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Increasing Inequality in Parent Incomes and Children's Schooling

Greg J. Duncan
University of California-Irvine

Ariel Kalil
University of Chicago

Kathleen M. Ziol-Guest
New York University

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NON-TECHNICAL SUMMARY

Economic growth for much of the 20th century supported America's promise of offering opportunities to both parents and their children. In the thirty years between 1947 and 1977, a period in which gross national product per capita doubled, the incomes of families in the lowest income bracket nearly doubled as well. In contrast, the last 35 years have been marked by increasing income inequality, with stagnant incomes for families at the bottom of the distribution and sharp increases for those at the top of it.

What might be the implications of increasing income inequality for the educational attainment of children growing up in poor and affluent households? This paper examines children's attainment measured with years of completed schooling as well as college attendance and graduation. Specifically, we track changes in income inequality and educational attainment between children born into low- and high-income households in the U.S. between 1954 and 1985. Our data comes from a single source– the U.S. Panel Study of Income Dynamics (PSID) – which (1) provides consistent, high-quality measures of income, (2) enables us to link family income in adolescence to schooling completed a decade later, and (3) supplies measures of important family demographic conditions.

Our primary goal is to attempt to account for the increase in the attainment gap with changing gaps in family income as well as other demographic factors (increasing mother's education, and falling family sizes, two-parent family structure, and mother's age at birth). Across all 31 birth cohorts, we find that increases in the income gap between high- and low-income children account for about three-quarters of the increasing gap in completed schooling, 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 small. On the other hand, increasing gaps in the age of mother at the time of birth accounts for a substantial portion of the increasing schooling gap because mother's age is consistently predictive of children's completed schooling.

ABOUT THE AUTHORS

Greg J. Duncan is Distinguished Professor in the School of Education at the University of California, Irvine. His recent work has focused on the effects of increasing income inequality on schools and children's life chances. Duncan was President of the Population Association of America in 2008 and the Society for Research in Child Development between 2009 and 2011. He was elected to the National Academy of Sciences in 2010. Email: gduncan@uci.edu

Ariel Kalil is Professor in the Harris School of Public Policy Studies at the University of Chicago. At Chicago Harris, she directs the Center for Human Potential and Public Policy and co-directs the Behavioral Insights and Parenting Lab. She is a developmental psychologist who studies economic conditions, parenting, and child development. Her current research examines the historical evolution of income-based gaps in parenting behavior and children's cognitive and non-cognitive skills. Email: a-kalil@uchicago.edu

Kathleen M. Ziol-Guest is Research Associate Professor in Steinhardt School of Culture, Education, and Human Development at New York University (NYU) and Project Director for the Early Childhood Meta-Analysis Project in the Metropolitan Center for Research on Equity and the Transformation of Schools. She is a policy analyst who studies the demographic characteristics and socioeconomic environments of children and families. Email: kmz204@nyu.edu

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lifecoursecentre

(ARC Centre of Excellence for Children and Families over the Life Course)
Institute for Social Science Research, The University of Queensland
St Lucia, Qld 4072, Telephone: +61 7 334 **67477**
Email: lcc@uq.edu.au, Web: www.lifecoursecentre.org.au

Abstract

Both 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 paper 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 school attainment 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 about three-quarters of the increasing gap in completed schooling, 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 small. On the other hand, increasing gaps in the age of mother at the time of birth accounts for a substantial portion of the increasing schooling gap because mother's age is consistently predictive of children's completed schooling.

Keywords: income inequality, educational attainment, Panel Study of Income Dynamics, family background

Increasing Inequality in Parent Incomes and Children's Schooling

Economic growth for much of the 20th century supported America's promise of offering opportunities to both parents and their children. In the thirty years between 1947 and 1977, a period in which gross national product per capita doubled, the incomes of families in the lowest income bracket nearly doubled as well.[1] In contrast, as documented in countless studies, the last 35 years have been marked by increasing income inequality, with stagnant incomes for families at the bottom of the distribution and sharp increases for those at the top of it.

Reardon (2011) explores the implications of this increasing income inequality for test score gaps between high and low income students. He finds that these gaps grew sharply, but also several reasons to doubt that the increasing gaps in income and test scores are causally linked. This paper shifts the focus from achievement to attainment, 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 U.S. 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 – 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 attainment gaps have grown, although not by as much as what Reardon (2011) found for achievement gaps.

Our primary goal is to account for the increase in the schooling gap with changing gaps in family income and other demographic factors (increasing mother's education, and falling family sizes, two-parent family structure, and mother's age at birth). We also estimate changes in the relative importance of income and these other demographic factors for 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) present a conceptual model of how increasing family income inequality may affect access to high-quality child care, 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 high- and low-income families can spend on enrichment goods and services for their children (Kornrich and Furstenberg, 2012).

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). This can reduce interactions between

[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.

rich and poor in schools, in child-care centers, in libraries, and in grocery stores. Without the financial and human resources and political clout of the wealthy, institutions in 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 child care, 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 (2012) show that spending on child-enrichment goods and services jumped for families in the top quintiles but increased much less – in both absolute and relative 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 about $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.

Changes in participation in extracurricular activities between 1972 and 2004 also favored more advantaged youth (Putnam, Frederick, & Snellman, 2012). Belley and Lochner (2007) compare the two cohorts of the NLSY (79 and 97) to show that high family income has become a substantially more important determinant of college attendance and college quality (but not high school completion) in recent years, particularly for those youth with the lowest skills. This, they argue, is consistent with the hypothesis that more youth are borrowing constrained today (given, e.g., rising tuition costs and falling Pell Grant offerings) than they were in the early 1980s.

In a related vein, Hurst (2010) shows 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 weekly hours in childcare in 1985 (compared to 16.2 hours for less-educated households), the two figures in 2003 were 25.6 and 18.9, respectively. Altintas (2012) further shows 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 actual attainments.

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 proportion of children living with two married parents dropped from 85 percent in 1960 to 69 percent in 2002 to 64 percent in 2012 (Vespa, Lewis, & Krieder, 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 about 90%. In contrast, the share of children living with mothers who lacked a high school degree who were married decreased from about 73% to about 66% (Stykes & Williams, 2013).

Children growing up in two biological, married parent families 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, Craigie, and Brooks-Gunn 2010), in stepparent families (Coleman, Ganong, and Fine 2000), and with cohabiting or never-married single parents (Waldfogel et al., 2010; Osborne and McLanahan 2007). This is due in large part to the greater economic well-being and higher levels of parental time investment in children in two biological parent households (Kalil, Ryan, & Chor, 2014). Other studies of family structure have focused on growing up with a single parent and have found 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 have attributed this reverse gender gap to boys' lower levels of non-cognitive 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.

At the same time, other demographic trends in the US have changed in ways that may have partially offset the adverse impacts of rising income inequality. In particular, women's education levels have risen, they have increasingly delayed childbearing, and families have gotten smaller (Cherlin, 2005). With respect to education, undergraduate enrollment grew rapidly in the 1970's, especially for women. Correspondingly, the share of women age 25–34 with at least a college degree has more than tripled since 1968, from about 11 percent to about 35 percent (White House Council on Women and Girls, 2011).

These trends are important because maternal education has a positive impact on children's development (Carneiro, Meghir, & Parey, 2013). One reason is that 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, Ryan, & Corey, 2012), produce more cognitively stimulating home learning environments (Harris, Terrel & Allen, 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). 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).

Trends in maternal age at first birth have also changed in important ways. On one hand, the average age at first birth for all mothers increased 3.6 years from 1970 to 2006, from 21.4 to 25.0 years (Matthews and Hamilton, 2009). And, births to teenagers have been declining steadily over the past 50 years and have now reached historic lows in the U.S. (Martin, Hamilton, Ventura 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, Lee, Kalil, & Ziol-Guest, 2014). 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 (Francesconi, 2007; Angrist & Lavy, 1996; Hoffman, 2008).

Finally, families with large numbers of children have become less common, with a drop in the proportion of families containing four or more children from seventeen percent in 1970 to six percent 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 – maternal schooling, two-parent family structure, maternal age at birth, 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- vs. low-income families and the factors themselves have important associations with child outcomes.

How has children's educational performance changed over time?

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) documents 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 (10^{th} income percentile) children lagged behind those of their better-off (90^{th} income percentile) peers by a little over half a standard deviation, or about 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 (Reardon, 2011; Magnuson & Waldfogel, 2008).

Reardon (2011) explores several possible explanations for the increasing income-based test-score gap. He fails to find evidence that the growing income-achievement gap results from a growing achievement gap between children with highly and less-educated parents. But he also presents evidence that casts 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 he does 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. Nor do trends in high-end income and test score gaps coincide. Moreover, he finds evidence that the gap has grown at least in part from the growing importance of income for children's achievement.

Using data from the 1979 and 1997 National Longitudinal Surveys of Youth, Bailey and Dynarski (2011) show 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 thirty-nine to fifty-one percentage points. With respect to college completion, the top-income quartile gained eighteen percentage points (from 36 to 54 percent) but the bottom quartile rose only slightly to nine from five percent. 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 which casts some doubt on traditional explanations linking rising income inequality to rising gaps in attainments, though it is possible, as Bertrand and Pan (2013) show, that boys and girls respond differently to the same family circumstances.

The goal of the present paper 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-long period, the latter half of which spans the NLSY and NLS97 cohorts. In doing so, we add 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.

METHOD

Data

We use data spanning 31 cohorts born between 1954 and 1985 from the Panel Study of Income Dynamics (PSID; http://psidonline.isr.umich.edu). The PSID has 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 non-missing data on completed schooling around age 24. We adjust for differential non-response by using the PSID's attrition-adjusted weights in all of 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 through 2009). This measure has a value between one and 17, where one through 16 represents the highest grade or year of school completed. The PSID assigns a value of 17 for those who report at least some post-graduate work. We also use this completed schooling measure to define dichotomous indicators of: i) attending college (defined as 13+ years of schooling) and ii) completing college (16+ years).[2]

Childhood income

We created a measure of average annual household income across the three calendar years when the child was 14-16 years old. We used the PSID's high-quality edited measure of annual total family income (pre-tax), 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 were inflated to 2010 levels using the U.S.

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[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 24 was 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 is 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.

consumer price index. Finally, income was 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. But 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 impact 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: highest completed schooling of the mother when the child was 14 years old; number of siblings born to the child's mother; fraction of years between ages 14 and 16 that the child's household contained two biological parents; age of the mother at the child's birth; child sex (female=1), race/ethnicity (Black and Hispanic), whether the child was the mother's first born (yes=1), and age of mother at her first birth. We run OLS regressions using STATA 13.0 MP and cluster standard errors at the family level. All analyses were weighted using the PSID-provided attrition-adjusted weight.

RESULTS

Simple trends

After establishing reasonable comparability between the PSID with other data sources (see supplemental appendix), we estimated trends in our key dependent variable – children's completed schooling. In Figure 1 (and detailed in Appendix Table 1), 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 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 half (.43) a year by the end of the period. Most of this increase occurred in the second half of the period – roughly the time covered in the Bailey and Dynarski (2011) study. A similar pattern emerges for college graduate rates (Figure 2a). In the case of college attendance, most of the gap increase occurred in the first half of the period (Figure 2b).

[Figures 1 and 2 about here]

Both absolute and relative income gaps grew as well (Figures 3a and 3b). 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 had grown to about $165,000 by the last year (Figure 3a). About one-third of this increase occurred between the beginning and middle of our 31-year period. In the case of log income, a little more than half of the increase had occurred between the beginning and middle of the period. 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, while at the same time income gaps were increasing.[3]

[Figure 3 about here]

Other large demographic changes were taking place as well, some of which favored high-income children and others favored low-income children. Trends in maternal education over the first half of the period and in family size across the whole period favored low-income children Figure 4a). As shown in Appendix Table 1, maternal schooling levels for higher income children increased modestly across the first half of the period. Maternal schooling levels for low-income children start much lower but increased more rapidly. These trends were reversed in the second half of the period. And while family sizes are larger for low- relative to high-income families, the gap narrowed between the beginning and end of the period (Figure 4b).

