The Effects of Experiencing the Great Depression as a Child on Socioeconomic and Health Outcomes

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PRELIMINARY: PLEASE DO NOT CITE WITHOUT PERMISSION

Abstract:

In this paper we use 20th century data to examine how macroeconomic conditions just before and after birth affected infants after they became adults. Our analysis focuses on the worst downturn ever experienced in the United States—the Great Depression, although we do not restrict our analysis to the Depression period. By merging data reported by respondents in decadal U.S. Census micro data from 1970-1980 with information on the path of state per capita income during the individual's childhood years in the state of birth, we find that individuals born in poorer states (and in states with lower rates of income growth after birth) are more likely to be high school dropouts, earn lower incomes, and have greater rates of disability than individuals born in states with higher incomes, even after controlling for socioeconomic characteristics such as race and education, year of birth, state of birth, and state of current residence. These results suggest that fluctuations in state-wide economic activity during the infant and early childhood period may have long term consequences for an individual's socioeconomic status and health outcomes.

Introduction

The generation born during the Great Depression decade of the 1930s lived through the worst economic downturn in American history. Over the course of the Depression, real GNP fell by 30 percent from 1929 to 1933 and did not recover to 1929 levels until late in the decade. Unemployment rates rose from 3.2 percent to a peak of 24.9 percent in 1933 and remained above 10 percent the rest of the decade (U.S. Bureau of the Census, 1975, Series F1, 5, D 86). Meanwhile, infant mortality rates rose between 1932 and 1934, counter to the strong long -run downward trend over the course of the 20th century (Fishback, Haines, and Kantor 2001). Interviews with people who lived through the Depression showed that their hard times influenced their choices and opportunities in later years in a variety of ways (Terkel, 1970). As yet, there have been few attempts to document these influences in a rigorous fashion.

We investigate the impact of birth and childhood during the Great Depression on adult incomes, high school drop-out rates, and disability. The analysis goes beyond showing the cohort effect of being born in the 1930s. The extent of the economic disruption and recovery varied substantially across states and time during the 1930s and in other decades, providing an opportunity to examine the effects of state-level economic and health risks on long run outcomes.

A focus on the Great Depression is particularly useful because it was the arguably the largest drop in economic activity in American history. The wide range of events that influence income in the course of a life-time for which information is not available to the econometrician are broad enough that the analysis will not easily capture the effects of small changes of one or two percent in economy-wide income from year to year. There was also large variation in the income changes across the states, which allows us to measure the effects of income changes in a smaller geographic area than the entire United States. Figure 1 shows the ratios of state per capita income for 1933 relative to 1929 and for 1939 relative to 1929. The 1933/1929 ratio ranges from .53 to .9 while the 1939/1929 ratio ranges from .85 to 1.3. Although our focus is on the Great

Depression, the analysis covers birth and childhoods between 1921 through 1955; therefore, we also can examine the impact of the World War II and the relative booms during the 1920s and the Post-War era.

In addition to studying the impact of the Great Depression and other years, the analysis also adds to a broader literature on the impact of conditions at birth on socio-economic success in later life. The importance of *in utero* and early childhood health on later health and socioeconomic outcomes has been documented by numerous scholars in both economics and epidemiology. First posited by British physician David Barker (1992), the "fetal origins hypothesis" argues that adverse conditions experienced during the fetal period (such as poor maternal nutrition) have long-run implications for adult health. Economists have used a variety of techniques to document the relationship between fetal and early childhood health and later health and socioeconomic outcomes. Case, Fertig and Paxson (2005) control for maternal smoking and infant birth weight and find that children who experienced poorer uterine environments and poorer childhood health have significantly lower educational attainment and socioeconomic status as adults than other children, even after controlling for factors such as parental income and education. Using U.S. Census data from 1960-1980, Almond (2006) finds that birth cohorts who were *in utero* during the 1918-1919 influenza pandemic have significantly lower rates of educational attainment, income and socioeconomic status, and higher rates of disability than cohorts born just one quarter later.

Other papers directly examine the link between income and socioeconomic status during childhood and a child's later adult health. Case, Lubotsky and Paxson (2002) find that children with chronic health conditions in lower-income households are in poorer health as adults than children with chronic health conditions in higher-income households. In addition to the income of the parents, overall conditions in the economy could also influence a child's environment by heightening the fears of her parents about job loss and downturns, witnessing the impact of hard

times that her friends might be going through, and raising the probability of catching infectious diseases from other children whose own risks are elevated when they receive poorer nutrition and less than adequate housing. In this vein, Van den Berg, Lindeboom and Portrait (2006) use data from 19th century Netherlands to examine how general macroeconomic conditions experienced during childhood affect later life health outcomes. They find that children born during recessions live, on average, a few years less than children born during booms. Cutler, Miller, and Norton (2007), on the other hand, find virtually no quantitative effects on the health of people in later life who were infants in the Dust Bowl areas during the 1930s. A paper done using 20th century data comes to somewhat different conclusions. Dehejia and Lleras-Muney (2004) use data collected after 1975 and find that infants conceived during times of high unemployment are in fact healthier than other infants, with lower rates of infant mortality.

To examine how adult lives were influenced by economic conditions at birth and during childhood, we develop a new data set that merges the socioeconomic and health outcomes reported by respondents in the 1970 and 1980 Censuses with information on infant mortality rates and personal income per capita during the respondent's childhood years in the state where they were born. Since we do not have information on the parents' income during the Depression, the effect we measure is an average effect that combines the impact of parental income and the incomes and health conditions in the state at that time. Individuals born in states with higher personal incomes per capita during childhood tend to earn higher incomes as adults and have lower rates of disability than other individuals, even after controlling for educational attainment, year of birth, state of birth, and current state of residence. They are also less likely to be high school dropouts. These results suggest that the economic and health conditions in the local economy where someone grows up have long term consequences for an individual's socioeconomic status and health outcomes.

