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Increasing Inequality in Parent Incomes and Children's Schooling

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Abstract

Income inequality and the achievement test score gap between high- and low-income children increased dramatically in the United States beginning in the 1970s. This article investigates the demographic (family income, mother's education, family size, two-parent family structure, and age of mother at birth) underpinnings of the growing income-based gap in schooling using data from the Panel Study of Income Dynamics. Across all 31 cohorts, we find that increases in the income gap between high- and low-income children account for approximately three-quarters of the increasing gap in completed schooling, one-half of the gap in college attendance, and one-fifth of the gap in college graduation. We find no consistent evidence of increases in the estimated associations between parental income and children's completed schooling. Increasing gaps in the two-parent family structures of high- and low-income families accounted for relatively little of the schooling gap because our estimates of the (regression-adjusted) associations between family structure and schooling were surprisingly small for much of our accounting period. On the other hand, increasing gaps in mother's age at the time of birth accounts for a substantial portion of the increasing schooling gap: mother's age is consistently predictive of children's completed schooling, and the maternal age gap for children born into low- and high-income families increased considerably over the period.

Keywords

Income inequality; Educational attainment; Panel Study of Income Dynamics; Family background

Introduction

Economic growth for much of the twentieth century supported America's promise of offering opportunities to both parents and their children. In the 30 years between 1947 and 1977, a period in which gross national product (GNP) per capita doubled, the incomes of families in the lowest income bracket nearly doubled as well.[1] In contrast, as documented in

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countless studies, several decades have been marked by increasing income inequality in the United States, with stagnant incomes for families at the bottom of the distribution and sharp increases for those at the top of it.

Reardon (2011) explored the implications of this increasing income inequality for test score gaps between high- and low-income students, finding that these gaps grew sharply but also several reasons to doubt that the increasing gaps in income and test scores are causally linked. This article shifts the focus from test scores to school completion outcomes, as measured by years of completed schooling as well as college attendance and graduation, and tracks changes in income inequality and educational attainment between children born into low- and high-income households in the United States between 1954 and 1985. A key advantage of our efforts over Reardon's is that our data come from a single source—the Panel Study of Income Dynamics (PSID)—which provides consistent, high-quality measures of income, enables us to link family income in adolescence to schooling completed a decade later, and supplies measures of important family demographic conditions. We find that school completion gaps have grown, although not by as much as what Reardon (2011) found for test score gaps.

Our primary goal is to account for the increase in the schooling gap with changing gaps in family income and changes in related demographic factors (mother's education, family size, two-parent family structure, and mother's age at birth). We also estimate changes in the relative contribution of income and these other demographic factors for explaining increases in the income-based gap in children's completed schooling.

Background

How Rising Inequality May Influence Children's Skills and Attainment

Assessing how increased income inequality influences skill acquisition and educational attainment of children born into different circumstances is complicated. Duncan and Murnane (2011) presented a conceptual model of how increasing family income inequality may affect access to high-quality childcare, schools, and other settings that help build children's skills and educational attainments. Changes in these social contexts may in turn affect children's skill acquisition and educational attainments directly and indirectly through influences on how schools operate. Growing income inequality also increases the gap in the resources that high- and low-income families can spend on enrichment goods and services for their children (Kornrich and Furstenberg 2013).

Growing disparities in parental investments may also indirectly widen skill gaps by contributing to residential segregation as the wealthy purchase housing in neighborhoods where less-affluent families cannot afford to live. Indeed, residential segregation by income has increased in recent decades (Reardon and Bischoff 2011), which can reduce interactions between rich and poor families in schools, childcare centers, libraries, and grocery stores. Without the financial and human resources and political clout of the wealthy, institutions in

[1]These data are reported in Duncan and Murnane (2011) and are from the U.S. Census Bureau, which started tracking annual family income in 1947.

poorer neighborhoods—perhaps most importantly, schools—may decline in quality, with detrimental effects on the education and life chances of children born into poor families (Altonji and Mansfield 2011).

Similarly, low family income also makes it more difficult for parents to afford high-quality childcare, which prepares children for kindergarten. In the aggregate, it can also lead to difficult-to-teach classrooms filled with low-achieving, inattentive classmates. Crime in low-income neighborhoods may provide tempting alternatives to working hard at school and, at the same time, make it more difficult for neighborhood schools to recruit high-quality teachers.

Empirical evidence on how the relationship between family income and children's participation in these settings has changed over time is limited. What is known suggests that the rich have sharply increased the resources they spend on promoting their children's development. Kornrich and Furstenberg (2013) showed that spending on child-enrichment goods and services jumped for families in the top quintiles but increased much less—in both dollar and percentage terms—for families in bottom income quintiles, as reflected in four large consumer expenditure surveys conducted between the early 1970s and 2005–2006. In 1972–1973, high-income families spent approximately $2,700 more per child per year on child enrichment than did low-income families. By 2005–2006, this gap had nearly tripled, to $7,500 (Kornrich and Furstenberg 2013). Changes in participation in extracurricular activities between 1972 and 2004 also favored more advantaged youth (Putnam et al. 2012).

Belley and Lochner (2007) compared the two cohorts of the National Longitudinal Survey of Youth (NLSY; 79 and 97) to show that family income has become a substantially stronger predictor of college attendance and college quality (but not high school completion) in recent years, particularly for those youth with the lowest skills. This finding, they argued, implies that youth became more credit constrained over the period 1979–1997.

In a related vein, Hurst (2010) showed substantial social class divergence in parental time investments in young children between 1985 and 2003. Specifically, whereas college-educated mothers with children ages 5 and younger spent 18.0 weekly hours in childcare in 1985 compared with 16.2 hours for less-educated households, the two figures in 2003 were 25.6 and 18.9, respectively. Altintas (2012) further showed that the growing education gap in parental time with young children is driven by time in educationally enriching activities. Thus, changes in parental time and capital investments are potentially plausible candidates for explaining divergence in children's educational attainments.

Changes in demographic factors correlated with changes in income may also account for changes in the income-based gaps in children's schooling. Such factors include two-parent family structure, mother's age at birth, maternal education, and family size. Each of these factors showed considerable change over the period in which income inequality grew, with some changes plausibly widening gaps between rich and poor children and others potentially narrowing those gaps. Kornrich (2016) pursued a similar question by decomposing the spending gap on young children, finding that most of the increase in spending is due to income rather than changes in family structure or other household characteristics.

Our data afford us a detailed examination of these factors, which we review next.

Two-Parent Family Structure—The rising number of children growing up without two married parents might well be a powerful explanatory factor shaping the correlation between income inequality and children's outcomes (McLahanan and Percheski 2008). The percentage of children living with two married parents dropped from 85 % in 1960 to 69 % in 2002 to 64 % in 2012 (Vespa et al. 2013). This period corresponds to a sharp increase in the number of children born to an unmarried mother. Further, the decrease in the likelihood of living in a two-parent household has been greatest for children with the fewest economic advantages. Between 1980 and 2010, the share of children living with college-educated mothers who were married remained at approximately 90 %. In contrast, the share of children living with mothers who lacked a high school diploma who were married decreased from approximately 73 % to approximately 66 % (Stykes and Williams, 2013).