[Figure 4 about here]

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 about 42% between ages 14 and 16. This decreased to 28% 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 (Figure 4c).

Gaps in mothers' age at birth between low and high-income families increased as well. 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). These reinforcing trends produced a sharp increase in gaps in mother's age – from about 1.5 years early in the period to nearly 5 years at the end (Figure 4d).

Regression results

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 Appendix Table 2.

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[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 in the paper.

Our schooling regressions are straightforward, using children's years of completed schooling as the dependent variable and, as independent variables: income, family structure and size (all averaged across ages 14-16), mother's age at the birth of the child, plus mother's schooling, race (and Hispanic status), and child gender and parity. We adjust standard errors to account for within-family clustering of siblings. Although our demographic regressions cannot isolate the causal impacts 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 Appendix Table 3. The first column of Table 1 presents regression results when all 31 cohorts are pooled together. Both raw-score and, in brackets, standardized coefficients are shown.

[Table 1 about here]

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 .63 year increase in children's schooling, while each additional year of mother's schooling is associated with a .23 year schooling increase for their children. Standardizing these coefficients by multiplying by their 31-year standard deviations produces respective coefficients of .22 and .29. Additional siblings are associated with less schooling while more time spent with two biological parents 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) suggests, 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.[4]

The second and third columns of Table 1 and Figure 5 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 increase in the explanatory power of family income; in fact, point estimates show a small decline in the raw score coefficients and (as depicted in Figure 10) 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.

[Figure 5 about here]

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[4] 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.

We estimated models in which the year the child turned age 14 (centered in 1984) was interacted with log income and other demographic measures in our model (second column of Appendix Table 4). Only in the case of number of siblings is there a statistically significant trend, which in this case is toward less of a negative impact.

Accounting for change

A standard decomposition analysis of the links between income and 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 completed schooling. It is clear from Table 1 that, at least according to the estimates coming from our demographic regressions fit to data from the PSID, parent income has not become more predictive of children's completed schooling over the past 31 years. As a result, we confine our accounting exercise to the first half of the decomposition approach, and use the first and last six year period 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, which very roughly coincides with the period over which family income inequality has increased the most. The left 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. Over that time, the schooling gap between children in the top and bottom quintiles of the family income distribution increased by .43 years. The gap in log average family income increased by .50. When valued by the .629 coefficient from the "All cohorts" regression in Table 1, the increasing income gap accounts for .31 years of the schooling gap, which is about 73% of the raw .43-year gap.

[Table 2 about here]

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 Figure 4d that the income-based gap in the age of the mother at the time the child was born increased sharply over the period. Moreover, age of mother was a quite 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 penalty for completed schooling for children was very small, leading family structure changes to account for only about one-tenth of the increasing schooling gap. Gaps in maternal schooling changed little 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.

Changes since the early 1980s. As a robustness check, we estimated our accounting model across the period most associated with increasing income inequality, using the middle (age 14 in 1980-85) and final (age 14 in 1994-99) six-year cohorts. This is a period over which children's schooling gaps increased markedly (by half a year; Figure 1 and Appendix Table 1), as did gaps favoring high-income children in parent income, family structure, maternal schooling, and age of mother (Figures 2-4 and Appendix Table 1). 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 3, is quite different. Increasing income gaps are not nearly as dominant as before, accounting for about one-quarter of the increases in the schooling gap.

A look back to the trends in Figures 1 to 4 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. This means that there is as much change in the income-based children's schooling gap as before. Income equality increased in a roughly linear way, which means that changes in the income-based gap between low- and high-income children account for only about 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 schooling gap in the second half of the PSID period increases rather than decreases (Figure 4d). 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. To estimate the contributions of income and other demographic factors, we ran logistic regressions on all 31 cohorts and obtained the results listed in Appendix Table 5. Patterns of significance are similar to those obtained in our regressions for years of completed schools: 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. But the fraction of the gap accounted by income is less – about 50% in the case of college attendance and 20% in the case of college completion.

How robust are our regression estimates?

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 step-siblings 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 Appendix Table 4, the coefficients change very little. Family structure itself can be measured in many ways (McLanahan and Perchesky, 2007). 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 actual years 1972, 1993, 1994, 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 Appendix Table 4, the income coefficient decreases slightly, from .658 to .633. Adding food stamp income increases that coefficient further, to .678. 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 Appendix Table 4 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 non-Blacks than Blacks. Given the Betrand and Pan (2012) 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 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.

Appendix Table 5 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 half, from 1.183 to .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 .63 to .83. Here again it does not appear that our income estimates in our main analysis are 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 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), it appears that adolescent income matters the most, early-childhood income is next most important, and that 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 .629 year increase in completed schooling. The 95% confidence interval around that point estimate ranges from .515 to .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, Mallar (1977) estimated that the 50% increase in family income caused by the NIT treatment was associated with between one-third and one-half years more schooling. Assuming a 50% increase in income, our .629 coefficient and its standard error would have predicted education increases of between .21 and .31 years, which are somewhat below Mallar's results. Akee et al. (2011) use 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 .38- and .12-year increases in educational attainment. Our .629 coefficient would have predicted that the income increase would have led to an attainment increase ranging between .07 to .58 more years. However, for families 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 increase was a statistically insignificant .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 have used the 31-year time series in the Panel Study of Income Dynamics 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 about half a year across the entire period, with virtually all of 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, gaps in both the absolute and relative incomes of 14-16 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 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 since 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 requires 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. And second, income-based gaps in the age of mother at the birth of the child turned out to be surprisingly powerful in predicting income-based attainment gaps for children. Not surprisingly, family income and maternal education turned out to be the most powerful predictors of children attainment.

Our accounting exercise showed that, using 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 about 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.

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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		Age 14 in 1968-1973	Age 14 in 1980-1985	Age 14 in 1994-1999
Natural log parent income, age 14-16	.629*** (.058) [β= .215]	.700*** (.100) [β=.239]	.625*** (.071) [β=.214]	*p* = .535	.682*** (.169) [β=.234]	.634*** (.121) [β=.217]	.641*** (.102) [β=.219]
Mother's years of education	.226*** (.016) [β=.294]	.198*** (.021) [β=.258]	.239*** (.022) [β=.311]	*p* = .182	.175*** (.030) [β=.228]	.292*** (.038) [β=.380]	.231*** (.033) [β=.301]
Number of siblings	-.111*** (.022) [β=-.116]	-.126*** (.024) [β=-.132]	.007 (.037) [β=.007]	*p* < .001	-.114*** (.030) [β=-.120]	-.051 (.050) [β=-.053]	-.023 (.056) [β=-.024]
Two parent family (% of years, age 14-16)	.287** (.082) [β=.060]	.177 (.123) [β=.037]	.379** (.109) [β=-.079]	*p* = .218	.207 (.185) [β=.043]	.185 (.176) [β=.039]	.427** (.169) [β=.089]
Mother's age at birth	.038*** (.008) [β=.106]	.028** (.012) [β=.078]	.034** (.012) [β=.095]	*p* = .725	.022 (.018) [β=.061]	.055** (.023) [β=.154]	.059** (.021) [β=.167]
Other controls	incl.	incl.	incl.		incl.	incl.	incl.
Number of observations	6,072	3,005	3,067		1,341	954	1,312

Regressions are weighted using the PSID attrition-adjusted weight. Family-cluster-adjusted standard errors are given in parentheses. Standardized coefficients are given in brackets.
***p<.01; **p<.05; *p<.10

Table 2: Accounting for increases in the schooling gap between the top and bottom income quintiles with mean changes in income and demographic measures

	Last minus first six years in period (total increase in schooling gap is .43 years)			Last minus middle six years in period (total increase in schooling gap is .55 years)			Second minus first half (total increase in schooling gap is .38 years)		
	Change in gap	Amount of schooling gap accounted for	Percent of gap accounted for	Change in gap	Amount of gap accounted for	Percent of gap accounted for	Change in gap	Amount of gap accounted for	Percent of gap accounted for
Completed schooling	0.43 years			0.55 years			.38 years		
ln parent income	0.50	0.31	73.1%	0.20	0.13	22.7%	0.33	0.21	54.6%
Mother's years of education	-0.14	-0.03	-7.4%	1.47	0.35	63.9%	-0.22	-0.05	-13.1%
Number of siblings	0.75	-0.08	-19.4%	0.02	0.00	0.0%	0.60	-0.07	-17.5%
Two parent family	0.14	0.04	9.5%	0.17	0.07	11.9%	0.12	0.03	9.1%
Mother age at child's birth	4.45	0.17	39.3%	1.37	0.05	8.5%	3.12	0.12	31.2%

Note: "Last minus first six years" and "Second minus first half" gap changes are weighted by the "all cohorts" regression results shown in the first column of Table 2. "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 2.

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 1968-73 and 1994-99

	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–1st 6 yrs	Amount of schooling gap accounted for	Percent of gap account ed for	Marginal effects and standard errors from logistic regression	Change in gap last–1st 6 yrs	Amount of schooling gap accounted for	Percent 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%	.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%

Note: 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 given in parentheses.
***p<.01; **p<.05; *p<.10.

Supplemental materials for: **Increasing Inequality in Parent Incomes and Children's Schooling**

Comparability of PSID, CPS and NLSY. We sought to compare PSID information on income and schooling with Census data and data taken from the two youth cohorts in the National Longitudinal Studies of Youth. Appendix Figure 1 shows 10th, 50th and 90th percentiles of the distribution of child-based family income between 1968 and 1999 taken from the Current Population Survey.[5] Both sets of time series are child-based, although the CPS data are drawn from children of all ages, whereas PSID children were all age 14 at the time of the income measurement. Another difference is that we average trios of consecutive years in the PSID to remove some of income's transitory error, and we center each of the 3-year averages on the middle years. In all cases, the income figures are inflated to 2010 dollars using the CPI.

Note first in Appendix Figure 1 that a child-based calculation of income trends in the Current Population Survey (and PSID) shows that the income gaps between the top and bottom of the income distribution were already increasing in the early 1970s, well before the point nearly 10 years later that marks the beginning of most accounts of the inequality increase. This has implications for how we think about using PSID cohorts to examine periods of increasing income inequality.

Turning to the comparative time series, Appendix Figure 1 show that incomes at all three points in the income distributions are higher in the PSID than CPS, which results in part from the older age of the PSID sample (all are age 14) relative to the CPS sample (children of all ages) and the fact that the PSID has always accounted for more aggregate income than the CPS (Fitzgerald et al., 1998). Our interest is in how well the two sets of time series track one another, particularly at the low and high ends of the income distribution. That appears to be the case, with the correlation between the two 90th percentile series at .78 and the 10th percentile correlation at .89. At .60, the correlation between the two time series of median income is somewhat lower.

Bailey and Dynarski (2011) present time series information on the relationship between childhood income and college completion. They use data from the NLSY79 and NLS97 to compare children in the top and bottom quartiles of the income distribution. They select children who began in these two studies between the ages of 14 and 19 and use parent family income measured in the first study year. They then measure completed schooling as of age 25. As described above, our PSID analysis tracks average income between ages 14 and 16 and completed schooling at age 24, which provides roughly comparable data on completed schooling by income. In both cases we measure college graduation rates.

Data from the two studies are shown in Appendix Figure 2. As might be expected from the fact that our use of 3-year average income quartiles likely excludes youth with transitory residence in the top and bottom income quintiles, PSID college graduation rates are a bit higher in the top quartile and lower in the bottom quartile than in the two NLS datasets. The striking increase in graduation rates for top-quartile youth tracks closely in the two data sources. For bottom quartile youth, the PSID's rates are somewhat flatter the NLS's. The PSID's failure to include low-income but high-achieving immigrants in its sample design may account for some of

[5] Sean Reardon kindly supplied us with the CPS data.

this difference.[6] Changes in the income-based gaps in college graduation are very similar in the two studies – 18 percentage points in the NLSYs and 17 percentage points in the PSID.