Empirical Framework

Grossman (1972) suggests that health is produced by investments in human capital, medical care, lifestyle behaviors such as diet and exercise, and random events such as disease. Thus, health is influenced by the price of medical care, income, and the opportunity cost of an individual's time. In this model, higher income may be associated with greater levels of health, since an individual can buy better food and more medical care as income increases.[1] Framed in this way, it could be the case that macroeconomic downturns are associated with poorer health and macroeconomic upturns are associated with better health. The results in Van den Berg, Lindeboom and Portrait (2006) that show infants born during recessions live shorter lives than infants born during booms support this argument.

It could also be the case that recessions (and lower rates of employment) lower the opportunity cost of time, allowing people to engage in healthier behaviors such as exercising and cooking healthier meals. Research by Ruhm (2000, 2005) and Dehejia and Lleras-Muney (2004) suggests that this latter substitution effect is non-trivial and may indeed dominate the effect of lower income on health. Ruhm finds that health improves during recessions; an increase in unemployment reduces mortality due to cardiovascular disease, pneumonia, etc. He argues that these reductions in mortality are driven by changes in behavior (smoking and excess weight decline during recession), but could also be affected by factors such as reduced pollution as manufacturing slows (see also Chay and Greenstone 2003). Dehejia and Lleras-Muney (2004) find that babies conceived during periods of high unemployment are healthier than babies conceived under better macroeconomic conditions. Like Ruhm, they find that much of the effect

[1] It should be noted that some risky behaviors (such as alcohol consumption) are also normal goods (see Ruhm 2000 for a general discussion). These behaviors might increase as income increases, leading to deleterious effects on health.

is explained by changes in the behavior of mothers; for example, mothers receive more prenatal care during recessions.[2] While these results only examine contemporaneous effects on mortality, studies suggest that low birth weight infants (infants who weigh less than 2500 grams at birth) are not only at greater risk of morbidity and mortality as infants, but also have lower rates of educational attainment, self-reported health status, and earnings as adults (see Berhman, Rosenzweig, and Taubman 1994; Currie and Hyson 1999; Berhman and Rosenzweig 2004).

The results from Ruhm and Lleras-Muney suggest that the income effect of macroeconomic downturns on health is outweighed by the substitution effect of having more time to engage in healthy behaviors (as well as perhaps by other factors such as reduced pollution, and fewer accidents at work). This paper examines the effect of being born during the Great Depression on later life outcomes. It might be the case that the effects of the Great Depression are different than those of later recessions. As mentioned, the Great Depression eclipses all other economic downturns in the 20th century with respect to its severity. Real GDP per capita ($2000) fell from $7,105 in 1929 to $5,056 in 1933, a decrease of almost 23 percent (Unemployment over the same period rose from 3.2 percent to 24.9 percent (U.S. Bureau of the Census, 1975, Series D, 85-86). In contrast, the recession of 1980-1982 was much less severe, with real GDP per capita (measured in year 2000 dollars) falling from $22,982 in 1979 to $22,347 in 1982, a decrease of only 2.76 percent (Johnston and Williamson 2007). Unemployment rose only to 9.7 percent in 1982 from 5.8 percent in 1979 (U.S. Department of Labor, Bureau of Labor Statistics, 2007).

The significant decline in income during the Great Depression may have made it more difficult for pregnant mothers to eat well and obtain prenatal care. Further, an increase in

[2] Dehejia and Lleras-Muney also find compositional effects associated with fertility during economic downturns. They find that black women who conceive during recessions tend to be more educated, while white mothers tend to be less educated. Both blacks and whites have conceive healthier infants during recessions, suggesting that the behavioral effects are (at least for whites) stronger than the selection effects.

unemployment among fathers may have induced women to enter the work-force to augment family income. Thus, instead of having more time to engage in healthy behaviors (as posited by Ruhm), they may have had less. Finegan and Margo (1994) estimate that women with unemployed husbands who were not on relief were 9.1 percentage points more likely to participate in the labor force than women with employed husbands. Thus, the characteristics of the labor market for women during the Great Depression may have meant that more women worked, thus increasing the opportunity cost of their time and reducing their ability to engage in lifestyle behaviors that may have led to healthier infants.

The effects of the Great Depression might have manifested themselves through other channels. Richard Easterlin (1961) has argued that expectations about the future, risk attitudes, consumption pattern, and attitudes toward saving are often determined by experiences during childhood.[3] Holding later income constants, people who faced harsh economic conditions during childhood might therefore take fewer risks and consume less and therefore might not strive as hard for higher incomes as those who grew up in boom economies. We therefore match information on the economic environment in the states where the person likely grew up through the time that they reached age fourteen.[4]

Data and Methods

To determine how being born and growing up during the Great Depression influenced a child's later health and socioeconomic outcomes, we merge data on individuals' health and

[3] Easterlin focused on the impact on fertility of income as an adult relative to anticipated income, which was set based on experiences as a child. Macunovich (1988) surveys the literature on the topic in depth.
[4] We recognize that some individuals may have been raised in states other than which they were born. Unfortunately, we have no way of knowing the extent to which this is true. We find that roughly 75 percent of people surveyed in a given census year reside in the same state in which they were born.

economic outcomes reported in U.S. decadal censuses in 1970 and 1980 with information on the disease and economic environment in the respondent's state and year of birth. We estimate ordinary least squares (OLS) regressions on the following equation on various health and socioeconomic outcomes (*O*):

$$O_{i,b,sb,s} = X_{i,s}\beta_1 + Z_{b,sb}\beta_2 + \gamma_s\theta_b + \mu_{sb},$$

where the subscripts refer to individual i, born in year b in state sb, and now living in state s. The vector $X_{i,s}$ refers to characteristics of individual i in state s in the census year in which they were surveyed. The vector $Z_{b,sb}$ is specified in three different ways. Because the uterine environment may play a role in subsequent health and economic outcomes, we include the natural logarithm of birth state income in the year before birth in each specification. To capture effects in early childhood, we also include the growth rate in real income for the state birth for up to 14 years following birth.[5] Data on outcomes and individual characteristics are from the U.S. Census data from the Integrated Public Use Microdata Series (Ruggles, Sobek, Alexander, Fitch, Goeken, Hall, King, and Ronnander, 2004).