Children growing up in families with two biological, married parents have better academic and socioemotional outcomes, on average, than children in all other family types, including those living with divorced single mothers (McLanahan and Sandefur 1994; Waldfogel et al. 2010), in stepparent families (Coleman et al. 2000), and with cohabiting or never-married single parents (Osborne and McLanahan 2007; Waldfogel et al. 2010). This difference is due largely to the greater economic well-being and higher levels of parental time investment in children in households with two biological married parents (Kalil et al. 2014). Other studies of family structure have focused on growing up with a single parent, finding that these children experience lower school achievement and aspirations, increased psychological distress, earlier initiation of substance use and sexual activity, and a greater likelihood of engaging in problem behaviors or deviant activities (McLahanan and Percheski 2008; McLanahan and Sandefur 1994).

The links between single parenthood and attainment may differ for boys and girls. The gender gap in achievement and attainments (favoring girls) is now well documented. Some researchers have attributed this reverse gender gap to boys' lower levels of noncognitive skills, which are hypothesized to arise from their greater sensitivity to stressful environmental conditions, such as exposure to single parenthood (Bertrand and Pan 2013). Boys' heightened sensitivity to stressful environmental conditions could mean that increasing income inequality is more strongly related to growing income-based gaps in schooling for boys versus girls.

Maternal Age at Birth—Trends in maternal age at first birth have also changed in important ways. The average age at first birth for all mothers increased by 3.6 years from 1970 to 2006, from age 21.4 to age 25.0 (Matthews and Hamilton 2009). Relatedly, births to teenagers have been declining steadily over the past 50 years and have now reached historic lows in the United States (Martin et al. 2012). However, recent reductions in teen birth rates have masked a growing gap in maternal age at birth for children born to high- and low-SES) mothers. Comparing data on U.S. births in 1970, 1989, and 2006 by age of mother and maternal schooling reveals that the maternal age gap between children born to high school dropout and college graduate mothers grew by nearly 3 years—from 4.3 years to 7.1 years (Duncan et al. 2015). Maternal age at childbirth appears to be a positive determinant of

children's learning and educational attainment; financial independence from public programs, such as welfare, food stamps, and Medicaid; (reduced) teen pregnancy; and adolescent and young adult problem behaviors, such as fighting, truancy, and sexual activity; even after accounting for rich sets of covariates (Angrist and Lavy 1996; Francesconi 2007; Hoffman 2008).

Maternal Education—Other demographic trends in the United States have changed in ways that may have partially offset the adverse effects of rising income inequality. In particular, women's education levels have risen, women have increasingly delayed childbearing, and families have gotten smaller (Cherlin 2005). With respect to education, undergraduate enrollment grew rapidly in the 1970s, especially for women. Correspondingly, the share of women aged 25–34 with at least a college degree has more than tripled from 1968 to 2009, from approximately 11 % to approximately 35 % (White House Council on Women and Girls 2011).

These trends are important because maternal education has a positive impact on children's development (Carneiro et al. 2013). More years of parental education generate higher earnings and increase family incomes, which enables parents to purchase more resources for their children. Second, highly educated parents adopt different child socialization strategies than their less-educated counterparts. They spend more “developmentally effective” time with their children (Kalil et al. 2012), produce more cognitively stimulating home learning environments (Harris et al. 1999), have higher expectations for their children's educational attainment (Davis-Kean 2005), and are more likely to adopt parenting strategies that promote achievement (Steinberg et al. 1992). In addition, skills acquired through schooling may enhance parents' abilities to organize their daily routines and resources in a way that enables them to accomplish their parenting goals effectively (Michael 1972).

Family Size—Finally, families with many children have become less common, with a drop in the percentage of families containing four or more children from 17 % in 1970 to 6 % in 2000, for example (Lofquist et al. 2012). Family size is inversely related to children's attainments (Price 2008).

Our investigation of links between income inequality and children's schooling will account for concurrent trends in all four of these important demographic factors: two-parent family structure, maternal age at birth, maternal schooling, and family size. However, in the spirit of the Duncan (1969)/Oaxaca (1973) decomposition framework, these other demographic factors will matter for increasing inequality in child outcomes only to the extent that their trends have favored higher- versus low-income families, and the factors themselves have important associations with child outcomes.

How Children's Educational Performance Has Changed

As the incomes of affluent and poor American families have diverged over the past three decades, so too has the educational performance of the children in these families. Reardon (2011) documented startling growth in the income-based gap on the test scores of children born since the 1950s. Among children born around 1950, test scores of low-income (tenth income percentile) children lagged behind those of their better-off (ninetieth income

percentile) peers by a little more than one-half of a standard deviation, or approximately 50 points on an SAT-type test. Fifty years later, this gap was twice as large. Interestingly, the income-based gap grew despite the fact that racial gaps in test scores diminished during the same period (Magnuson and Waldfogel 2008; Reardon 2011).

Reardon (2011) explored several possible explanations for the increasing income-based test-score gap. He failed to find evidence that the growing income-achievement gap results from a growing achievement gap between children with highly and less-educated parents. However, he also presented evidence casting doubt on strong linkages between income inequality and test scores. For example, one would expect that if income inequality caused income-based test score inequality, then that relationship should hold in both the top and bottom halves of the income distribution. But Reardon did not find that growing income gaps at the low end of the income distribution coincide with growing test scores gaps between low- and middle-income children, or that trends in high-end income and test score gaps coincide. Moreover, he did find evidence that the gap has grown at least partly because of the growing importance of income for children's achievement.

Using data from the 1979 and 1997 National Longitudinal Surveys of Youth (NLSY), Bailey and Dynarski (2011) showed growing income-based gaps in college entry and completion for children born between the early 1960s and early 1980s. Specifically, the gap in the college entry rate between the bottom- and top-income quartiles increased from 39 to 51 percentage points. With respect to college completion, the top-income quartile gained 18 percentage points (from 36 % to 54 %), but the bottom quartile rose only slightly to 9 % from 5 %. Similar increases in income-based gaps in high school graduation (and GED receipt) are not apparent in these data. Moreover, the growing income-related gaps in college attendance and completion have been driven primarily by women, a result that casts some doubt on traditional explanations linking rising income inequality to rising gaps in attainments. It is nevertheless possible, as Bertrand and Pan (2013) showed, that boys and girls respond differently to the same family circumstances.

The goal of this study is to relate changes in income inequality to changes in the years of schooling completed by children in low- and high-income families over a three-decade period, the latter half of which spans the NLSY and NLS97 cohorts. Our work adds to the evidence produced by Reardon, and by Bailey and Dynarski, with a more thorough investigation of the associations between growth in income and educational inequality. We also add a new examination of the role of changes in a set of income-related demographic changes in explaining income-related changes in children's schooling. We show that a particularly important result of the latter exercise is to suggest a strong role for changes in maternal age and a weak role for changes in family structure.

Method

Data

We use data spanning 31 cohorts born between 1954 and 1985 from the Panel Study of Income Dynamics (PSID n.d.). The PSID followed a nationally representative sample of families and their children from 1968 through 2009. Our analysis sample consists of 6,072

respondents who were observed in the PSID between ages 14 and 16 (the period over which we measure parental income and demographic variables) and had nonmissing data on completed schooling around age 24. We adjust for differential nonresponse by using the PSID attrition-adjusted weights in all our analyses.