The top panel of Appendix Table 1 shows correlations among the 31-cohort average values of children's schooling and the five key demographic measures in our analysis. Maternal education and income have the highest correlations with children's schooling. Among the family demographic measures, income and two-parent family structure are most highly correlated (r= -.447). The bottom panel shows that these correlations are broadly similar to those calculated over the most recent cohorts. An exception is that most of the correlations involving age of mother at the birth of the child have become stronger.

[6] Apart from marriage between immigrants and nonimmigrants (and the 1997 addition of an immigrant cohort), the PSID has no mechanism for adding immigrants to its sample. Since both the NLSY79 and the NLS97 drew fresh dwelling-based samples of youth, their samples should include immigrants in the population at the time the samples were drawn. Given the generally lower college-graduation rates for immigrants, this ought to lead the NLS-based samples to show less of an increase in graduation rates than the PSID. On the other hand, the intergenerational trust built up by the PSID with its repeated contacts since 1968 might lead to higher response rates among highly disadvantaged youth, which would lead the PSID to show less of an increase in college graduation rates. Another possible source of difference is the age at which completed schooling is measured – 25 in the NLS and 24 in the PSID. Given the considerable schooling undertaken by low-income women in their 20s, the younger age may reduce completed schooling in the PSID relative to the NLS.

Appendix Table 1: Means and standard deviations for variables used in the analysis, by year turned age 14

	All cohorts		First /second half of period				First /middle/last six years of period			
			Age 14 in 1968-1981	Age 14 in 1982-1999	p level of difference		Age 14 in 1968-1973	Age 14 in 1980-1985	Age 14 in 1994-1999	p level of difference
Child's years of completed schooling										
All	13.20 (2.03)		12.92 (2.03)	13.45 (1.99)	$p < .001$		12.79 (1.96)	13.07 (2.03)	13.70 (2.02)	$p < .001$
Bottom quintile	11.88 (1.65)		11.67 (1.64)	12.00 (1.65)	$p < .001$		11.44 (1.92)	11.74 (1.75)	12.21 (1.66)	$p < .001$
2nd quintile	12.41 (1.79)		11.83 (1.74)	12.74 (1.73)	$p < .001$		11.61 (1.69)	12.50 (2.02)	12.65 (1.66)	$p < .001$
3rd quintile	12.92 (1.84)		12.64 (1.81)	13.19 (1.84)	$p < .001$		12.55 (1.88)	12.80 (1.81)	13.43 (1.85)	$p < .001$
4th quintile	13.37 (1.88)		12.91 (1.78)	13.85 (1.86)	$p < .001$		12.65 (1.61)	13.40 (2.87)	14.25 (1.87)	$p < .001$
Top quintile	14.21 (1.99)		13.87 (2.09)	14.58 (1.81)	$p < .001$		13.76 (1.92)	13.94 (1.95)	14.96 (1.70)	$p < .001$
Top minus bottom quintile	2.33 (.08)		2.20 (.13)	2.58 (.11)	$p < .05$		2.32 (.20)	2.20 (.21)	2.75 (.13)	
Child's college attendance (%)										
All	48.69 (---)		41.71 (---)	54.80 (---)	$p < .001$		40.09 (---)	46.40 (---)	58.77 (---)	$p < .001$
Bottom quintile	20.28 (---)		16.33 (---)	22.52 (---)	$p = .099$		20.31 (---)	17.00 (---)	26.27 (---)	$p < .05$
2nd quintile	31.95 (---)		20.55 (---)	38.48 (---)	$p < .001$		17.83 (---)	34.43 (---)	36.51 (---)	$p < .001$
3rd quintile	42.06 (---)		33.15 (---)	50.45 (---)	$p < .001$		32.95 (---)	36.90 (---)	55.65 (---)	$p < .001$

4th quintile	51.92 (---)		39.66 (---)	64.70 (---)	*p* < .001		34.01 (---)	54.34 (---)	71.33 (---)	*p* < .001
Top quintile	70.84 (---)		63.99 (---)	78.10 (---)	*p* < .001		61.97 (---)	66.87 (---)	83.33 (---)	*p* < .001
Top minus bottom quintile	50.56 (---)		47.66 (---)	55.58 (---)	*p* < .001		41.66 (---)	49.87 (---)	57.06 (---)	
Child's college graduation (%)										
All	22.42 (---)		18.78 (---)	25.61 (---)	*p* < .001		16.47 (---)	20.36 (---)	31.32 (---)	*p* < .001
Bottom quintile	3.95 (---)		3.02 (---)	4.48 (---)	*p* = .392		1.85 (---)	6.16 (---)	4.98 (---)	*p* = .137
2nd quintile	8.82 (---)		4.68 (---)	11.19 (---)	*p* < .01		5.05 (---)	12.35 (---)	9.90 (---)	*p* < .05
3rd quintile	15.32 (---)		13.00 (---)	17.52 (---)	*p* = .092		12.70 (---)	14.35 (---)	22.01 (---)	*p* < .05
4th quintile	22.92 (---)		15.36 (---)	30.80 (---)	*p* < .001		11.29 (---)	21.78 (---)	40.79 (---)	*p* < .001
Top quintile	41.49 (---)		35.03 (---)	48.36 (---)	*p* < .001		30.59 (---)	34.54 (---)	58.67 (---)	*p* < .001
Top minus bottom quintile	37.54 (---)		32.01 (---)	43.88 (---)	*p* < .001		28.74 (---)	28.38 (---)	53.69 (---)	
Parent income (average, age 14-16, in 10,000s of 2010$)										
All	8.71 (5.45)		8.86 (5.03)	8.58 (5.78)	*p* < .05		8.65 (4.76)	8.24 (5.49)	9.05 (6.43)	*p* < .01
Bottom quintile	2.00 (.70)		2.23 (.58)	1.87 (.73)	*p* < .001		2.34 (.52)	1.97 (.68)	1.93 (.73)	*p* < .001
2nd quintile	4.11 (.69)		4.09 (.61)	4.12 (.74)	*p* = .491		3.95 (.54)	3.96 (.70)	3.97 (.66)	*p* = .973

3rd quintile	6.28 (.83)		6.11 (.79)	6.43 (.84)	$p < .001$		5.91 (.74)	5.89 (.74)	6.47 (.88)	$p < .001$
4th quintile	8.92 (1.19)		8.59 (1.14)	9.27 (1.15)	$p < .001$		8.19 (.99)	8.44 (1.07)	9.57 (1.20)	$p < .001$
Top quintile	15.32 (4.77)		14.48 (4.42)	16.22 (4.96)	$p < .001$		13.79 (4.45)	15.08 (5.11)	17.64 (5.17)	$p < .001$
Top minus bottom quintile	13.32 (.12)		12.25 (.18)	14.35 (.16)	$p < .001$		11.46 (.29)	13.11 (.31)	15.71 (.25)	
Parent income (average, age 14-16, in natural log)										
All	1.96 (.69)		2.02 (.61)	1.90 (.76)	$p < .001$		2.01 (.56)	1.89 (.71)	1.93 (.79)	$p < .001$
Bottom quintile	.62 (.41)		.76 (.30)	.54 (.44)	$p < .001$		.82 (.25)	.61 (.40)	.57 (.43)	$p < .001$
2nd quintile	1.40 (.17)		1.40 (.15)	1.40 (.19)	$p = .894$		1.37 (.14)	1.36 (.18)	1.36 (.17)	$p = .948$
3rd quintile	1.83 (.13)		1.80 (.13)	1.85 (.13)	$p < .001$		1.77 (.13)	1.77 (.12)	1.86 (.14)	$p < .001$
4th quintile	2.18 (.13)		2.14 (.13)	2.22 (.12)	$p < .001$		2.10 (.12)	2.13 (.13)	2.25 (.13)	$p < .001$
Top quintile	2.69 (.28)		2.63 (.27)	2.74 (.28)	$p < .001$		2.58 (.27)	2.67 (.30)	2.83 (.28)	$p < .001$
Top minus bottom quintile	2.07 (.01)		1.87 (.01)	2.20 (.01)	$p < .001$		1.76 (.02)	2.06 (.03)	2.26 (.02)	
Mother's years of education										
All	12.17 (2.63)		11.58 (2.71)	12.69 (2.45)	$p < .001$		11.32 (2.89)	12.07 (2.14)	12.99 (2.66)	$p < .001$
Bottom quintile	10.34 (2.64)		9.42 (2.98)	10.86 (2.26)	$p < .001$		8.59 (3.17)	10.48 (2.32)	10.90 (2.54)	$p < .001$

2nd quintile	11.15 (2.63)		10.02 (2.70)	11.80 (2.36)	$p < .001$		9.51 (2.59)	11.54 (3.27)	11.52 (2.60)	$p < .001$
3rd quintile	11.78 (2.44)		10.99 (2.43)	12.52 (2.21)	$p < .001$		10.55 (2.61)	11.91 (1.88)	12.70 (2.30)	$p < .001$
4th quintile	12.40 (2.16)		11.84 (2.18)	12.98 (1.99)	$p < .001$		11.67 (2.37)	12.31 (1.75)	13.47 (2.03)	$p < .001$
Top quintile	13.51 (2.36)		12.92 (2.38)	14.14 (2.18)	$p < .001$		12.74 (2.54)	13.02 (1.90)	14.91 (1.87)	$p < .001$
Top minus bottom quintile	3.17 (.75)		3.50 (.67)	3.28 (.71)	$p < .001$		4.15 (.76)	2.54 (.67)	4.01 (.38)	
Number of siblings	2.73 (2.12)		3.51 (2.46)	2.04 (1.46)	$p < .001$		3.76 (2.45)	2.55 (2.05)	1.92 (1.19)	$p < .001$
Bottom quintile	3.21 (2.45)		4.50 (3.05)	2.47 (1.61)	$p < .001$		4.85 (2.79)	3.22 (2.44)	2.42 (1.39)	$p < .001$
2nd quintile	3.05 (2.47)		4.46 (2.91)	2.24 (1.72)	$p < .001$		5.12 (3.00)	2.74 (2.35)	2.18 (1.28)	$p < .001$
3rd quintile	2.74 (2.16)		3.50 (2.48)	2.03 (1.51)	$p < .001$		3.86 (2.57)	2.62 (2.05)	1.78 (1.15)	$p < .001$
4th quintile	2.50 (1.67)		3.09 (1.84)	1.89 (1.21)	$p < .001$		3.34 (1.90)	2.12 (1.38)	1.81 (1.20)	$p < .001$
Top quintile	2.53 (1.03)		3.22 (2.34)	1.80 (1.27)	$p < .001$		3.34 (2.27)	2.42 (2.02)	1.65 (.87)	$p < .001$
Top minus bottom quintile	-.68 (.09)		-1.28 (.17)	-.68 (.07)	$p < .001$		-1.52 (.26)	-.79 (.22)	-.77 (.10)	
Two parent family (% of years, age 14-16)	76.04 (42.05)		81.71 (38.37)	71.08 (44.43)	$p < .001$		80.82 (38.99)	79.29 (40.33)	70.29 (44.85)	$p < .001$
Bottom quintile	33.71 (46.29)		43.29 (49.01)	28.28 (43.77)	$p < .001$		42.16 (48.94)	48.68 (50.09)	28.00 (44.07)	$p < .001$
2nd quintile	58.20 (48.31)		61.75 (48.12)	56.17 (48.34)	$p < .10$		59.46 (48.57)	64.12 (47.77)	54.51 (48.35)	$p < .10$
3rd quintile	77.74		82.30	73.44	$p < .001$		81.12	76.85	66.90	$p < .001$