The socioeconomic outcomes we examine are total income, whether a person graduated from high school, and health status. Since the Census data do not report health directly, we use a measure of disability to proxy for health status. The variable is equal to one if the respondent reports having a work limiting disability, and zero otherwise. The measures in the $X_{i,s}$ vector of controls include race, marital status, educational attainment and whether or not a respondent is Hispanic. In order to control for the disease environment in a person's state of birth and year of birth, we include the infant mortality rate in a person's state and year of birth. Infants in particular are very vulnerable to disease (particularly gastroenteritis, pneumonia, and influenza) and are

[5]We have also experimented with using the annualized growth rate of real state income for 4 to 10 and then 11 to 18 years after birth to save on parameters. The results are robust to changes in the specification.

among the first people in a population to suffer during disease outbreaks. We limit our sample to men over age 25 in the year of the census to avoid potentially confounding effects of female labor force supply issues, as well as to ensure that educational attainment is complete.

While we have included a number of standard control variables in our regression, there is always the possibility that our results could be biased if there are unobserved variables that are not included in the regression. A vector of Birth-year fixed effects (θ_b) were included to control for unmeasured nation-wide factors that would have influenced all people born in the same year the same way. In the cross-sectional regressions, for example in 1980, these factors include the age of the person in 1980 and nation-wide macroeconomic shocks like fluctuations in GDP and war. We incorporated a vector of state-of-birth fixed effects (μ_{sb}) to control for unmeasured factors that varied across states and did not vary across time during the period from 1920 through 1960, including long-term differences in the cost of living, climate, health environment, and the regulatory structure. In addition, fixed effects were added for the state in which the person was located during the survey year (γ_s) to control for differences across states in state-wide economic conditions at the time of the survey. With these controls we can more effectively isolate the effect of income and infant mortality during the person's childhood that is specific to the state-year in which the person was born ($Z_{b,sb}$).

Table 1 provides summary statistics for 1970 and 1980. Table 2 shows the results from the cross-sectional regressions for individuals aged 25 to 60 in 1970. The first is an OLS regression for the natural log of income, the second and third are probit estimations on zero-one dummies for disabled persons and high school dropouts respectively. Per capita state incomes in the state of birth during childhood were strongly associated with income, educational attainment and the likelihood of disability in a person's adult years. Table 3 reports results the same series of estimations on a cross-section of males between the ages of 25 to 65. In the discussion of the

results we focus on the 1980 cross-sectional regression to streamline the narrative. The results for the 1970 regressions are very similar.

We experimented with a variety of specifications for incorporating information on the path of state per capita income during childhood in the analysis. As would be expected, the level of state personal income across years within a state is highly positively correlated across time. We have tried a specification for the log income regressions that incorporates the levels of the natural log of state income for the year before birth, the year of birth, and several childhood years, instead of the growth rate specification in Tables 2 and 3. In those cases the coefficients for the income levels in the year before birth, the year of birth, the year after birth, etc. are all positive but imprecisely estimated, leading to low t-statistics for many of the income coefficients during the childhood years. However, an F-test rejects the hypothesis that all of the income level coefficients are zero.

To reduce this correlation across levels of income and the consequent multi-collinearity in the coefficient estimates, we used a specification with the level of income in the year prior to birth and then the growth rates in income during the year of birth and a number of years during childhood. As seen in Tables 2 and 3, this specification leads to coefficients that are estimated more precisely with t-statistics that imply statistical significance of the coefficients for incomes in the state of birth up to age 14. This growth rate path specification also makes it easier to identify a stopping point for the number of years during childhood for which the growth rate is included in the specification. We settled on including growth rates through age 14 by estimating the model with growth rates included for each childhood year through age 18. Beyond age 14 the coefficients on the growth rates are no longer statistically significant. Many of the results are similar when we use a much sparer specification that includes only the log of state per capita income in the year before birth and the growth rate in income during the year of birth, as can be seen in the discussion in Appendix I.

It is important to note that the basic effects we report for the impact of streams of income are similar under both the specification including all levels of log state income from the year before birth through age 14 and the specification when we include the level of log state income in the year prior to birth and the growth rates for throughout. The specifications show that income during the prenatal period was important. In Table 3 for 1980 income a one percent increase in birth state real income in the year before birth was associated with a personal income as an adult in 1980 that was 0.26 percent higher. We can also put this into a dollar-for-dollar comparison. Consider a white male high school graduate who was born in Alabama in 1923 and lived in Alabama in 1980. The coefficient from Table 3 implies that adding an additional dollar (1967$) per capita to Alabama state income in 1922, the year before he was born, holding all else constant, would have been associated with an increase in his income in 1980 of $1.53 (1967$). This is a sizeable effect but does not take into account the rates of return on investment over time. Had the Alabama man's father invested one dollar in a retirement account for his anticipated son in 1922 and earned an average real rate of return of 2 percent, the Alabama man could have withdrawn $3.15 from the account in 1980.

Real personal income growth rates throughout childhood up to age 14 also have effects on income in 1980, as the coefficients on real income growth rates are positive and statistically significant for 12 years following birth. An additional percentage point of state personal income growth in each of those years raised log income as an adult in 1980 by more than 0.0018 in the year of birth, 0.0017 in the year after birth, 0.15 at age 2, down to less than 0.0010 at age 14.