Completed Education—We focus our analysis on a continuous measure representing years of completed schooling reported at age 24 (which, given our cohorts, are calendar years 1978–2009). This measure has a value between 1 and 17, where 1–16 represents the highest grade or year of school completed. The PSID assigns a value of 17 for those who report at least some postgraduate work. We also use this completed schooling measure to define dichotomous indicators of (1) attending college (defined as 13 or more years of schooling) and (2) completing college (16 or more years).[2]

Childhood Income—We create a measure of average annual household income across the three calendar years when the child was 14–16 years old. We use the PSID's high-quality edited measure of annual total family income (pretax), which includes taxable income and cash transfers to all household members. We also examined an income measure that included the family's estimated food stamp benefits, although that information was not available for all of the cohorts in our analysis. Three-year average family incomes are inflated to 2010 levels using the U.S. consumer price index (CPI). Finally, income is truncated at the 1st and 99th percentiles to avoid undue influence on our regression estimates from children with very large family incomes.

Control Variables and Regression Procedures—We first look at simple correlations between income and attainment inequality. We also find it useful to calculate trends in these measures after adjusting for concurrent changes in key demographic correlates of income—mother's education, family size, family structure, and mother's age at birth—plus other demographic controls. We do not pretend to believe that these adjustments will isolate the causal effect of income in our comparisons of the completed schooling of poor and rich children, but they are useful for providing a rough estimate of association after controlling for these demographic measures.

The specific set of controls used in the regressions are (1) highest completed schooling of the mother when the child was 14 years old; (2) number of siblings born to the child's mother; (3) fraction of years between ages 14 and 16 that the child's household contained two biological parents; (4) age of the mother at the child's birth; (5) child's sex (female = 1); (6) race/ethnicity (black and Hispanic); (7) whether the child was the mother's firstborn (yes = 1); and (8) age of mother at her first birth. We run ordinary least squares (OLS) regressions using STATA 13.0 MP and cluster standard errors at the family level. All analyses are weighted using the PSID-provided attrition-adjusted weight.

[2]Because the PSID switched to a biannual survey starting in 1997, for the even years 1998–2008, the year immediately previous or immediately following the year the respondent was aged 24 is used. Further, education values for heads and wives are not asked annually (as they are for other family members) because for adults, it does not change quickly or commonly; so in some cases, the most recent data available are also used. Periodically, the PSID updates head/wife education, but in many cases, earlier year education information is brought forward to the current-year survey.

Results

Simple Trends

After establishing reasonable comparability between the PSID with other data sources (see Online Resource 1), we estimated trends in our key dependent variable: children's completed schooling. In Fig. 1 (and detailed in Table S1), we plot raw gaps between children in the top and bottom quintiles of the income distribution for all PSID cohorts. Smoothed trends are captured using lowess, based on line least-square smoothing and a bandwidth of 0.8. We also show lowess-based trends for data in the second half of the period, which corresponds roughly to the years covered by Bailey and Dynarski (2011).

Figure 1 shows relatively little change in the schooling gap in first half of the period, an increasing gap across the 1980s, and then little change after that. Schooling gaps between the top and bottom quintiles are quite large. Top-quintile children who turned age 14 in the first six years of the period enjoyed a 2.3-year advantage in completed schooling over corresponding children in the bottom quintile. This advantage increased by nearly one-half (0.43) a year by the end of the period. Most of this increase occurred in the second half of the period, which is roughly the time covered in the Bailey and Dynarski (2011) study.

A similar pattern emerges for college graduation rates. In the case of college attendance, most of the gap increase occurred in the first half of the period (Fig. 2). Figures S3 and S4 in Online Resource 1 present the patterns for high school graduation and post-bachelor's degree, respectively.

Income gaps grew in both dollar (Fig. 3) and percentage terms as well. The gap in income for children in the top and bottom quintile of the income distribution increased in the first part of the period, followed by a flat period and then ending with an increase. The average difference in incomes of children in the top and bottom quintiles was close to $100,000 in the first year of the period; this grew to approximately $165,000 by the last year (Fig. 3). Juxtaposing the schooling and income trends in the first half of our accounting period presents one potential problem for an income-based explanation of changes in the schooling gap between high- and low-income children. Figure 1 shows that schooling gaps closed slightly in the very beginning and end of the period, at the same time that income gaps were increasing.[3]

As noted previously, other large demographic changes were taking place as well, some favoring high-income children and others favoring low-income children. Trends in maternal education over the first half of the period favored low-income children (Fig. 4). As shown in Table S1 (Online Resource 1), maternal schooling levels for higher-income children increased modestly across the first half of the period. Maternal schooling levels for low-

[3]It is tricky to think about timing issues. For one thing, our age 14–16 accounting period over which family income is measured was chosen for practical rather than conceptual reasons: it enabled us to gain as many PSID birth cohorts as possible for which both family income and children's completed schooling were measured at sensible ages. If income before or after the age 14–16 window matters the most for children's schooling, then our age 14–16 window may be providing an erroneous reading of the degree to which income inequality that may be causing disparities in completed schooling. We explore whole-childhood results later.

income children start much lower but increased more rapidly. These trends were reversed in the second half of the period.

Leading the list of adverse changes are decreases in family structures with two biological parents, which were particularly sharp among low-income children. In the first six years of the period, rates of two-biological-parent families for low-income youth averaged approximately 42 % between ages 14 and 16. This decreased to 2 8% in the last six years of the period. The contrasting figures for high-income youth remained flat at 91 %. As a result, the two-parenthood gap favoring higher-income children increased over the period (Fig. 5).

And whereas family sizes are larger for low-income relative to high-income families, the gap narrowed between the beginning and end of the period (Fig. 6)—a trend that favors low-income children. At the same time, gaps in mothers' age at birth between low- and high-income families increased—a trend that favors high-income children. The average age of the mother at birth declined over the period for low-income children (from 27.9 to 24.7), whereas the average age increased for high-income children (from 27.4 to 28.7). This may seem at odds with declining teen births to low-income mothers but can be reconciled by the fact that even though early births to low-income mothers occurred at older ages, the rapidly falling family sizes for these mothers led to a decline in the age of mother at birth, on average, for children in low-income families. All told, the reinforcing trends produced a sharp increase in gaps in mother's age—from approximately 1.5 years early in the period to nearly 5 years at the end (Fig. 7).

The ability of changes in parent income and education, family structure and size, and maternal age at birth to account for increases in schooling disparities between high- and low-income children also depends on the importance of these demographic factors in determining children's schooling. Simple correlations among children's completed school and our key demographic measures are shown in Table S2 (Online Resource 1).

Our schooling regressions are straightforward, using children's years of completed schooling as the dependent variable and the following as independent variables: income; family structure and size (all averaged across ages 14–16), mother's age at the birth of the child, mother's schooling, race (and Hispanic status), and child's gender and parity. We adjust standard errors to account for within-family clustering of siblings. Although our demographic regressions cannot isolate the causal effects of these factors, it is instructive to perform this kind of accounting and then consider the sensitivity of our estimates to possible biases in our estimates of importance.

Regression results are summarized in Table 1 and detailed in Table S3 (Online Resource 1). The first column of Table 1 presents regression results when all 31 cohorts are pooled. Both raw score and standardized coefficients (in brackets) are shown.

Consistent with abundant past literature, family income and maternal education are the most powerful predictors of children's schooling. Each log unit increase in income is associated with a 0.63-year increase in children's schooling, while each additional year of mother's schooling is associated with a 0.23-year schooling increase for their children. Standardizing these coefficients (using 31-year standard deviations) produces respective coefficients of

0.22 and 0.29. Additional siblings are associated with less schooling, while more time spent in a two–biological-parent household[4] and older maternal ages at the birth of the child are associated with more schooling.

