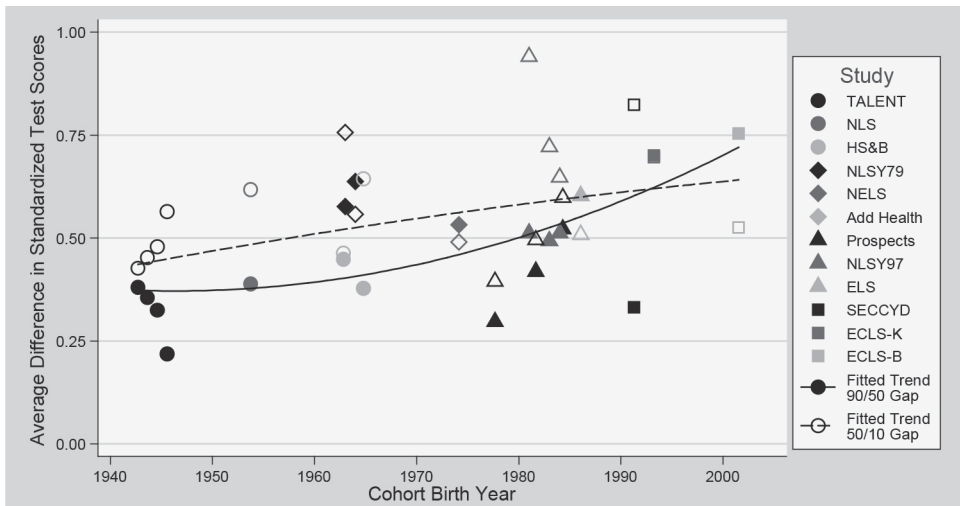


FIGURE 28.5 Trends in 90/50 and 50/10 Income Achievement Gap in Math, by Birth Year (1943 to 2001 Cohorts)

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.

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.⁸ Figures 28.4 and 28.5 display the estimated 90/50 and 50/10 income achievement gaps for each of the studies with income data.

Figures 28.4 and 28.5 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 28.4 and 28.5 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.

Differential Investments in Children's Cognitive Development

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).

Another factor that may contribute to parents' increasing focus on their children's cognitive devel-

opment 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 socio-emotional 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

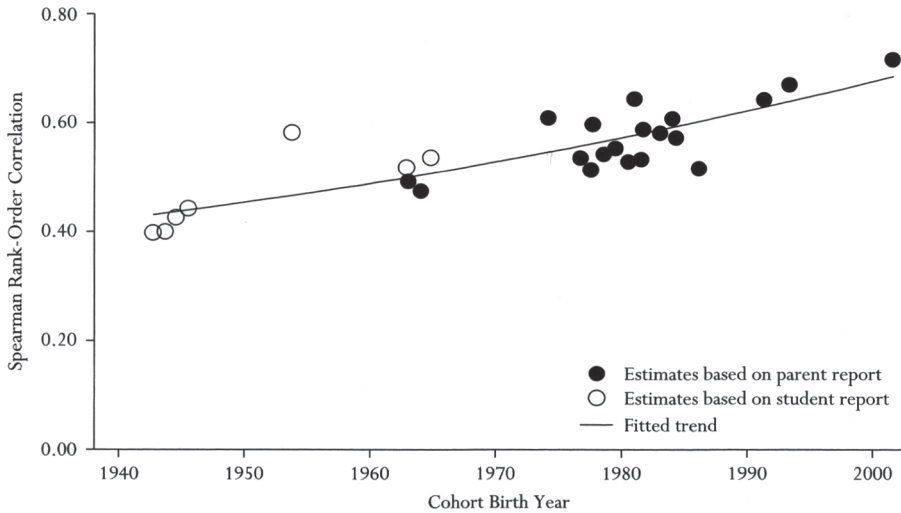


FIGURE 28.6 Trend in Correlation Between Parental Education and Family Income (1943 to 2001 Cohorts)

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).

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 28.6, which shows a relatively unambiguous trend of increasing correlation between parental education and family income across cohorts.⁹ 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.

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.

Because income and parental education are correlated, and increasingly so with time, as shown in [Figure 28.6](#), 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. These partial associations are shown in [Figures 28.7](#) and [28.8](#).

The key result evident in [Figures 28.7](#) and [28.8](#) 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.