Given that state income changes throughout childhood have effects on adult income, it is important to examine the impact of streams of income during childhood. Consider a white male high school graduate born in Alabama in 1923 and living in Alabama in 1980. Compare a situation where the Alabama state income per capita in the year before birth was one percent higher than a baseline and the growth rate of income each year through age 14 was one percent.

This stream of one percent higher growth rates from the year before birth through age 14 would have been associated with an income in 1980 that was 2 percent higher.

Another comparison, this time in dollar terms, would be to add one dollar (in 1967 dollars) to per capita income in Alabama in the year before birth and each year through age 14. This stream of dollars would have been associated with an increase of 0.38 percent in the Alabama man's income in 1980, or about $28.55 in 1980 income. After converting to 1967 dollars to make them comparable with the spending power of the state income measure, the rise is $11.57. As before, it is too optimistic to say that an additional $16 in state income per capita during the person's youth led to $11.57 in income at age 58 in 1980. A relevant comparison should take into account the opportunity cost of investments. For the purpose of discounting, assume a two-percent real discount rate for the long run. At the beginning of 1922, the year before the man was born, the present value of the stream of dollars each year from the year before birth through age 14 was $13.58 in 1967 dollars. If the Alabama man's parents could have invested that $13.58 at the beginning of the year before he was born and earned a two percent real return over 58 years, the value in 1980 would have been $42.82 (in 1967$). Thus, the stream of one dollar increases in per capita income has an effect on adult income that is approximately 25 percent of the income that would have been available in 1980 had that stream of income been invested in a retirement account.

We can use the coefficients to give a sense of the impact of the Great Depression on future incomes in 1980 by using the actual stream of per capita state income measures to predict what would happen to a series of white male high school graduates who lived in Alabama in 1980 who were born in Alabama during the years 1922 through 1945. Remember that we have already controlled for the year of birth, the fact that they were born in Alabama and that they live

in Alabama in 1980; therefore, the predictions are showing the impact of the changes over time in Alabama per capita income. [6]

Figure 2 shows the impact on the natural log of income in 1980 of the path of Alabama state income during childhood for white males in Alabama born in each year between 1922 and 1945. The estimates are calculated with regression coefficients, the actual log per capita level of real state personal income for Alabama in the year before birth, and the actual growth rates in real state personal income per capita through age 14 for each birth year. As a focal point for comparison, Figure 2 also shows what would have happened to 1980 income had Alabama real state income per capita started at the same initial level in 1922 and then grown each year throughout the period at 3.1 percent per year. The 3.1 percent estimate was the long run average annual rate of growth between 1923 and 1970 in Alabama.

The estimated 1980 income on the straight-line for those born in 1922 is higher than the estimated income based on the actual experience in Alabama, even through the log of Alabama per capita income used to calculate the estimates for people born in 1922 is the same in both cases. The reason for the difference is that the actual growth path in Alabama in the first fourteen years of life for someone born in 1922 was lower than the long run annual average growth path. The estimates based on the actual path are below the projected average path throughout the 1920s and the 1930s. Only men born after 1942 experienced childhood income levels and growth rates

[6]We are trying to gauge the impact of living through the Depression in a disastrous state compared to living in a state that was less affected. Alabama had the fifth lowest per capita income in 1929, fourth lowest in 1933, and third lowest in 1939. Alabama had a mid-range drop in per capita income of 28.7 percent between 1929 and 1933. Massachusetts ranked eighth in per capita income in 1929, fourth in 1933, and 7th in 1939. It had the sixth lowest percentage drop of 16.9 percent from 1929 to 1933 in real per capita income and by 1939 its real income had returned to 99.7 percent of its 1929 level.

that put their later incomes above the projected incomes associated with growth path based on the same long run average annual growth rates each year. These men grew up during the rapid expansion in real GDP during the war and in most of the post-war years.[7]

The long range income effects in 1980 of the gyrations in state per capita income for people born between 1920 and 1945 are muted relative to the size of the original fluctuations. Figure 3 compares the percentage changes in Alabama real per capita income between 1922 and 1945 to the percentage changes in the impact of the changes on income in 1980 for the men born in Alabama in those years. Alabama experienced some large fluctuations with drops in real per capita income of roughly 15 percent per year in three years in the early 1930s and then rapid increases above 10 percent in several years at the end of the decade and during World War II. Meanwhile, the percentage changes in 1980 income related to these gyrations are much smaller and typically less than 2 percent.

There are two main reasons for the muted effect. First, the coefficient on the log level of income in the year before birth is substantially less than one. Second, the growth rates during the first fourteen years of childhood also influenced the adult income in 1980. As a result, the tremendous drop in real incomes between 1929 and 1933 in Alabama during the Great Depression influenced the 1980 incomes of everybody born in the 1920s as well as those born in the trough of the Depression. Another potential reason for the muted effect may be measurement error in the coefficients that arises to the extent that people born in Alabama in that year and living in Alabama in 1980 had moved out of the state during childhood and then returned by 1980. Our sense is that this is a relatively small effect, but we have as yet been

[7] Robert Higgs (1991) argues that the official income and consumption measures between 1942 and 1945 overstate the true level of living experienced by Americans in that period. We are still working on ways to take that information into account.

unable to get a measure of the extent to which people move out as children and then return later in life.

Not every state experienced the same degree of fluctuations in state per capita income as Alabama. Figure 4 compares the impact on 1980 income of the path of state per capita income during childhood on white high school graduates by birth year for men born in Alabama and living in Alabama in 1980 and men born in Massachusetts and living in Massachusetts in 1980. Part of the difference in the income levels predicted from the regression equation is driven by the fact that the intercept terms for men born in Massachusetts and living in Massachusetts in 1980 are more positive than for men born in Alabama and living in Alabama in 1980, respectively. The differences in the intercepts reflect long-standing differences in income by region that have narrowed over time.