	(40.93)		(37.96)	(43.14)			(38.89)	(42.13)	(46.07)	
4th quintile	87.21 (32.72)		89.28 (30.68)	85.06 (34.63)	*p* < .05		87.10 (33.10)	90.03 (29.55)	88.54 (30.74)	*p* = .563
Top quintile	92.14 (26.56)		93.53 (24.45)	90.66 (28.59)	*p* < .010		91.44 (27.68)	94.92 (21.51)	91.37 (27.83)	*p* = .269
Top minus bottom quintile	58.43 (3.00)		50.24 (2.94)	62.38 (3.07)	*p* < .001		49.28 (3.16)	46.24 (3.06)	63.37 (2.93)	
Mother's age at child's birth	25.89 (5.69)		26.42 (5.91)	25.42 (5.46)	*p* < .001		26.45 (5.66)	24.96 (5.89)	26.12 (5.31)	*p* < .001
Bottom quintile	24.84 (7.02)		26.80 (7.33)	23.72 (6.59)	*p* < .001		27.89 (7.02)	23.56 (6.79)	24.73 (6.48)	*p* < .001
2nd quintile	24.82 (5.81)		25.79 (6.36)	24.26 (5.40)	*p* < .001		25.92 (6.49)	24.85 (6.40)	23.67 (4.78)	*p* < .001
3rd quintile	25.41 (5.72)		25.92 (6.07)	24.93 (5.34)	*p* < .01		25.65 (5.82)	24.57 (5.41)	24.86 (5.37)	*p* = .093
4th quintile	25.71 (5.14)		25.86 (5.40)	25.56 (4.86)	*p* = .308		25.76 (5.33)	24.66 (5.53)	26.96 (4.64)	*p* < .001
Top quintile	27.35 (5.13)		27.33 (5.44)	27.36 (4.78)	*p* = .913		27.39 (4.97)	26.15 (5.57)	28.68 (4.05)	*p* < .001
Top minus bottom quintile	2.51 (.26)		.53 (.41)	3.65 (.33)	*p* < .01		-.50 (.60)	2.58 (.66)	3.95 (.46)	
Mother's age at first birth	21.66 (4.12)		21.50 (4.02)	21.80 (4.20)	*p* < .01		21.86 (4.06)	20.62 (3.49)	22.65 (4.56)	*p* < .001
Child first born?	33.40 (---)		26.30 (---)	39.62 (---)	*p* < .001		25.41 (---)	35.05 (---)	38.60 (---)	*p* < .001
Child male?	49.43 (---)		49.36 (---)	49.49 (---)	*p* = .686		49.24 (---)	50.42 (---)	47.40 (---)	*p* = .329
Black?	13.89 (---)		11.66 (---)	15.85 (---)	*p* = .038		10.49 (---)	13.40 (---)	18.37 (---)	*p* < .001
Hispanic?	3.41 (---)		3.61 (---)	3.23 (---)	*p* = .008		2.74 (---)	2.95 (---)	4.46 (---)	*p* = .033

Number of observations	6,072		3,006	3,067			1,342	954	1.312	

Note: Income quintiles are defined by family income averaged over ages 14-16 for each birth cohort.

Appendix Table 2: Correlation matrix of dependent and key independent variables (weighted)

	All cohorts					
	Child's completed schooling	Parent income (average, age 14-16, in natural log)	Mother's years of education	Number of siblings	Two parent family (% of years, age 14-16)	Mother's age at birth
Parent income (average, age 14-16, in natural log)	.398***	---				
Mother's years of education	.456***	.423***	---			
Number of siblings	-.239***	-.129***	-.328***	---		
Two parent family (% of years, age 14-16)	.200***	.447***	.134***	.009	---	
Mother's age at birth	.153***	.166***	.090***	.257***	.134***	---
	Last six years of period (1994-1999)					
	Child's completed schooling	Parent income (average, age 14-16, in natural log)	Mother's years of education	Number of siblings	Two parent family (% of years, age 14-16)	Mother's age at birth
Parent income (average, age 14-16, in natural log)	.507***	---				
Mother's years of education	.495***	.542***	---			
Number of siblings	-.191***	-.227***	-.306***	---		
Two parent family (% of years, age 14-16)	.323***	.496***	.199***	-.045*	---	
Mother's age at birth	.321***	.293***	.292***	.025	.244***	---

Appendix Table 3: Coefficients and standard errors from regressions of children's completed schooling on family income and demographic measures

	All cohorts	First /second half of period			First/last six years in period			Middle/last six years in period		
		Age 14 in 1968-1981	Age 14 in 1982-1999	Difference	Age 14 in 1968-1973	Age 14 in 1994-1999	Difference	Age 14 in 1980-1985	Age 14 in 1994-1999	Difference
Natural log parent income (average, age 14-16	.629*** (.058)	.700*** (.100)	.625*** (.071)	p = .535	.682*** (.169)	.641*** (.102)	p = .835	.634*** (.121)	.641*** (.102)	p = .966
Mother's years of education	.226*** (.016)	.198*** (.021)	.239*** (.022)	p = .182	.175*** (.030)	.231*** (.033)	p = .207	.292*** (.038)	.231*** (.033)	p = .229
Number of siblings	-.111*** (.022)	-.126*** (.024)	.007 (.037)	p < .01	-.114*** (.030)	-.023 (.056)	p = .151	-.051 (.050)	-.023 (.056)	p = .708
Two parent family (% of years, age 14-16	.288*** (.083)	.177 (.123)	.379*** (.125)	p = .218	.207 (.185)	.427** (.169)	p = .381	.185 (.176)	.427** (.169)	p = .321
Mother's age at child's birth	.038*** (.008)	.028** (.012)	.034*** (.012)	p = .725	.022 (.018)	.059*** (.020)	p = .166	.055** (.023)	.059*** (.020)	p = .885
Mother's age at first birth	.029** (.013)	.032* (.018)	.041** (.018)	p = .738	.054** (.025)	.017 (.027)	p = .304	.022 (.031)	.017 (.027)	p = .905
Child first born?	.212** (.066)	.164 (.106)	.238*** (.086)	p = .593	.019 (.167)	.471*** (.138)	p < .05	.474*** (.181)	.471*** (.138)	p = .989
Child male?	-.277*** (.056)	-.113 (.083)	-.430*** (.073)	p < .01	-.170 (.113)	-.550*** (.109)	p < .05	-.321** (.143)	-.550*** (.109)	p = .204
Black?	.282** (.088)	.440*** (.131)	.146 (.108)	p < .10	.402** (.190)	-.083 (.156)	p < .05	.613*** (.181)	-.083 (.156)	p < .01
Hispanic?	.211 (.215)	-.209 (.319)	.501** (.231)	p < .10	-.385 (.453)	1.012*** (.346)	p < .05	-.127 (.391)	1.012*** (.346)	p < .05
R^2 (from regression	.30	.26	.33		.27	.40		.28	.40	

#2)										
Number of observations	6,072	3,005	3,067		1,341	1,312		954	1,312	

Regressions are weighted using the PSID attrition-adjusted weight. Regressions are weighted using the PSID attrition-adjusted weight.
Family-cluster-adjusted standard errors are given in parentheses.
***p<.01; **p<.05; *p<.10

Appendix Table 4: Time-based interaction effects and robustness checks of the regression analysis of children's completed schooling

	Basic specification	Include CY interactions	Substitute all children <18 in household for # sibs	Food stamp subsample		Race			Child sex		
				Cash income	Cash + food stamp income	Blacks only	Non Blacks only	p value of differen ce	Males only	Females only	p value of difference
ln income	.629*** (.058)	.658*** (.060)	.650*** (.059)	.633*** (.075)	.678*** (.083)	.491*** (.104)	.689*** (.069)	p = .114	.645*** (.084)	.674*** (.077)	p = .863
Maternal education	.226*** (.016)	.217*** (.015)	.219*** (.015)	.253*** (.025)	.253*** (.025)	.145*** (.034)	.228*** (.017)	p < .05	.219*** (.021)	.215*** (.020)	p = .958
Number of siblings	-.111*** (.022)	-.065** (.023)	---	-.037 (.032)	-.043 (.032)	-.026 (.042)	-.091*** (.024)	p = .212	-.034 (.030)	-.092*** (.026)	p < .10
Two parent	.287** (.0183)	.265** (.083)	.278** (.083)	.269** (.103)	.267** (.103)	.237 (.153)	.317** (.095)	p = .586	.281** (.108)	.253** (.109)	p = .909
Mother's age at birth	.038*** (.008)	.033*** (.008)	.011 (.009)	.025** (.011)	.025** (.011)	.021* (.013)	.037*** (.010)	p = .306	.019* (.011)	.047*** (.012)	p < .10
ln income * CY turned 14	---	-.002 (.004)	-.003 (.004)	-.009 (.010)	-.008 (.010)	.007 (.006)	-.005 (.004)	p = .127	-.004 (.005)	-.005 (.005)	p = .564
Maternal education* CY turned 14	---	.001 (.001)	.000 (.000)	.006** (.002)	.006** (.002)	-.001 (.001)	.001 (.001)	p = .583	.001 (.001)	.001 (.001)	p = .895
Number of sibs * CY turned 14	---	.005** (.001)	---	.007** (.002)	.007** (.002)	.001 (.002)	.006*** (.002)	p < .05	.006** (.002)	.004** (.002)	p = .127

Two parent * CY turned 14	---	.008	.007	.014	.015	.003	.005	*p* = .842	.001	.014**	*p* < .10
		(.005)	(.005)	(.012)	(.012)	(.009)	(.006)		(.007)	(.007)	
Mother age at birth* CY turned 14	---	.000	.001*	.000	.000	.001	.000	*p* = .609	.000	.001	*p* < .05
		(.000)	(.000)	(.001)	(.001)	(.001)	(.001)		(.001)	(.001)	
# children in HH age 14-16	---	---	-.083***	---	---	---	---	---	---	---	---
			(.022)								
# children in HH* CY turned 14	---	---	.004**	---	---	---	---	---	---	---	---
			(.001)								
Other controls?	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.
Number of observations	6,072	6,072	6,072	4,588	4,588	2,505	3,567	6,072	2,900	3,172	6,072

Note: All regressions include controls for main effects of all variables, race/ethnicity, sex, firstborn status, and age of mother at first birth. Calendar year is centered on 1984. Regressions are weighted using the PSID attrition-adjusted weight. Family-cluster-adjusted standard errors are given in parentheses.
***p<.01; **p<.05; *p<.10