Is Income Becoming a More Powerful Predictor of Child Attainment?

Part of the story we are investigating involves changes in the importance of our demographic measures—in particular, family income—in explaining children's completed schooling. Perhaps, as Reardon (2011) suggested, the increasing income-based gaps in school success are caused more by an increase in the *importance* of income rather than an increase in the income gap itself. We investigate this in three ways, two of which involve fitting separate regressions to early and later calendar years covered by our data, and the third involving the addition of calendar year interactions to the regression model shown in the first column of Table 1.[5]

The second and third columns of Table 1 present results from regressions fit separately for children born in the first and second halves of the 31-year period. They show no statistically significant change in the explanatory power of family income; in fact, point estimates show a small and nonsignificant decline in the raw score coefficients and standardized coefficients. Still more detail on coefficient changes is shown in the last three columns of Table 1. Tracking changes from the early, middle, and final years of the PSID, these three regressions show falling and then stable income coefficients. Looking ahead to our decomposition, generally insignificant changes in regression coefficients over the period suggest that the bulk of the explanatory power of demographic factors in accounting for the increasing attainment gaps between low- and high-income children will come from trends in gaps in the levels of these factors rather than changes in their predictive power.

We estimated models in which the year the child turned age 14 (centered on 1984) was interacted with log income and other demographic measures in our model (second column of Table S4, Online Resource 1). Only in the case of number of siblings is there a statistically significant trend, which in this case is toward a less-negative impact.

Accounting for Change

Ours is an unusual application of the Duncan/Oaxaca decomposition analysis, which is typically applied cross-sectionally between groups. We seek to explain changes in group (low- vs. high-income) differences in completed schooling as a function of changes in group differences in our set of demographic factors. So, for example, the accounting links between income and children's schooling distinguishes between how much of the divergence in schooling outcomes for high-and low-income children can be attributed to increases in the *amount* of income separating the two groups from increases in the *importance* of income for

[4]The small (.060) standardized coefficient on two-parent family structure is surprisingly small but results from other regression controls. Simple correlations between family structure and completed schooling are .200 for the entire period and .323 for the second half of the period (Table S2, Online Resource 1). Removing income from the regression presented in Table 1 increases the coefficient on two-parent structure from .287 to .620, which is still not large enough to matter much in our upcoming decomposition analysis.

[5]We also estimated a piecewise linear relationships between income (and log income) and children's completed schooling fit to the first and second half of the period, which allows for separate linear segments for each income quintile. There was some indication (p values between .05 and .10) of an increase in the importance of the lowest income quintile, but nothing close to a statistically significant change elsewhere in the income distribution.

completed schooling. More formally, the contribution of the “levels” of the demographic factors in accounting for the increased completed schooling gaps is the product of changes in those gaps multiplied by the “value” of those changes as represented by the coefficients shown in the first column of Table 1. And the contribution of changes in the “effects” of a given demographic factor is the product of the changes in the coefficients shown in the second and third columns of Table 1, multiplied by the average size of the gaps in the early part of the panel.

It is clear from Figs. 3–6 that income-based gaps in several of our demographic factors have changed substantially over the period, with some changes (e.g., income, two-parent family structure, and mother's age at the birth of the child) favoring high-income children and others (most notably family size) favoring low-income children. At the same time, second and third columns of Table 1 show that only one demographic factor (number of siblings) has become significantly more or less predictive of children's completed schooling over the past 31 years. This finding suggests that most of the reliable accounting “action” will come from changes in levels rather than effects of the demographic measures.

To conduct the primary accounting, we use the first and last six-year periods of the 31-year span to define beginning and ending periods and the “All Cohorts” regression coefficients in the first column of Table 1 to value the changes. We repeat the exercise with data from the middle and last six years of our accounting period using the “Second Half” coefficients, which very roughly coincides with the period over which family income inequality has increased the most. Finally, we use data from the first half and second half using the “All Cohorts” regression coefficient.

The first two panels of Table 2 show the accounting for changes in the income-based gap in children's completed schooling between the first and last six years of our 31-year period using mean changes in gaps in the demographic measures. Over that time, the schooling gap between children in the top and bottom quintiles of the family income distribution increased by 0.43 years. The gap in log average family income increased by 0.50. When valued by the 0.629 coefficient from the “All Cohorts” regression in Table 1, the increasing income gap accounts for 0.31 years of the schooling gap, which is approximately 73 % of the raw 0.43-year gap.

Among the remaining demographic measures, only age of mother at the birth of the child accounted for a noteworthy positive fraction of the increasing schooling gap. Recall from Fig. 6 that the income-based gap in the age of the mother at the time the child was born increased sharply over the period. Moreover, the first column of Table 1 shows that age of mother was a highly significant predictor of children's completed schooling even after controlling for correlated family conditions. As a result, the increasing gap in mother's age at birth accounted for more than one-third of the increasing gap in children schooling.

Changes in the high-/low-income gaps in the other demographic variables mattered much less. Although two-parent families became less prevalent among low- than high-income families, its ability to explain completed schooling was very small, leading family structure changes to account for only approximately one-tenth of the increasing schooling gap. Gaps

in maternal schooling decreased and then increased across the whole period and thus cannot account for increasing gaps in children's schooling, despite the considerable explanatory power of maternal education. Family size gaps favored low-income children and were thus a modest force for narrowing rather than widening the schooling gaps.

The final three columns of Table 2 show the contribution of changes in the coefficients on the demographic factors between the first and second half of the 31-year period. As shown in Table S3 (Online Resource 1), none of the coefficient changes is statistically significant at even the $p < .10$ level, so the accounting percentages in the final column should not be accorded much weight. They show that increases in the coefficients on maternal education and two-parent family structure and a decrease in the coefficient on number of siblings account for more of the gap than the other two demographic factors.

Changes Since the Early 1980s: As a robustness check on the accounting based on changes in the gaps in the demographic measures, we estimated our accounting model across the period most associated with increasing income inequality, using the middle (age 14 in 1980–1985) and final (age 14 in 1994–1999) six-year cohorts. This is a period over which children's schooling gaps increased markedly (by one-half a year; Fig. 1 and Table S1), as did gaps favoring high-income children in parent income, family structure, maternal schooling, and age of mother (Figs. 4–6, and Table S1). We used regression coefficients fit to data drawn from children turning 14 in the second half of our 31-year accounting period to value these gaps. The accounting picture for this period, shown in the middle panel of Table 2, is quite different from our first set of estimations. Here, increasing income gaps are not nearly as dominant as before, accounting for only approximately one-quarter of the increases in the schooling gap.

A look back to the trends in Figs. 1 and 2 shows what is going on. Changes across the second half of the period show even more of an increase in children's completed schooling than the changes across the whole period. Thus, there is as much change in the income-based children's schooling gap as before. Income equality increased in a roughly linear way: changes in the income-based gap between low- and high-income children account for only about one-half as much of the increasing schooling gap as before. In contrast to the long-run narrowing of differences in maternal schooling between children growing up in low- and high-income families, the gap in children's schooling in the second half of the PSID period increases rather than decreases. When coupled with the strong associations between maternal education and children's schooling, this leads maternal education to account for a large positive share of the gap.