Another reason for the difference in long run impacts is that Massachusetts had a much milder Depression than did Alabama. Figure 5 shows the path of the natural log of real per capita income in Alabama and Massachusetts between 1921 and 1945. While Alabama experienced three years of 15 percent declines in income during the early 1930s, Massachusetts experienced only one. Alabama also experienced much more of a boom during World War II and after than did Massachusetts.

The effect of income in the birth year can also be found in the birth year dummy variables. Remember that the effects for state income fluctuations described above are associated with the state-specific income fluctuations because the analysis controls for nation-wide shocks by including a series of birth-year dummy variables. The coefficients of the birth-year dummies capture the effects of nationwide macroeconomic shocks as well as other factors common to the people born in that year, of which age is the most important. The plot of the birth-year coefficients in Figure 6 shows the strong effects of the standard hump-shaped age-earnings profile found in income regression. The effect in this case is reversed, however, because the birth

year for all of these people is 1980 minus the age. The curve is relatively smooth so it appears that the age-earnings profile is the dominant feature.

To explore the extent to which changes in the macroeconomy influenced the curve, we run a descriptive regression with the birth-year coefficients as the dependent variable as a function of age, age-squared, the natural log of real U.S. GDP per capita in that year and a series of future growth rates in real U.S. GDP per capita akin to the group of growth rate in the year of birth and the growth rates up to age 14 that we incorporated in the regressions above. The results of the regression are reported in Table 4. [8] The age and age-squared coefficients have the expected positive and negative signs, respectively. The coefficient on the natural log of real U.S. GDP in that year is roughly the size of the coefficient for the log of state real GDP in the regression for 1980 in Table 3. Similarly, the coefficients for the future growth rates through childhood show a pattern of being positive and declining over the course of childhood. The smoothness of the birth-year coefficient curve in Figure 1 therefore appears to be a function of both the smoothness of the age-earnings profile and the fact that growth during multiple years during childhood influences future earnings.

The middle column of Tables 2 and 3 report the marginal effects from a probit analysis of whether the person reports a disability that makes it difficult to work, limits work, or prevents work in 1970 and 1980. Again, the results support the hypothesis that local economic conditions before birth and early childhood statistically significantly affect later life outcomes. Increasing

[8] We have also run a much simpler specification with just the age variables and the log real U.S. GDP per capita. The coefficients for age and age-squared were roughly the same as reported in Table 4, while the coefficient on the log of real GDP was negative. Given that we were finding effects of growth rates later in childhood in the regressions in Tables 2 and 3, we then estimated specifications with more future lags and discovered the same pattern in the birth-year coefficients that we were finding for the state income growth rates through childhood.

birth state income in the year before birth by one percentage point leads to a 4.5 percent reduction in the probability of having a disability in 1980, and a 3.34 percent decrease in the probability of disability in 1970. The estimated coefficients on income growth rates are also negative and generally statistically significant, suggesting that children living in poorer states in childhood are at an increased risk for disability in their adult years, controlling for other factors.

The final column of Tables 2 and 3 report marginal effects from a probit analysis of whether the individual dropped out of high school. For the most part, higher state income in the year before birth and higher real income growth rates during childhood lead to a lower likelihood of dropping out of high school. A one percentage point increase in birth state income in the year before birth leads to a 9.7 percent reduction in the likelihood of being a high school dropout in both 1970 and 1980. The estimated coefficients remain negative and statistically significant for most years following birth, suggesting that children living in states with higher income growth rates throughout childhood have a lower probability of dropping out of high school than children living in poorer states, even after controlling for birth year, birth state, and current state fixed effects.

Discussion

Adults who were born and/or were children during the Great Depression earned substantially lower incomes, were more likely to have dropped out of high school, and were more likely to be disabled. Although we focus on the impact of the Great Depression, the study is more general because it covers the experiences of people born during the years 1919 through 1960. The results are consistent with the fetal origins hypothesis that conditions experienced by the mother and child in and around the time of birth influence later socioeconomic success. The results provide more generality to the findings by Van den Berg, Lindeboom and Portrait that 19th century infants in the Netherlands born during recessions had shorter life spans than those born during booms. The results also suggest that adult incomes are influenced not only by the state of

the economy and parent's incomes during the pre-natal and birth years but also by fluctuations in growth through most of childhood. The finding is consistent with Richard Easterlin's arguments that expectations set by economic conditions during childhood influence economic success later in life. However, the results may run counter to findings by others that suggest that infants conceived in times of recession do better (in the short run) than infants conceived in booms.

The reasons for the discrepancy aren't obvious and require further investigation. It could be that the impact of the Great Depression was so severe that the income effects of job loss outweighed the time substitution effects and worsened infant health and possibly stunted development during childhood. The effect we estimate combines two effects that operate through the incomes of the person's own parents to the extent that the parents' income fluctuations match the fluctuations in the state incomes and through spillover effects on to the individual from the experiences of their neighbors in the states.