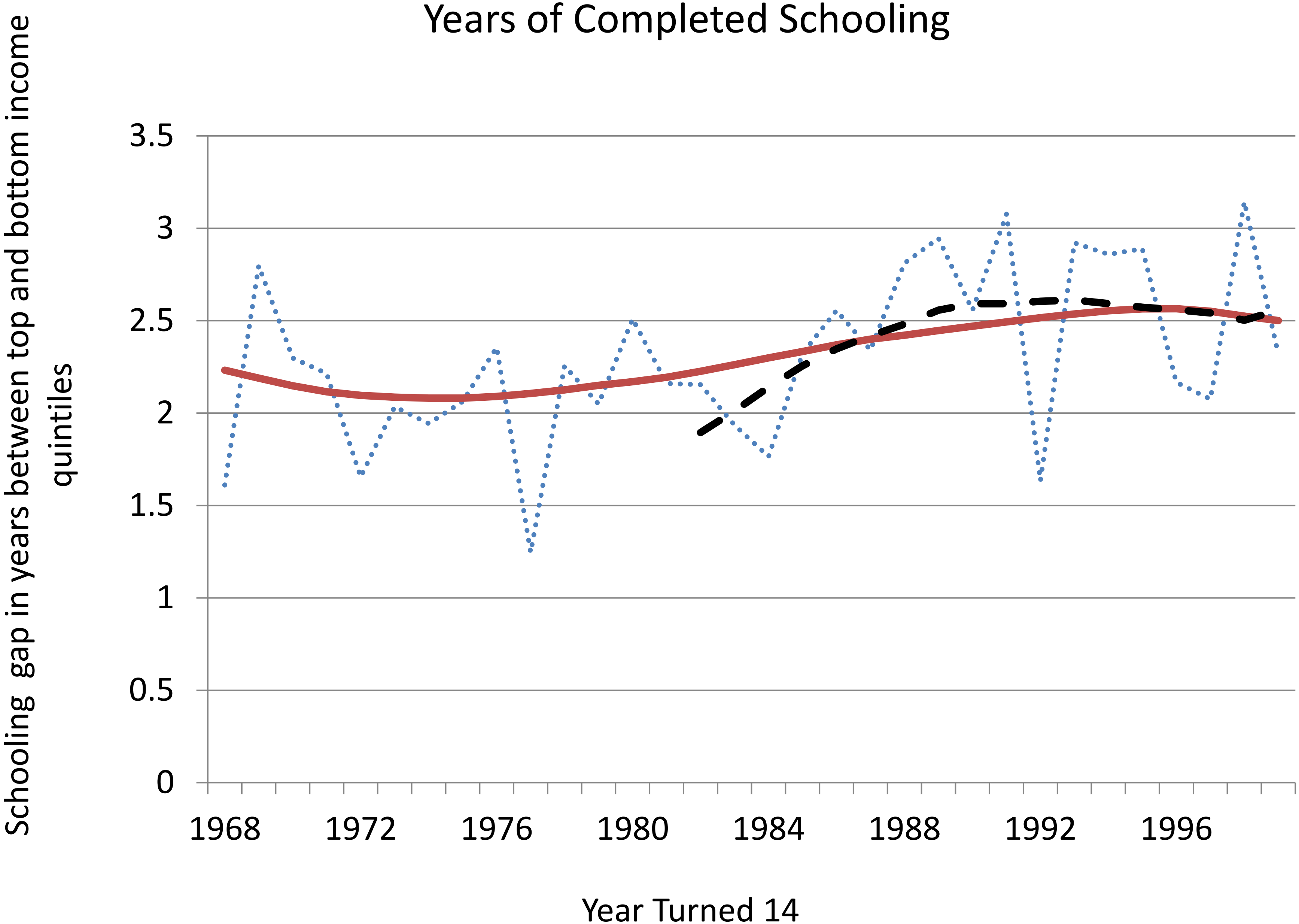
Appendix Table 5: Coefficients and standard errors from weighted regressions of children's completed schooling on adolescent and full-childhood income and family structure for children born 1968-1985

	Dependent variable: children's completed schooling (OLS)					Logistic regressions		
	Age 14-16 measures, no controls	Age 14-16 measures, with controls	Age 0-16, no controls	Age 0-16, controls	Stages, with controls	High school or more (no GED)	High school or more (includes GED)	College graduate
ln income	1.183*** (.055)	.625*** (.071)	1.524*** (.064)	.833*** (.093)	---	---	---	---
Mother's years of education		.239*** (.022)		.231*** (.023)	.244*** (.025)	.019*** (.003)	.019*** (.003)	.043*** (.006)
Number of siblings		.007 (.037)		.011 (.037)	.020 (.037)	.003 (.006)	-.003 (.005)	.006 (.009)
Two parent family (% of years, age 14-16		.379** (.109)		.366** (.108)	---	---	---	---
Mother's age at child's birth		.034** (.012)		.019 (.012)	.017 (.013)	.000 (.002)	.003 (.002)	.002 (.003)
ln income, 0-5					.361** (.115)	.063** (.021)	.045*** (.016)	.052* (.029)
ln income, 6-10					-.057 (.117)	.010 (.023)	-.010 (.018)	-.001 (.033)
ln income 11-16					.559*** (.110)	.065** (.020)	.041** (.016)	.097** (.029)
Two parent, 0-5					-.211 (.226)	-.019 (.038)	.000 (.030)	-.078 (.061)
Two parent, 6-10					.264 (.263)	-.019 (.056)	.067** (.033)	.065 (.070)
Two parent, 11-16					.251 (.191)	.059 (.045)	-.033 (.029)	.052* (.029)

Other controls?	No	Yes	No	Yes	Yes	Yes	Yes	Yes
R^2	0.20	0.33	0.22	0.33	0.34	0.22	0.21	0.25
N	3,067	3,067	3,067	3,067	2,932	2,734	2,932	2,932

Logistic regression outcomes present marginal effects (dy/dx) and standard errors. All regressions are weighted using the PSID attrition-adjusted weight. Family-cluster-adjusted standard errors are given in parentheses.
***p<.01; **p<.05; *p<.10.

Figure 1: Top minus Bottom Income Quintile Differences in Children's Years of Completed Schooling



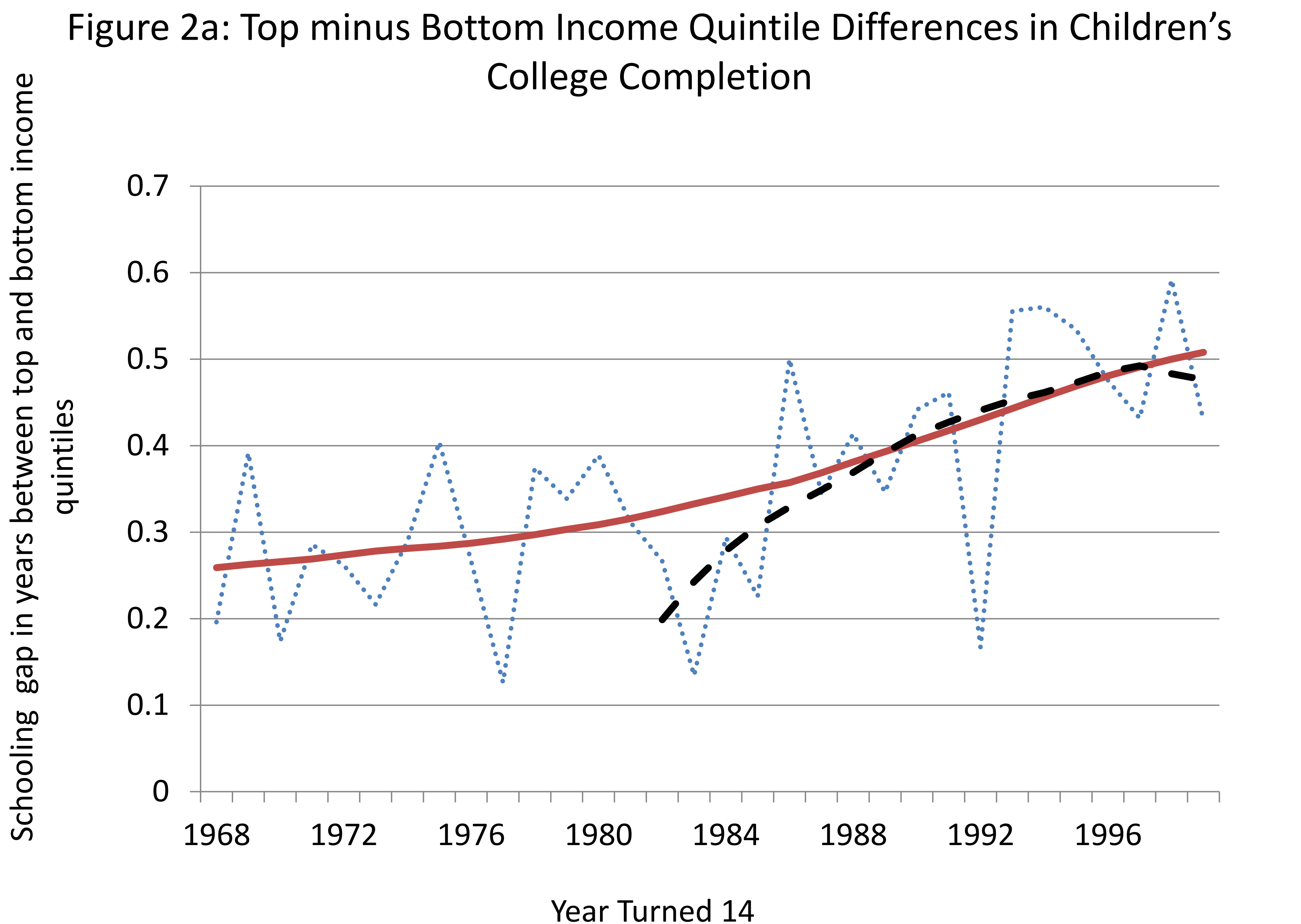


Figure 2a: Top minus Bottom Income Quintile Differences in Children's College Completion
Schooling gap in years between top and bottom income quintiles
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1968
1972
1976
1980
1984
1988
1992
1996
Year Turned 14

Figure 2b: Top minus Bottom Income Quintile Differences in Children's College Attendance

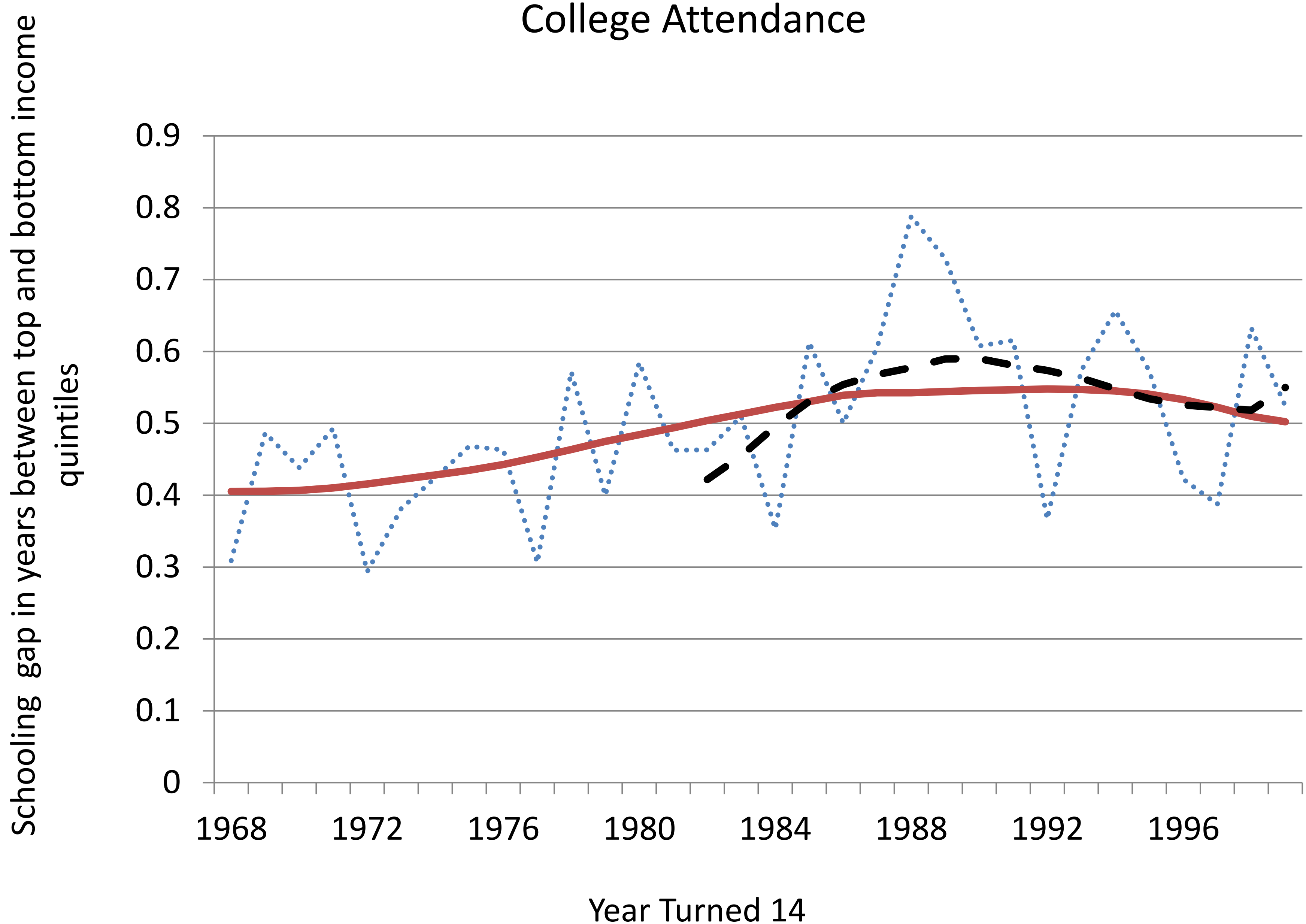


Figure 3a: Top minus Bottom Income Quintile Differences in Cohort-Specific Family Income