College Attendance and Graduation—We repeated our accounting analysis using college attendance and graduation rates instead of years of completed schooling (Table 3). To estimate the contributions of income and other demographic factors, we ran logistic regressions on all 31 cohorts and obtained the results listed in Table S5 (Online Resource 1). Patterns of significance are similar to those obtained in our regressions for years of completed schooling: income is the most powerful predictor. In both cases, increasing gaps in family income account for more of the gap changes than gap changes in other

demographic factors. However, the fraction of the gap accounted by income is less: approximately 50 % in the case of college attendance and 20 % in the case of college completion.

Robustness Checks: Family Structure, Income, and Child Characteristics—We explored the robustness of our regression results in a number of ways. A first possible problem is with using number of siblings to measure family-size-based competition for family resources. Blended families add stepsiblings and large differences in the ages of full siblings can lessen the resource competition. To investigate this, we substituted for number of siblings a measure of the total number of children in the household when the target child was between ages 14 and 16. As shown in the third column of Table S4 (Online Resource 1), the coefficients change very little. In addition, family structure itself can be measured in many ways (McLanahan and Perchesky 2008). Although we base our analysis on a definition of family structure based on the presence of two biological parents, we repeated our analysis using a measure of single-parent family status. None of the substantial conclusions reached with the current analysis were changed (results not shown).

A second possible problem is that our income coefficients might be biased by our failure to include in-kind sources, such as food stamps. Food stamp receipt is not available in the PSID in interview years 1973, 1994, 1995, or 1997 (so not for calendar years 1972so not for calendar years 1993so not for calendar years 1994so not for calendar years 1995, or 1996), but we can fit our income model using years in which food stamp income could be added to family income between ages 14 and 16. We first fit our cash-income based model to the years in which food stamp income was available up to and including 1992. As shown in the fourth column of Table S4, the income coefficient decreases slightly, from 0.658 to 0.633. Adding food stamp income increases that coefficient to 0.678. With such similar estimates, it appears that we are not imparting an upward bias to our income coefficient by failing to include food stamp income.

We also fit our models separately by race and gender of child. The final columns of Table S4 show that in only one case is there a statistically significant ($p < .05$) interaction involving main effects: the coefficient on maternal schooling was significantly higher for nonblacks than blacks. Given the Bertrand and Pan (2013) evidence that family structure appears to matter more for boy than girls, we were surprised that although the two-parent coefficient was more positive for boys than girls, the differences were not statistically significant.

Are Adolescent-Based Measures of Income and Family Structure Misleading?—Another potential problem with our analysis is that our measures of income and family structure are drawn only from when the child was between the ages of 14 and 16. If these conditions are more consequential in other stages of childhood, then our adolescent-only measurement may be problematic for assessing income associations with children's completed schooling (Duncan and Brooks-Gunn 1997; Duncan et al. 2010). Although we lack whole-childhood information on children born before 1968, the PSID does provide it for cohorts born between 1968 and 1985 (and who were therefore age 14 between 1982 and 1999, which translates into the second half of the 31-year period), along with the same completed schooling information available for all cohorts.

Table S5 presents coefficients from analyses of the sample of children born between 1968 and 1985. The first pair of columns shows that the age 14–16 income coefficient drops by nearly one-half, from 1.183 to 0.625, in the presence of control variables. The third and fourth columns show that measuring income over the entire period of childhood increases its coefficient substantially: the bivariate coefficient increases from 1.18 to 1.52, while the regression adjusted coefficient increases from 0.63 to 0.83. Here again, our income estimates in our main analysis do not appear to be biased upward, in this case by restricting our income accounting period to ages 14–16. Coefficients on other demographic measures change relatively little.

Given the possibility that income in different childhood stages matters differentially for children's schooling, we also estimated a stage-specific version of the whole-childhood model (Duncan and Brooks-Gunn 1997). Roughly speaking, coefficients on stage-specific income components should sum to the whole-childhood coefficient. Using children's years of completed school as the dependent variable (fifth column), adolescent income appears to matter the most, early-childhood income is next most important, and income in middle childhood matters very little for children's completed schooling. A look at different levels of completed education—high school or more without and with GED, and a college degree—shows that adolescent income is by far the strongest predictor of college graduation, while early income is most predictive of high school graduation. Adolescence is the only period in which family structure is predictive of college graduation.

Comparisons to Causal Estimates of Income Effects—Our 31-year estimate of income effects in Table 1 is that a one-unit increase in log income is associated with a 0.629-year increase in completed schooling. The 95 % confidence interval around that point estimate ranges from 0.515 to 0.743. How does this compare with estimates of causal effects of family income during adolescence on eventual attainment? Drawing data from the New Jersey Negative Income Experiment (NIT), Mallar (1977) estimated that the 50 % increase in family income caused by the NIT treatment was associated with between one-third and one-half year more schooling. Assuming a 50 % increase in income, our 0.629 coefficient and its standard error would have predicted education increases of between 0.21 and 0.31 year, which are somewhat below Mallar's results. Akee et al. (2010) used revenue for tribal members generated from the opening of a casino to estimate that a $3,900 annual income increase (on an average base income of $20,919) caused statistically insignificant 0.38- and 0.12-year increases in educational attainment. Our 0.629 coefficient would have predicted that the income increase would lead to an attainment increase ranging between 0.07 to 0.58 more years. However, for families who were poor at least once prior to the casino transfers, the increased schooling was a statistically significant 1.13 years, which is obviously much higher than our coefficient would have predicted. For the never-poor, the outcome was a statistically insignificant 0.17-year decrease, which is lower than we would have predicted. These back-of-the-envelope calculations suggest that our income effect estimates are, if anything, conservative.

Summary

We used the 31-year time series in the PSID to examine the evolution of income-based disparities in children's completed schooling in the United States. In line with the Bailey and Dynarski (2011) analysis of college enrollment and graduation rates, and Reardon's (2011) analysis of test scores, we find that gaps in the completed schooling of children in the top and bottom quintiles of the family income distribution increased by approximately one-half year across the entire period, with virtually all the increase occurring in the second half of the period. Our goal was to account for these increased schooling gaps changes with changes in the quantities and coefficients of income, maternal education, family structure and size, and age of mother at the birth of the child.

Consistent with census data, both dollar and percentage gaps in the incomes of 14- to 16-year-old children in the top and bottom quintiles of the family income distribution grew sharply over the entire period; the gap in absolute income increased by $42,000. But other big-ticket demographic changes were taking place at the same time. Rates of two-parent family structure decreased more for low- than higher-income families. Even more striking are trends in the age of the mother when the child was born, which increased for higher-income families but decreased for low-income families.

Maternal schooling increased substantially for both groups, but at times it increased faster for low- than higher-income children. Sibship size fell for both groups as well, again more for low- than high-income children. Each of these demographic factors is correlated with child achievement, but because our purpose is to account for growth in the income-based disparities in children's completed schooling, it is apparent that these disparate trends would complicate our task.

Attempts to account for increasing schooling gaps with changing gaps in demographic measures require some sort of measure of the relative importance of the demographic measures in explaining children's schooling. Our regressions provided several surprises. First, two-parent family structure was only modestly associated with children's schooling. Second, income-based gaps in the age of mother at the birth of the child were surprisingly powerful in predicting income-based attainment gaps for children. Not surprisingly, family income and maternal education were the most powerful predictors of children attainment.