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Table 1: Sample Means and Standard Deviations

Variable	Mean (Std. Dev.), 1970	Mean (Std. Dev.), 1980
Ln(Total Income)	8.7857	9.5714
	(1.4172)	(0.8520)
Disability	0.0859	0.0922
	(0.2803)	(0.2893)
High School Dropout	0.3257	0.2207
	(0.4686)	(0.4147)
Ln(Real birth state income), (b-1)	7.0851	7.2996
	(0.4318)	(0.4488)
Real birth state income growth rate, (b)	0.0325	0.0219
	(0.0984)	(0.0844)
Real birth state income growth rate, (b+1)	0.0336	0.0252
	(0.0943)	(0.0810)
Real birth state income growth rate, (b+2)	0.0274	0.0243
	(0.0952)	(0.0799)
Real birth state income growth rate, (b+3)	0.0206	0.0221
	(0.0956)	(0.0781)
Real birth state income growth rate, (b+4)	0.0219	0.0223
	(0.0943)	(0.0767)
Real birth state income growth rate, (b+5)	0.0224	0.0233
	(0.0937)	(0.0751)
Real birth state income growth rate, (b+6)	0.0260	0.0238
	(0.0927)	(0.0739)
Real birth state income growth rate, (b+7)	0.0266	0.0239
	(0.0921)	(0.0733)
Real birth state income growth rate, (b+8)	0.0267	0.0244
	(0.0911)	(0.0722)
Real birth state income growth rate, (b+9)	0.0267	0.0251
	(0.0900)	(0.0710)
Real birth state income growth rate, (b+10)	0.0285	0.0272
	(0.0861)	(0.0676)
Real birth state income growth rate, (b+11)	0.0335	0.0303
	(0.0816)	(0.0646)
Real birth state income growth rate, (b+12)	0.0397	0.0345
	(0.0747)	(0.0596)
Real birth state income growth rate, (b+13)	0.0380	0.0349
	(0.0737)	(0.0584)
Real birth state income growth rate, (b+14)	0.0337	0.0335
	(0.0720)	(0.0563)
Black	0.0878	0.0983
	(0.2829)	(0.2978)

High School Graduate	0.3583	0.3538
	(0.4795)	(0.4782)
Some College	0.1329	0.1903
	(0.3395)	(0.3925)
College Graduate	0.1831	0.2351
	(0.3868)	(0.4241)
Married	0.8391	0.7541
	(0.3674)	(0.4306)
Hispanic	0.0180	0.0294
	(0.1331)	(0.1690)
Infant Mortality Rate	58.3408	46.5171
	(17.4475)	(19.5755)

Notes: Sample includes males over age 25 at the time of the census. State income is in 1967 dollars; total personal income in 1970 and 1980 is in current dollars. N = 229,387 in 1970 and N= 2,006,977 in 1980.

Table 2:

Coefficients and Standard Errors (in Parentheses) from Estimations Using 1970 Census Micro-Data

	Ln(total income)	P(Disabled)	P(HS Dropout)
Ln(Real birth state income), (b-1)	0.2692 [a]	-0.0339 [a]	-0.0961 [a]
	(0.0567)	(0.0107)	(0.0197)
Real birth state income growth rate, (b)	0.2036 [a]	-0.0298 [b]	-0.0868 [a]
	(0.0647)	(0.0127)	(0.0235)
Real birth state income growth rate, (b+1)	0.2086 [a]	-0.0298 [b]	-0.0379
	(0.0686)	(0.0137)	(0.0252)
Real birth state income growth rate, (b+2)	0.2249 [a]	-0.0468 [a]	-0.0723 [a]
	(0.0695)	(0.0136)	(0.0250)
Real birth state income growth rate, (b+3)	0.2356 [a]	-0.0382 [a]	-0.0925 [a]
	(0.0686)	(0.0135)	(0.0249)
Real birth state income growth rate, (b+4)	0.1833 [a]	-0.0320 [b]	-0.0591 [b]
	(0.0679)	(0.0136)	(0.0250)
Real birth state income growth rate, (b+5)	0.1824 [a]	-0.0164	-0.0666 [a]
	(0.0688)	(0.0136)	(0.0250)
Real birth state income growth rate, (b+6)	0.2463 [a]	-0.0396 [a]	-0.0572 [b]
	(0.0681)	(0.0139)	(0.0256)
Real birth state income growth rate, (b+7)	0.2624 [a]	-0.0344 [b]	-0.0737 [a]
	(0.0699)	(0.0141)	(0.0261)
Real birth state income growth rate, (b+8)	0.2816 [a]	-0.0341 [b]	-0.0492 [c]
	(0.0709)	(0.0145)	(0.0267)
Real birth state income growth rate, (b+9)	0.1948 [a]	-0.0313 [b]	-0.0257
	(0.0742)	(0.0146)	(0.0271)
Real birth state income growth rate, (b+10)	0.1653 [b]	-0.0109	-0.0392
	(0.0722)	(0.0148)	(0.0273)
Real birth state income growth rate, (b+11)	0.1484 [b]	-0.0206	-0.0518 [c]
	(0.0745)	(0.0150)	(0.0278)
Real birth state income growth rate, (b+12)	0.1353 [c]	-0.0388 [a]	-0.0345
	(0.0733)	(0.0149)	(0.0275)
Real birth state income growth rate, (b+13)	0.0152	-0.0019	-0.0032
	(0.0739)	(0.0150)	(0.0278)
Real birth state income growth rate, (b+14)	0.0999	-0.0225	-0.0160
	(0.0731)	(0.0153)	(0.0281)
Black	-0.5135 [a]	0.0035 [c]	0.1873 [a]
	(0.0148)	(0.0021)	(0.0041)

High School Graduate	0.4525 [a]	-0.0422[a]	
	(0.0073)	(0.0012)	
Some College	0.5725 [a]	-0.0402[a]	
	(0.0090)	(0.0013)	
College Graduate	0.8298 [a]	-0.0598[a]	
	(0.0080)	(0.0011)	
Married	1.053 [a]	-0.0920[a]	-0.0700[a]
	(0.0126)	(0.0020)	(0.0029)
Hispanic	-0.1502 [a]	-0.0080[c]	0.3073[a]
	(0.0252)	(0.0041)	(0.0084)
Infant Mortality Rate	0.0008[b]	0.0001	0.0002[c]
	(0.0004)	(0.0001)	(0.0001)
Birth state dummies	Included	Included	Included
Birth year dummies	Included	Included	Included
Current state of residence dummies	Included	Included	Included
N	228,992	229,387	229,387
R^2	0.175	0.057	0.072

Notes: Sample includes males over age 25. Robust standard errors in parentheses. Column 1 reports OLS estimated coefficients; columns 2 and 3 report probit marginal effects (R^2 for these columns is pseudo R^2). For the independent variables with respect to income growth rate, in state of birth, b denotes the growth rate, between the year before birth and the year of birth, (b+1) denotes growth rate, between birth year and birth year + 1, etc. a: denotes statistical significance at the 1% level. b: denotes statistical significance at the: 5%. c: denotes statistical significance at the 10% level.