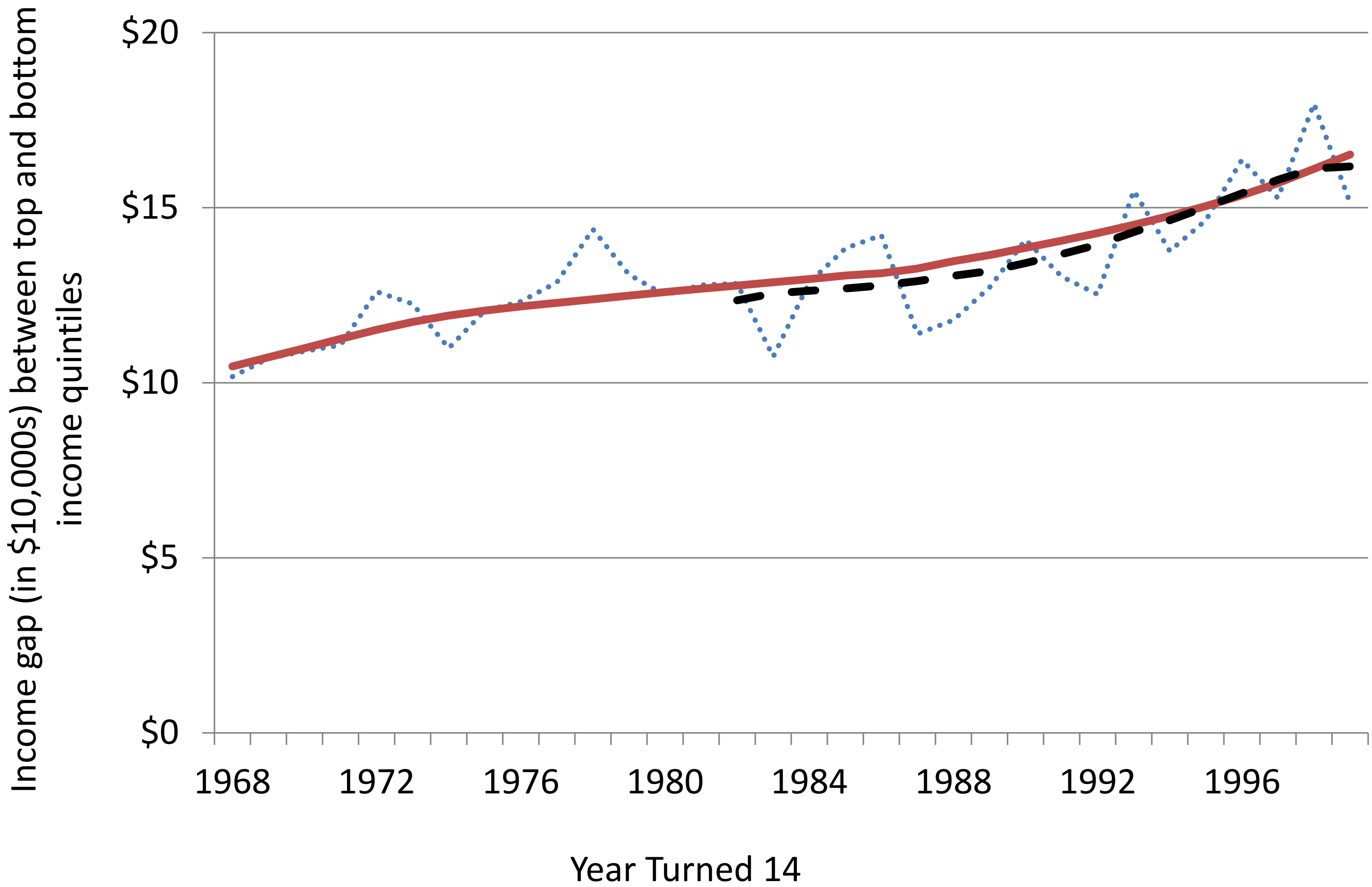
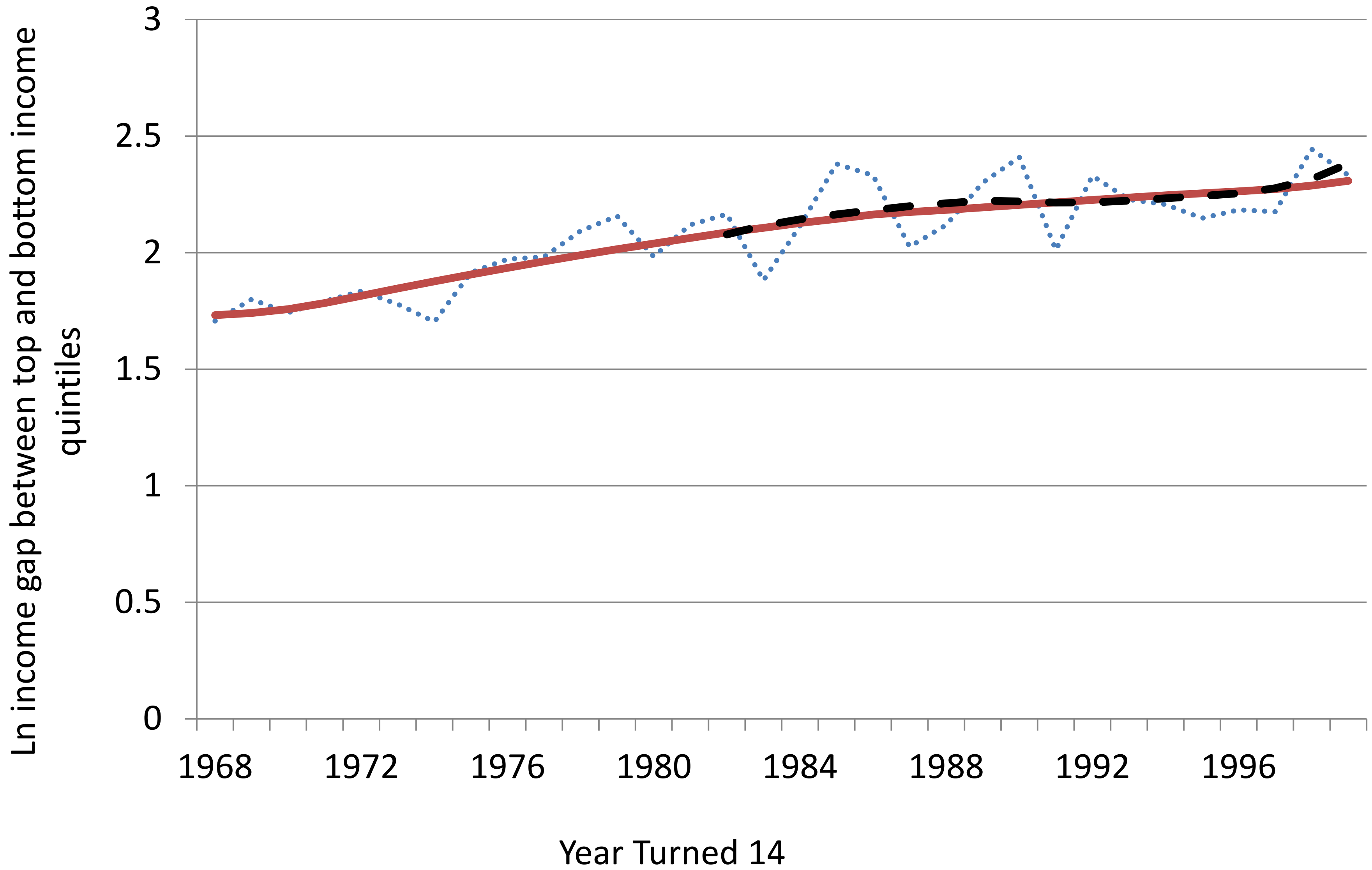


Figure 3b: Top minus Bottom Income Quintile Differences in Cohort-Specific Ln Family Income



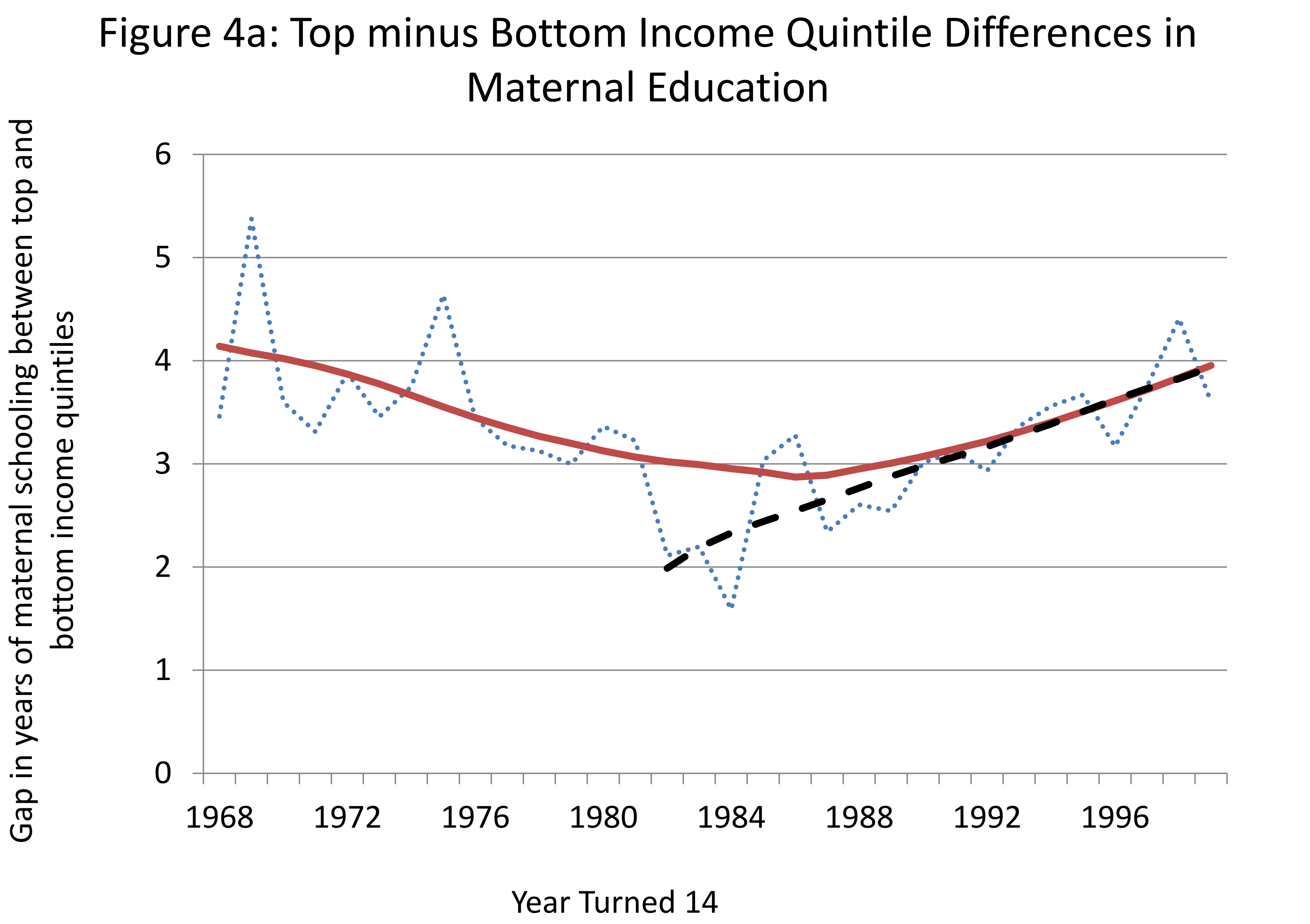


Figure 4a: Top minus Bottom Income Quintile Differences in Maternal Education
Gap in years of maternal schooling between top and bottom income quintiles
6
5
4
3
2
1
0
1968
1972
1976
1980
1984
1988
1992
1996
Year Turned 14