Our accounting exercise showed that for children who were adolescents between the late 1960s and late 1990s, increases in income inequality accounted for more of the attainment gaps trends than any other demographic predictor. In the case of completed schooling, income accounted for more than three-quarters of the increasing gaps in years of schooling between high- and low-income children. In the case of college attendance and graduation, income accounted for approximately one-half and one-quarter of the gaps, respectively. We found no consistent evidence that the importance of family income for children's schooling has increased over the past several decades.

Trend data such as our need to be interpreted cautiously. Changes in the labor market and growth in overall education attainment have changed the value and meaning of a high school, college, or post-bachelor's degree, which may have lessened the equity effect of

convergence in high school completion and increased the importance of rising gaps in bachelor's and post-bachelor's degree completion for future income inequality (Autor 2014). Moreover, our measures of college attainment fail to account for the selectivity of the colleges attended. We found increases in the income-based gap in college completion, but we do not know whether this has been reinforced by a concomitant increase in the gap in college quality. Longer-run data are needed to assess the degree to which increasing income inequality will drive increasing inequality in adult earnings, health, and family life.

In conclusion, our study highlights the factors most in need of tracking and most in need of causal assessment. The fact that income inequality plays so important a role in explaining rising income-based gaps in schooling underscores current efforts to understand this phenomenon with innovative methods, new kinds of data, and wide-ranging outcomes (e.g., Chetty et al. 2016). Our somewhat surprising finding about the importance of maternal age (above and beyond our ongoing concern for teen births) adds a new measure to a list of demographic factors to track in order to understand inequality. This finding may also point to the merit of identifying new means of increasing the age at first birth for low-income girls, especially given the potential effect of low-cost, scalable approaches for doing so (e.g., Kearney and Levine 2014).

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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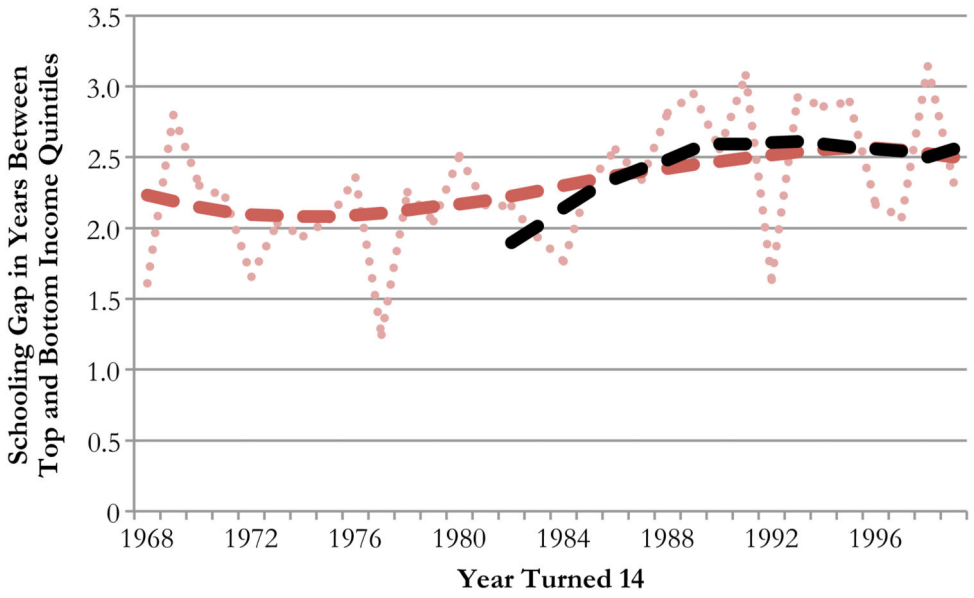

Fig. 1.

Top minus bottom income quintile differences in children's years of completed schooling: Panel Study of Income Dynamics. Dotted line shows gaps in years of completed schooling between children in the top and bottom quintiles of the income distribution for all PSID cohorts. Solid line shows lowess-based trends across all years of data; dashed line shows lowess-based trend for data in the second half of the period. Analyses in Table S1 (Online Resource 1) show that the gap in completed schooling rose between the first and second half of the period.

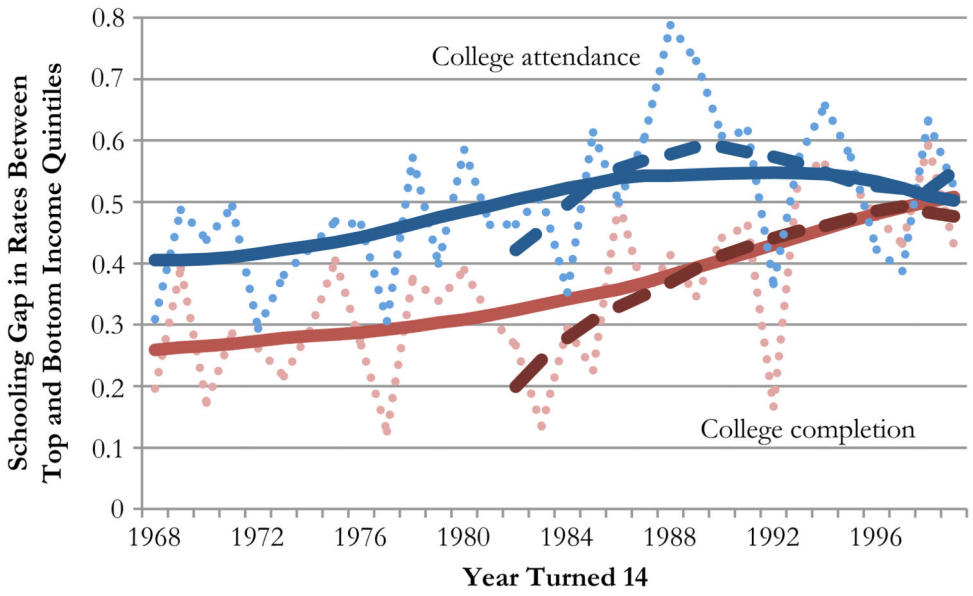

Fig. 2.

Top minus bottom income quintile differences in children's college attendance and completion rates: Panel Study of Income Dynamics. Dotted line shows gaps in college attendance (completion) between children in the top and bottom quintiles of the income distribution for all PSID cohorts. Solid line shows lowess-based trends across all years of data; dashed line shows lowess-based trend for data in the second half of the period. Analyses in Table S (Online Resource 1) show that the gap in college attendance and completion rose between the first and second half of the period

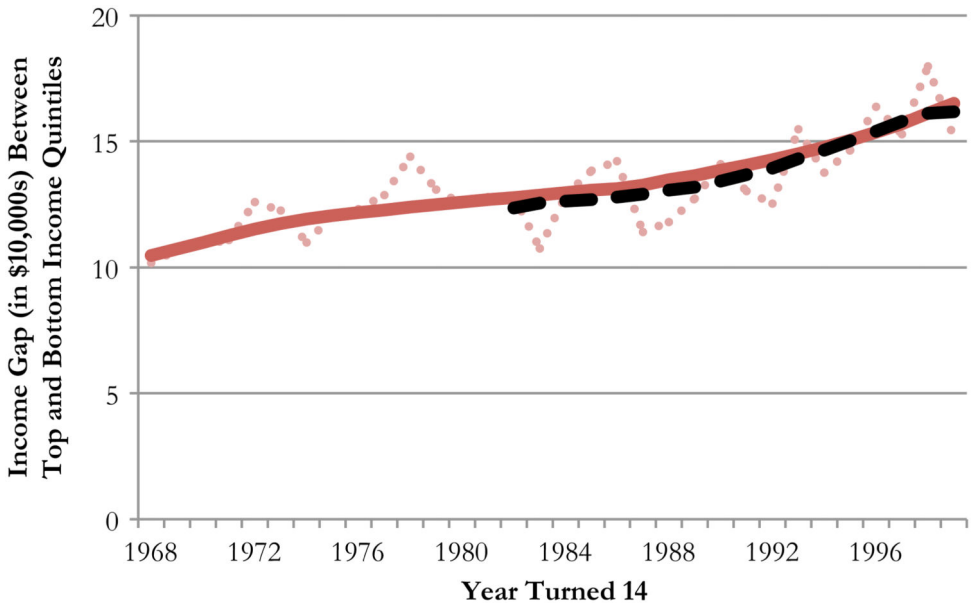

Fig. 3.