Table 3:
Coefficients and Standard Errors (in Parentheses) from Estimations
Using 1980 Census Micro-Data

	Ln(total income)	P(Disabled)	P(HS Dropout)
Ln(Real birth state income), (b-1)	0.2626 [a]	-0.0451 [a]	-0.0970 [a]
	(0.0093)	(0.0028)	(0.0045)
Real birth state income growth rate, (b)	0.1786 [a]	-0.0413 [a]	-0.0868 [a]
	(0.0145)	(0.0046)	(0.0073)
Real birth state income growth rate, (b+1)	0.1709 [a]	-0.0424 [a]	-0.0657 [a]
	(0.0151)	(0.0048)	(0.0077)
Real birth state income growth rate, (b+2)	0.1486 [a]	-0.0414 [a]	-0.0584 [a]
	(0.0154)	(0.0049)	(0.0078)
Real birth state income growth rate, (b+3)	0.1315 [a]	-0.0381 [a]	-0.0449 [a]
	(0.0158)	(0.0050)	(0.0079)
Real birth state income growth rate, (b+4)	0.1245 [a]	-0.0366 [a]	-0.0619 [a]
	(0.0160)	(0.0051)	(0.0081)
Real birth state income growth rate, (b+5)	0.1284 [a]	-0.0337 [a]	-0.0502 [a]
	(0.0162)	(0.0052)	(0.0082)
Real birth state income growth rate, (b+6)	0.0897 [a]	-0.0306 [a]	-0.0557 [a]
	(0.0166)	(0.0053)	(0.0084)
Real birth state income growth rate, (b+7)	0.1094 [a]	-0.0361 [a]	-0.0661 [a]
	(0.0169)	(0.0054)	(0.0085)
Real birth state income growth rate, (b+8)	0.1216 [a]	-0.0284 [a]	-0.0716 [a]
	(0.0174)	(0.0055)	(0.0087)
Real birth state income growth rate, (b+9)	0.1251 [a]	-0.0316 [a]	-0.0510 [a]
	(0.0176)	(0.0055)	(0.0088)
Real birth state income growth rate, (b+10)	0.0905 [a]	-0.0266 [a]	-0.0511 [a]
	(0.0178)	(0.0056)	(0.0089)
Real birth state income growth rate, (b+11)	0.072 [a]	-0.0171 [a]	-0.0537 [a]
	(0.0182)	(0.0057)	(0.0091)

Real birth state income growth rate, (b+12)	0.0917 [a] (0.0182)	-0.0212 [a] (0.0057)	-0.0389 [a] (0.0090)
Real birth state income growth rate, (b+13)	0.0728 [a] (0.0185)	-0.0219 [a] (0.0058)	-0.0257 [a] (0.0092)
Real birth state income growth rate, (b+14)	0.0904 [a] (0.0188)	-0.0236 [a] (0.0058)	-0.0408 [a] (0.0093)
Black	-0.336 [a] (0.0024)	0.0078 [a] (0.0007)	0.1288 [a] (0.0012)
High School Graduate	0.3628 [a] (0.0017)	-0.0479 [a] (0.0004)	
Some College	0.4665 [a] (0.0019)	-0.0480 [a] (0.0004)	
College Graduate	0.6945 [a] (0.0018)	-0.0800 [a] (0.0004)	
Married	0.432 [a] (0.0015)	-0.0750 [a] (0.0006)	-0.0464 [a] (0.0007)
Hispanic	-0.1552 [a] (0.0039)	-0.0094 [a] (0.0011)	0.2724 [a] (0.0024)
Infant Mortality Rate	-0.0003 [a] (0.0001)	0.0001 [a] (0.0000)	0.0002 [a] (0.0000)
Birth state dummies	Included	Included	Included
Birth year dummies	Included	Included	Included
Current state of residence dummies	Included	Included	Included
Number of observations	1,953,824	2,006,977	2,006,977
R^2	0.2107	0.0851	0.0986

Notes: Sample includes males over age 25. Robust standard errors in parentheses. Column 1 reports OLS estimated coefficients; columns 2 and 3 report probit marginal effects (R^2 for these columns is pseudo R^2). For the independent variables with respect to income growth rate, in state of birth, b denotes the growth rate, between the year before birth and the year of birth, (b+1) denotes growth rate, between birth year and birth year + 1, etc. a: denotes statistical significance at the 1% level. b: denotes statistical significance at the: 5%. c: denotes statistical significance at the 10% level.