Figure 4b: Top minus Bottom Income Quintile Differences in Number of Siblings

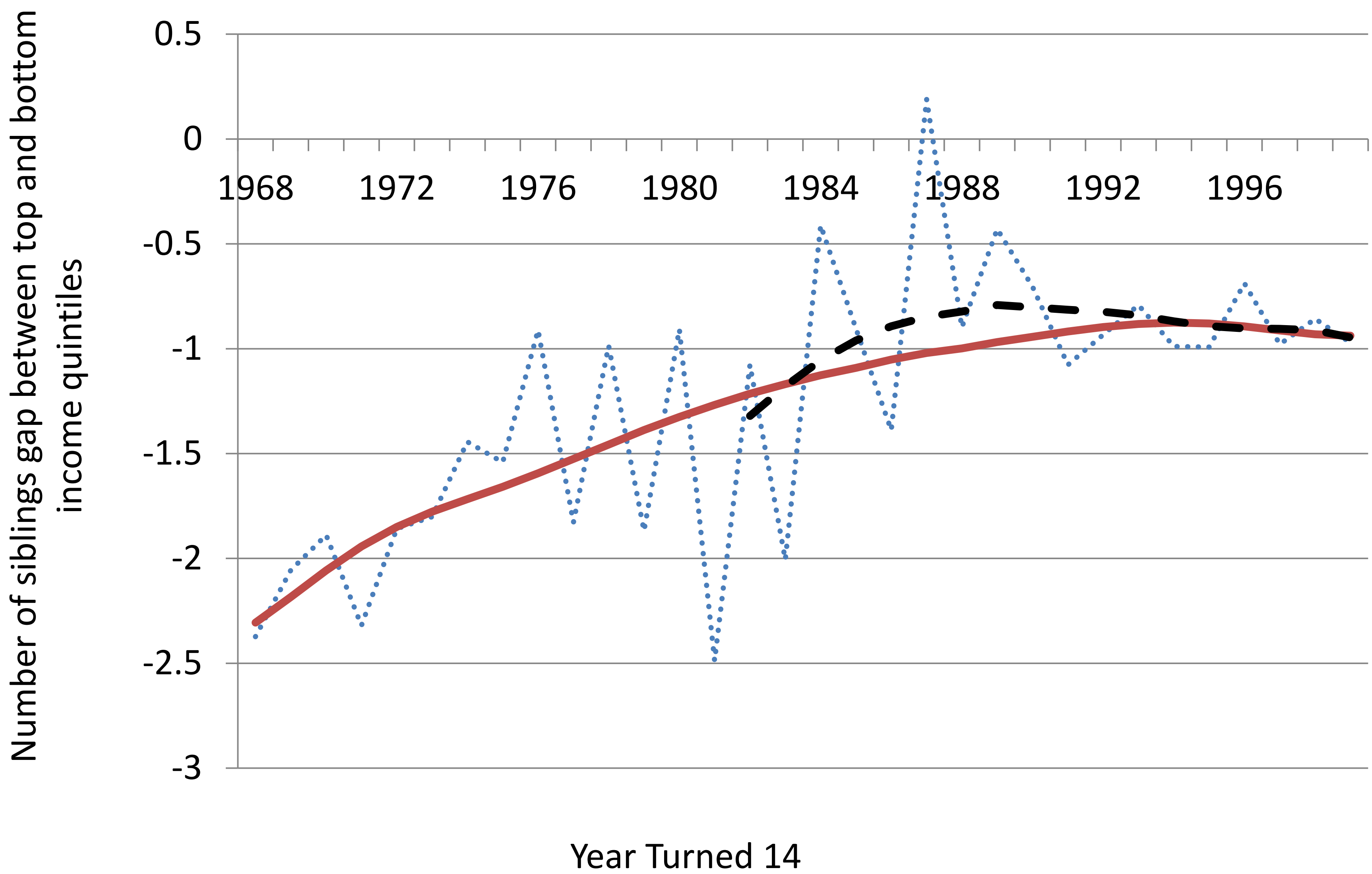


Figure 4c: Top minus Bottom Income Quintile Differences in Living with Two Parents

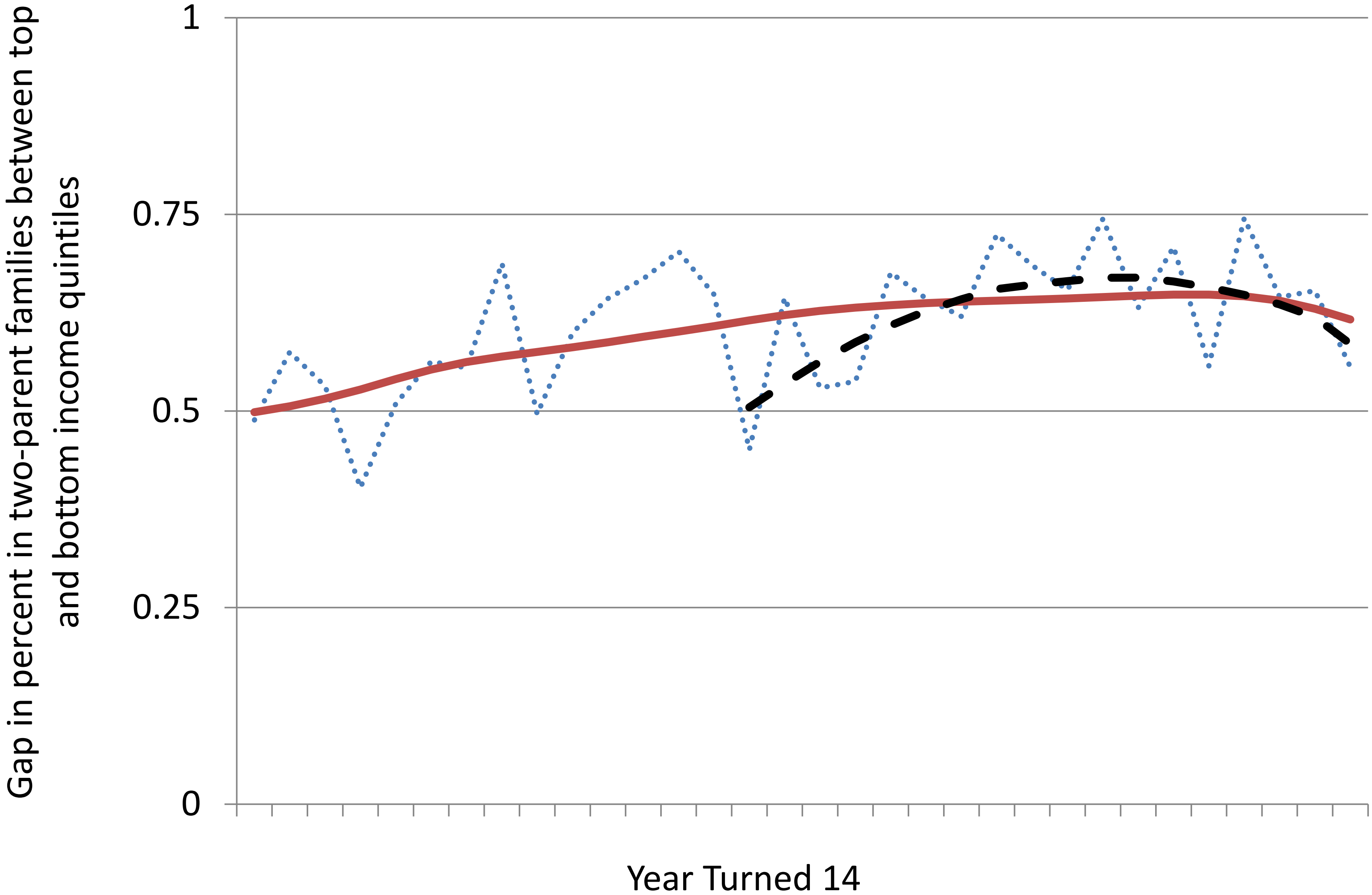


Figure 4d: Top minus Bottom Income Quintile Differences in Age of Mother at Birth