Top minus bottom income quintile differences in cohort-specific family income: Panel Study of Income Dynamics. Dotted line shows gaps in total family annual income between children in the top and bottom quintiles of the income distribution for all PSID cohorts. Solid line shows lowess-based trends across all years of data; dashed line shows lowess-based trend for data in the second half of the period. Analyses in Table S1 (Online Resource 1) show that the gap in total family income rose between the first and second half of the period

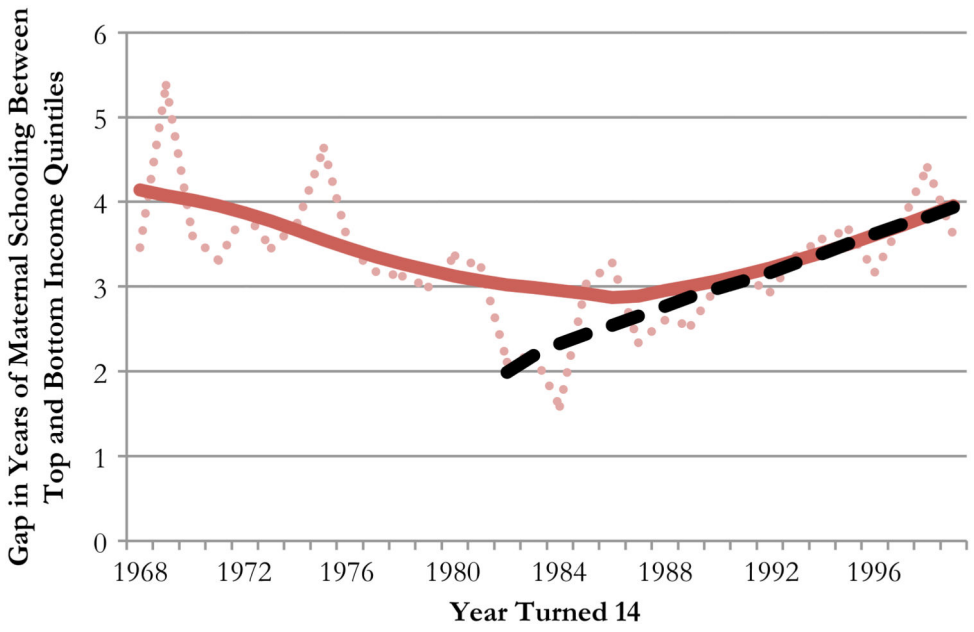

Fig. 4.

Top minus bottom income quintile differences in maternal education: Panel Study of Income Dynamics. Dotted line shows gaps in maternal education between children in the top and bottom quintiles of the income distribution for all PSID cohorts. Solid line shows lowess-based trends across all years of data; dashed line shows lowess-based trend for data in the second half of the period

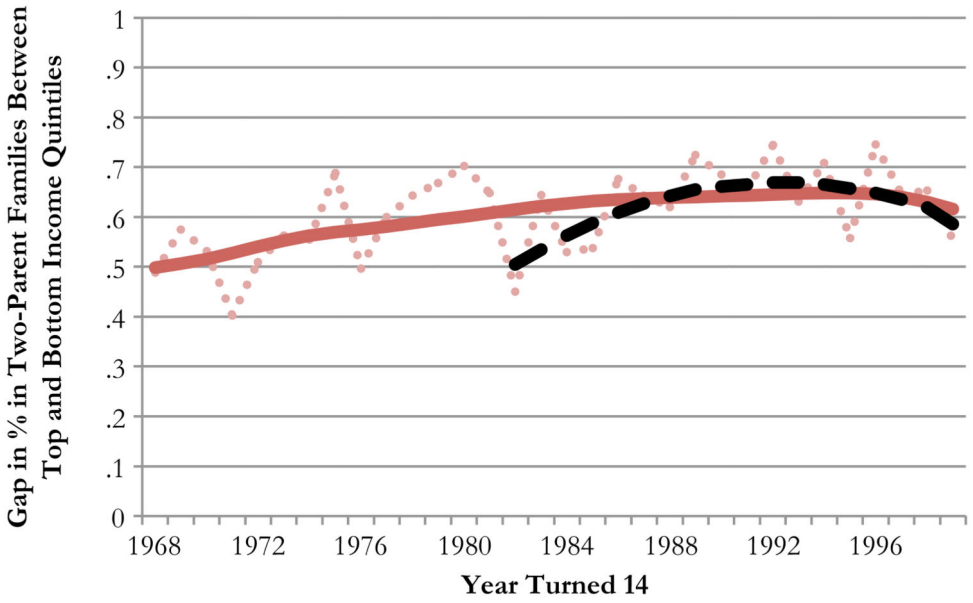

Fig. 5.

Top minus bottom income quintile differences in living with two parents: Panel Study of Income Dynamics. Dotted line shows gaps in living with two parents between children in the top and bottom quintiles of the income distribution for all PSID cohorts. Solid line shows lowess-based trends across all years of data; dashed line shows lowess-based trend for data in the second half of the period

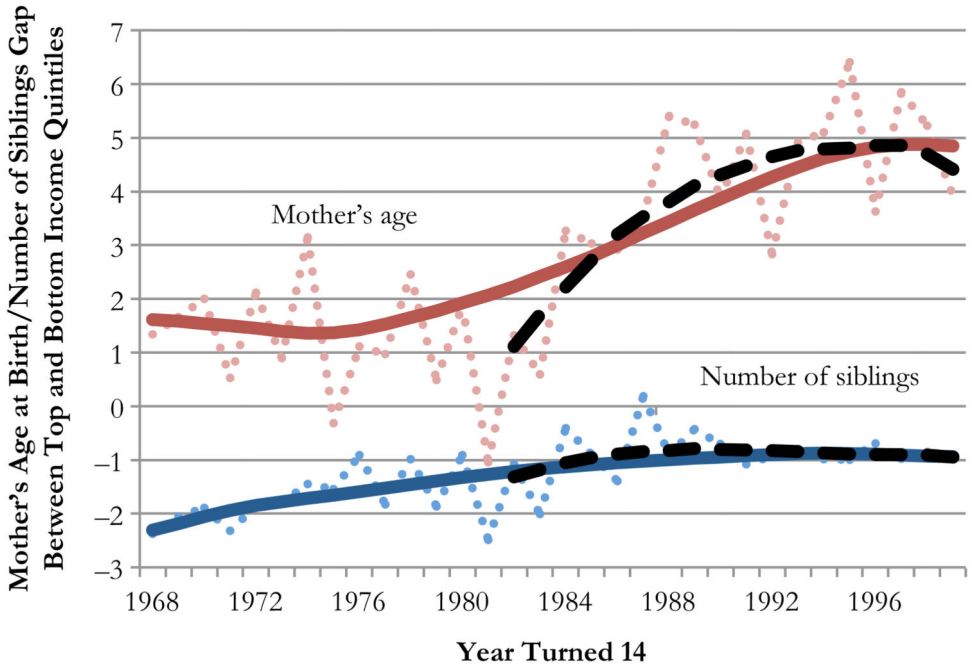

Fig. 6.