It is instructive to compare the trends in [Figures 28.7](#) and [28.8](#) with those in [Figures 28.1](#) and [28.2](#). Parental education accounts for a large proportion of the association between income and achievement in the early cohorts, but that proportion declines across cohorts. 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. 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 28.7](#) and [28.8](#) 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.¹⁰

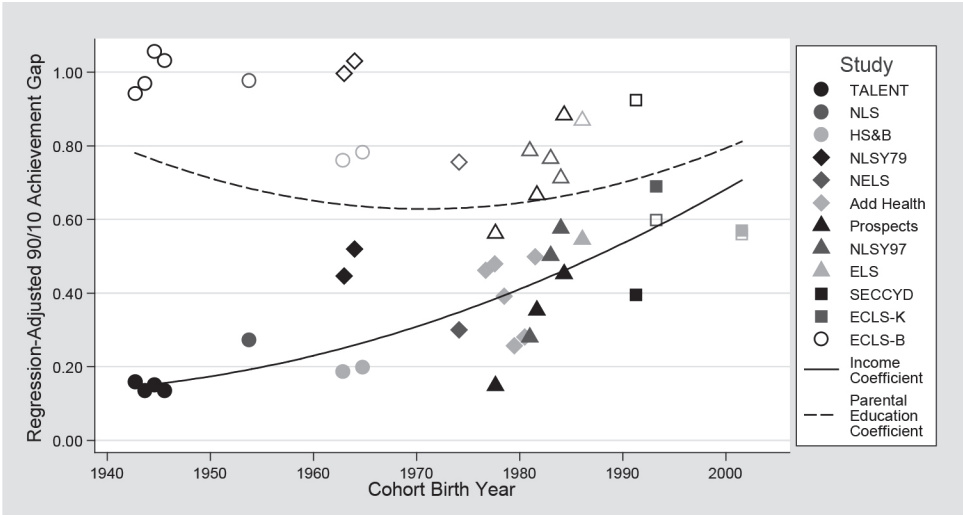


FIGURE 28.7 Estimated Partial Associations Between Reading Test Scores and Both Income and Parental Education, by Birth Cohort (1943 to 2001 Cohorts)

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.

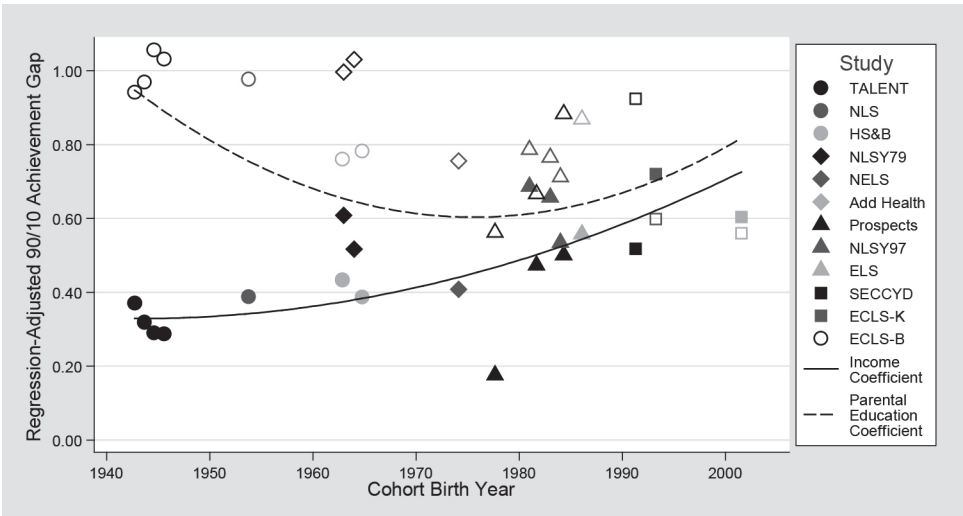


FIGURE 28.8 Estimated Partial Associations Between Math Test Scores and Both Income and Parental Education, by Birth Cohort (1943 to 2001 Cohorts)

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.

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.¹¹ 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.¹²

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 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. At the same time, 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.

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 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. 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.

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NOTES

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

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. For further information about each study, see http://russellsage.org/duncan_murnane-online-appendix.pdf.

2. The names of these studies are provided in full in note 1. Although HS&B includes parent's 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 28.1 and 28.2 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. Figure 5.A12 in the online appendix displays the trend in U.S. income inequality throughout the last century.

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

8. 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.

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

10. The income coefficients displayed in Figures 28.6 and 28.7 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 28.6 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.

11. 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.

12. An examination (not shown) of the intraclass correlations of test scores from the school-based studies included in this chapter provides some evidence that the intraclass 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.