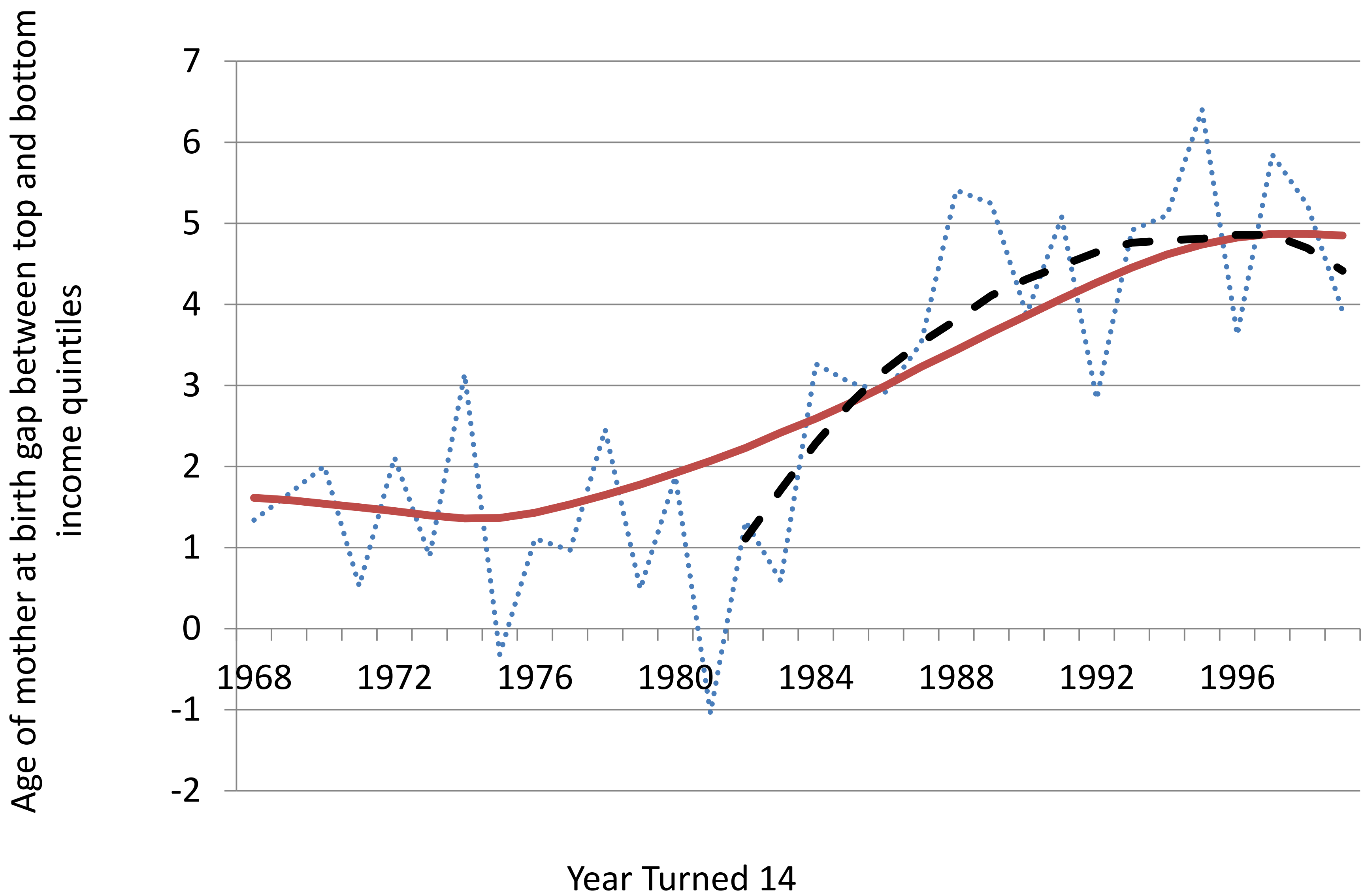
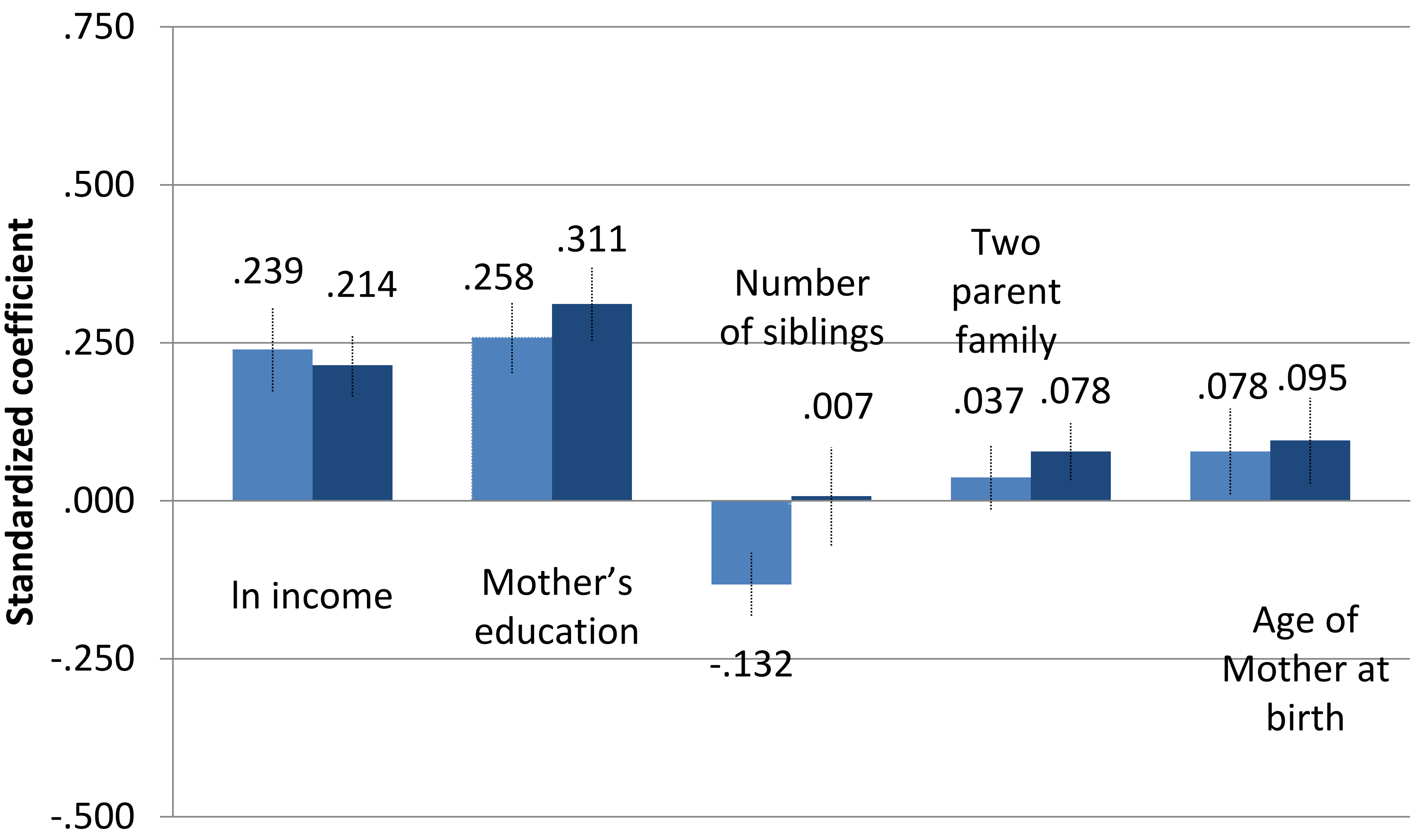
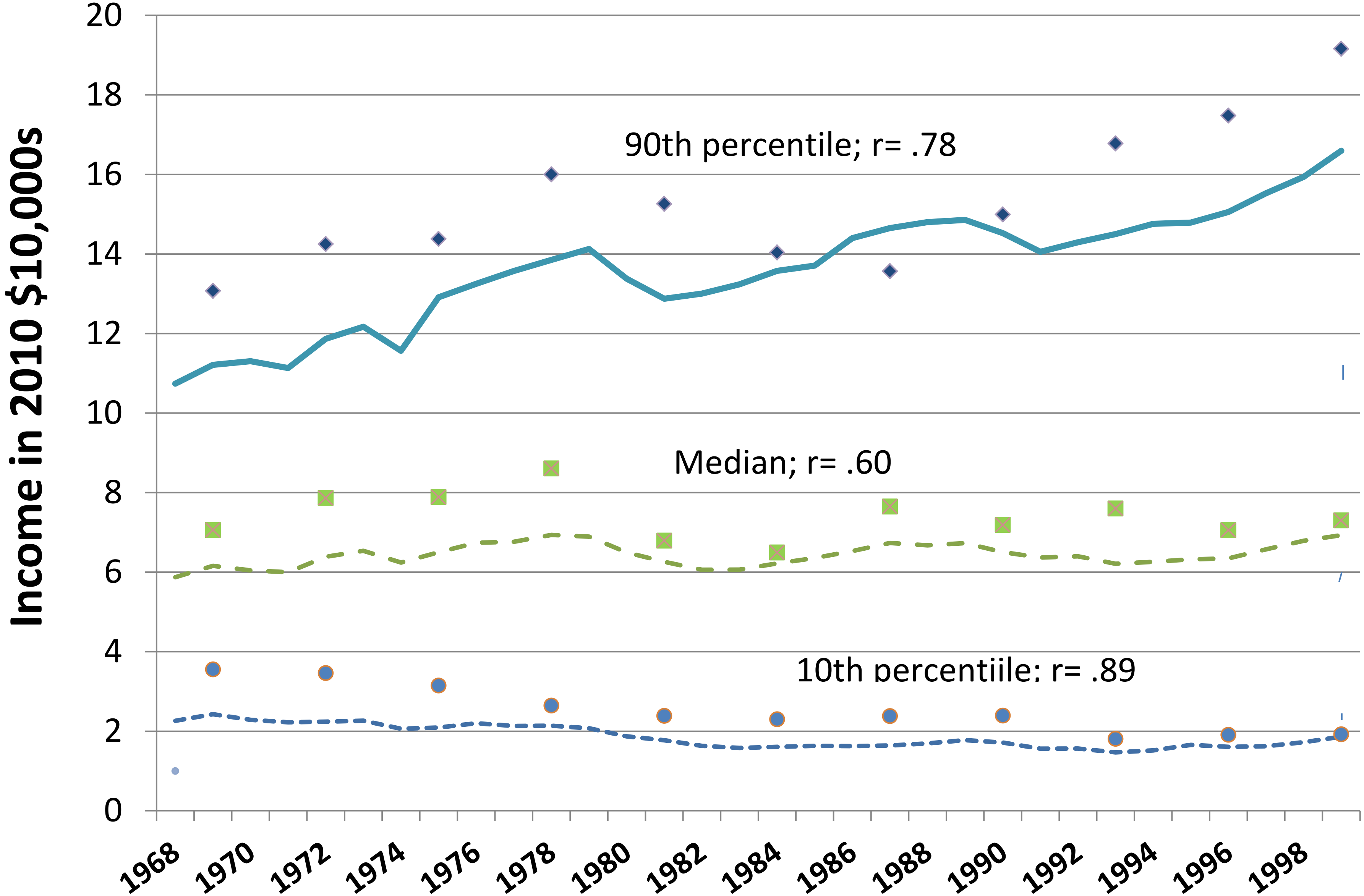


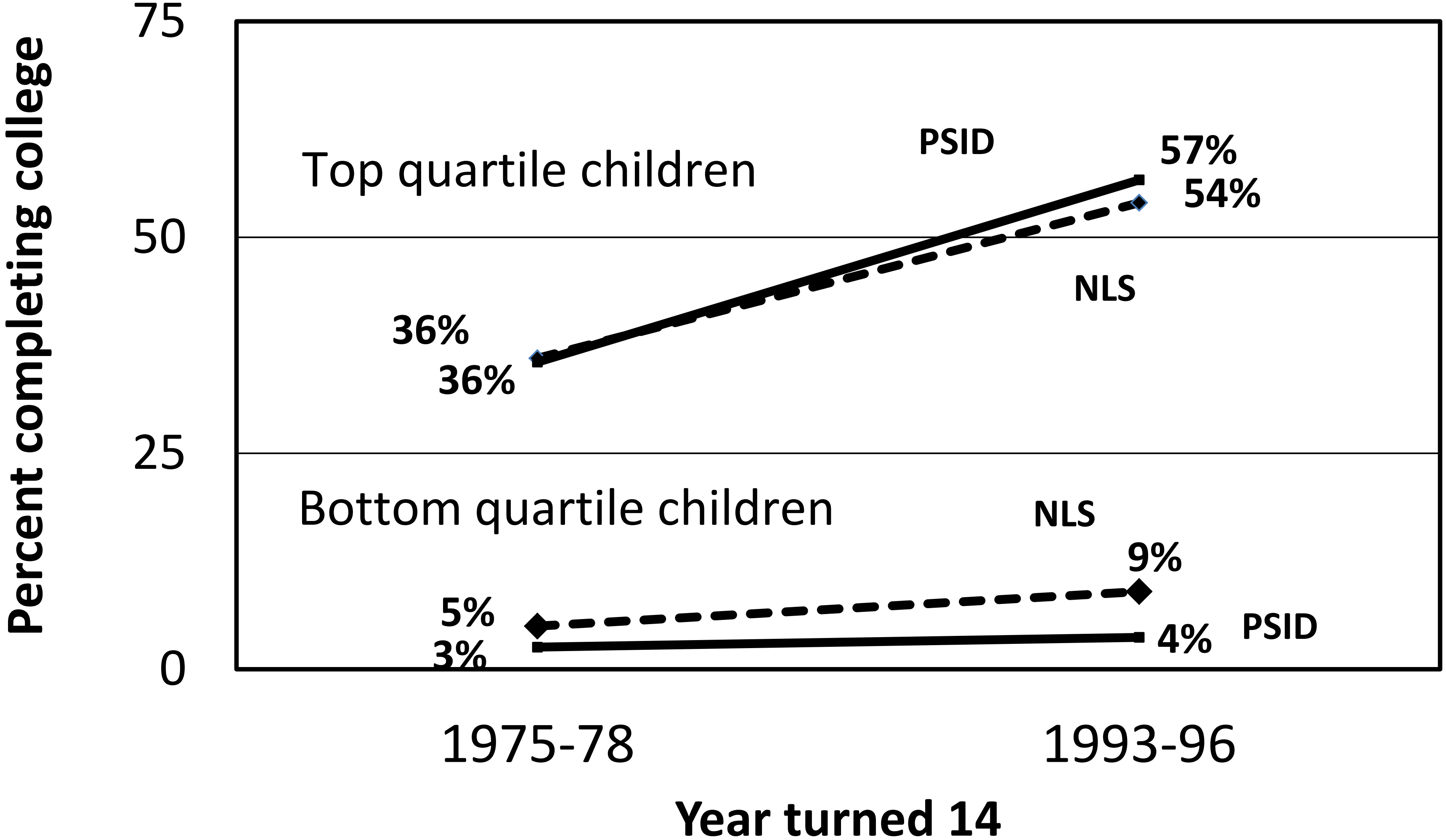
Figure 5: Standardized coefficients on determinants of children's completed schooling, 1968-81 and 1982-99



Appendix Figure 1: CPS (all ages) and PSID (age 14) income distributions for children



Appendix Figure 2: College graduation rates for high and low income children in NLS and PSID



Bailey and Dynarski (2011) for NLSY; authors' calculations for the PSID