Top minus bottom income quintile differences in age of mother at birth and number of siblings: Panel Study of Income Dynamics. Dotted lines show gaps in mother's age at birth (top dotted line) and number of siblings (bottom dotted line) between children in the top and bottom quintiles of the income distribution for all PSID cohorts. Solid lines shows lowess-based trends across all years of data; dashed lines show lowess-based trend for data in the second half of the period

Table 1

Coefficients, standard errors, and standardized coefficients from regressions of children's completed schooling on family income and demographic measures

	Age 14 in 1968–1999	Age 14 in 1968–1981	Age 14 in 1982–1999	Coefficient Differences (first half / second half)	Age 14 in 1968–1973	Age 14 in 1980–1985	Age 14 in 1994–1999	Coefficient Differences (first six / last six years)
Natural Log Parent Income, Ages 14–16	0.629**(0.058) [β = 0.215]	0.700**(0.100) [β = 0.239]	0.625**(0.071) [β = 0.214]	$p = .535$	0.682**(0.169) [β = 0.234]	0.634**(0.121) [β = 0.217]	0.641**(0.102) [β = 0.219]	$p = .835$
Mother's Years of Education	0.226**(0.016) [β = 0.294]	0.198**(0.021) [β = 0.258]	0.239**(0.022) [β = 0.311]	$p = .182$	0.175**(0.030) [β = 0.228]	0.292**(0.038) [β = 0.380]	0.231**(0.033) [β = 0.301]	$p = 207$
Number of Siblings	−0.111**(0.022) [β = −0.116]	−0.126**(0.024) [β = −0.132]	0.007(0.037) [β = 0.007]	$P < .001$	−0.114**(0.030) [β = −0.120]	−0.051(0.050) [β = −0.053]	−0.023(0.056) [β = −0.024]	$p = .151$
Two-Parent Family (% of years, ages 14–16)	0.287*(0.082) [β = 0.060]	0.177(0.123) [β = 0.037]	0.379*(0.109) [β = −0.079]	$p = .218$	0.207(0.185) [β = 0.043]	0.185(0.176) [β = 0.039]	0.427*(0.169) [β = 0.089]	$p = .381$
Mother's Age at Birth	0.038**(0.008) [β = 0.106]	0.028*(0.012) [β = 0.078]	0.034*(0.012) [β = 0.095]	$p = .725$	0.022(0.018) [β = 0.061]	0.055*(0.023) [β = 0.154]	0.059*(0.021) [β = 0.167]	$p = .166$
Number of Observations	6,072	3,005	3,067		1,341	954	1,312	

Notes: Regressions are weighted using the PSID attrition-adjusted weight. Family-cluster-adjusted standard errors are shown in parentheses. Standardized coefficients are shown in brackets. All models include the following set of controls: (1) highest completed schooling of the mother when the child was 14 years old; (2) number of siblings born to the child's mother; (3) fraction of years between ages 14 and 16 that the child's household contained two biological parents; (4) age of the mother at the child's birth; (5) child's sex (female = 1); (6) race/ethnicity (black and Hispanic); (7) whether the child was the mother's firstborn (yes = 1); and (8) age of mother at her first birth.

* $p < .05$;

** $p < .01$

Table 2

Accounting for increases in the schooling gap between the top and bottom income quintiles with changes in the levels and effects of income and demographic measures

	Levels Effects: Last Minus First Six Years in Period (total increase in schooling gap is 0.43 years)			Levels Effects (robustness check): Last Minus Middle Six Years in Period (total increase in schooling gap is 0.55 years)			Value Effects: Last Minus First Six Years in Period (total increase in schooling gap is 0.43 years)		
	Change in Gap	Amount of Schooling Gap Accounted for	% of Changes in Attainment Gap Accounted for	Change in Gap	Amount of Gap Accounted for	% of Changes in Attainment Gap Accounted for	Change in Regression Coefficient (Table 1)	Average Gap in First Six Years	% of Changes in Attainment Gap Accounted for
Completed Schooling (years)	0.43			0.55					
ln Parent Income	0.50 **	0.31	73.1	0.20 **	0.13	22.7	−0.041	1.76	−16.8
Mother's Years of Education	−0.14 **	−0.03	−7.4	1.47 **	0.35	63.9	0.056	4.15	54.0
Number of Siblings	0.75 **	−0.08	−19.4	0.02 *	0.00	0.0	0.091	−1.52	−32.2
Two-Parent Family	0.14 **	0.04	9.5	0.17 **	0.07	11.9	0.220	0.49	25.2
Mother Age at Child's Birth	4.45 **	0.17	39.3	1.37 **	0.05	8.5	0.037	−0.50	−4.30

Notes: "Last Minus First Six Years" gap changes are weighted by the "All Cohorts" regression results shown in the first column of Table 1. "Last Minus Middle Six Years" gap changes are weighted by the "Age 14 in 1982-1999" regression results shown in the third column of Table 1. The *p* levels of changes in coefficients are shown in Table S3 (Online Resource 1).

* $p < .05$;

** $p < .01$

Table 3

Accounting for increases in gaps in college attendance and graduation between the top and bottom income quintiles with gap changes in income and demographic measures between 1968-1973 and 1994-1999

	College Attendance Gap (total increase is 15.3 percentage points)				College Graduation Gap (total increase is 24.9 percentage points)			
	Marginal Effects and Standard Errors From Logistic Regression	Change in Gap Last–First 6 Years	Amount of Schooling Gap Accounted for	% of Gap Accounted for	Marginal Effects and Standard Errors From Logistic Regression	Change in Gap Last–First 6 Years	Amount of Schooling Gap Accounted for	% of Gap Accounted for
ln Parent Income	0.148**(0.015)	0.50	0.07	48.5	0.107**(0.014)	0.50	0.05	21.6
Mother's Years of Education	0.053**(0.004)	−0.14	−0.01	−4.9	0.040**(0.004)	−0.14	−0.01	2.3
Number of Siblings	−0.024**(0.006)	0.75	−0.02	−12.0	−0.024**(0.005)	0.75	−0.02	−7.2
Two-Parent Family	0.038†(0.022)	0.14	0.01	3.6	0.086**(0.022)	0.14	0.01	4.9
Mother Age at Child's Birth	0.009**(0.002)	4.45	0.04	25.7	0.007**(0.002)	4.45	0.03	11.0

Notes: The two logistic regressions include controls for race/ethnicity, sex, firstborn status, and age of mother at first birth. Regressions are weighted using the PSID attrition-adjusted weight. Family-cluster-adjusted standard errors are shown in parentheses.

$^{\dagger}p < .10$;

$^{*}p < .05$;

$^{**}p < .01$