Table 4
Descriptive Regressions of Birth-Year Coefficients from Table 3 on Age, Age-Squared, and Per-Capita State Income Path

Variable	Coefficient	Standard Error
Age in 1980	0.1048	0.0020
Age-Squared	-0.0009	0.0000
ln(real U.S. GDP per capita) in year t	0.2625	0.0717
Growth rate in real GdP in year t+1	0.2956	0.0620
Growth rate in real GdP in year t+2	0.2512	0.0687
Growth rate in real GdP in year t+3	0.2227	0.0704
Growth rate in real GdP in year t+4	0.2139	0.0628
Growth rate in real GdP in year t+5	0.2488	0.0614
Growth rate in real GdP in year t+6	0.1953	0.0571
Growth rate in real GdP in year t+7	0.1371	0.0473
Growth rate in real GdP in year t+8	0.1467	0.0550
Growth rate in real GdP in year t+9	0.1468	0.0525
Growth rate in real GdP in year t+10	0.1474	0.0463
Growth rate in real GdP in year t+11	0.1417	0.0379
Growth rate in real GdP in year t+12	0.0232	0.0365
Growth rate in real GdP in year t+13	0.0356	0.0363
Growth rate in real GdP in year t+14	0.0201	0.0366
Growth rate in real GdP in year t+15	0.0758	0.0381
Constant	-5.2373	0.6827

Sources: The birth-year coefficient and age information is from the estimation results for 1980 ln(income) in Table 3. Real GDP per capita is series CA=11 from Table Ca9-19 (Sutch, 2006).

Figure 1
1933/1929 and 1939/1929 Ratio of Real Per Capita Income By State

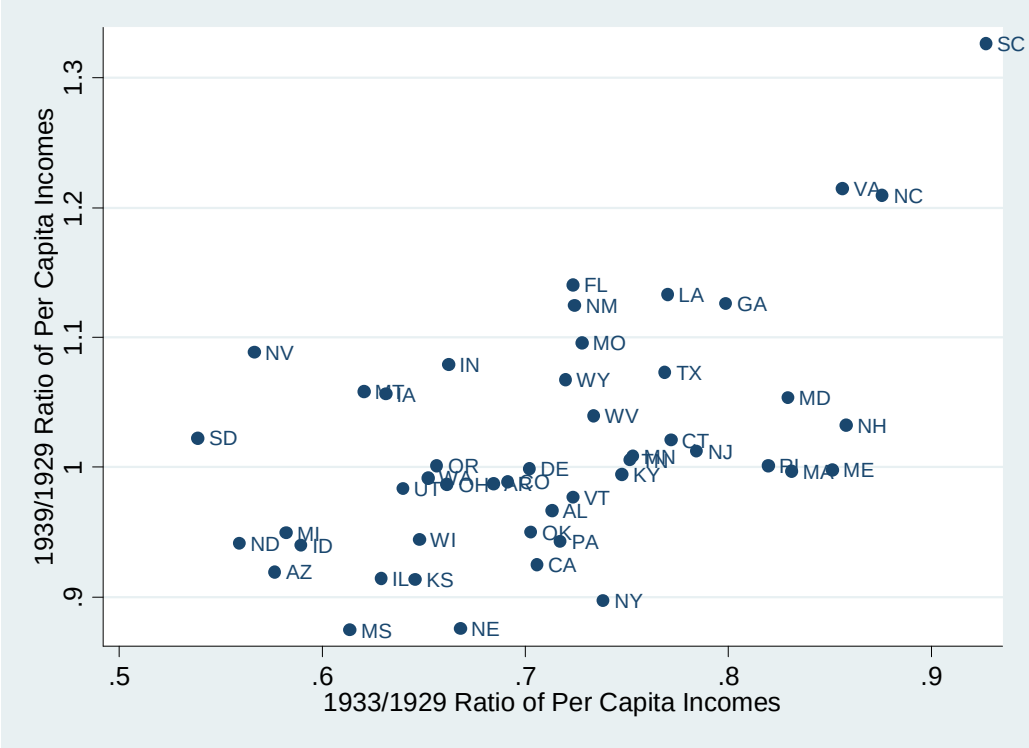


Figure 2
Impact on Natural Log of Income in 1980 of the Path of Alabama Real Per Capita Income During Childhood By Birth Year for White Male High School Graduates Born in Alabama and Living in Alabama in 1980

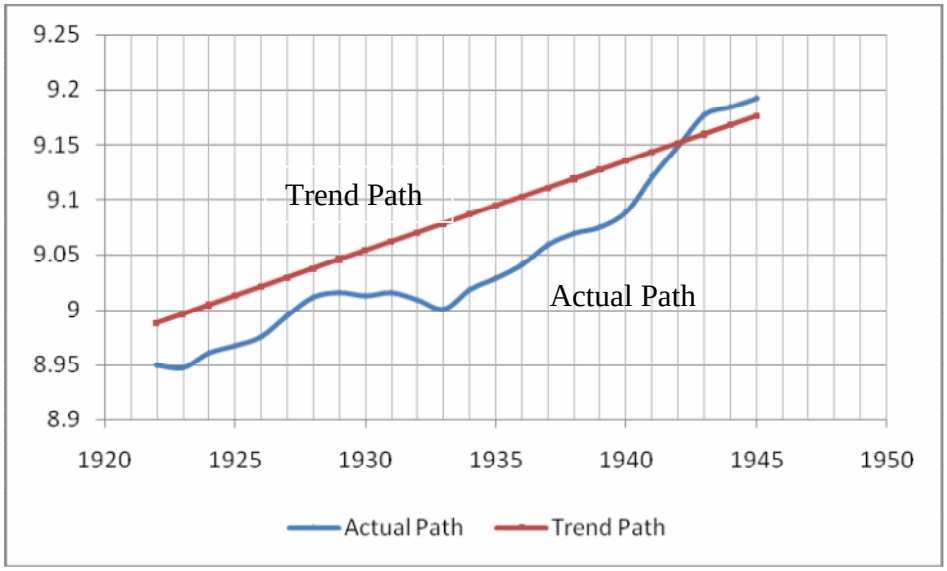


Figure 3
Changes in the Predicted Natural Log of Income in 1980 and How They Relate to the Changes in the Natural log of Real Per Capita Income by Birth Year For White Male High School Graduates Born in Alabama and Living There in 1980

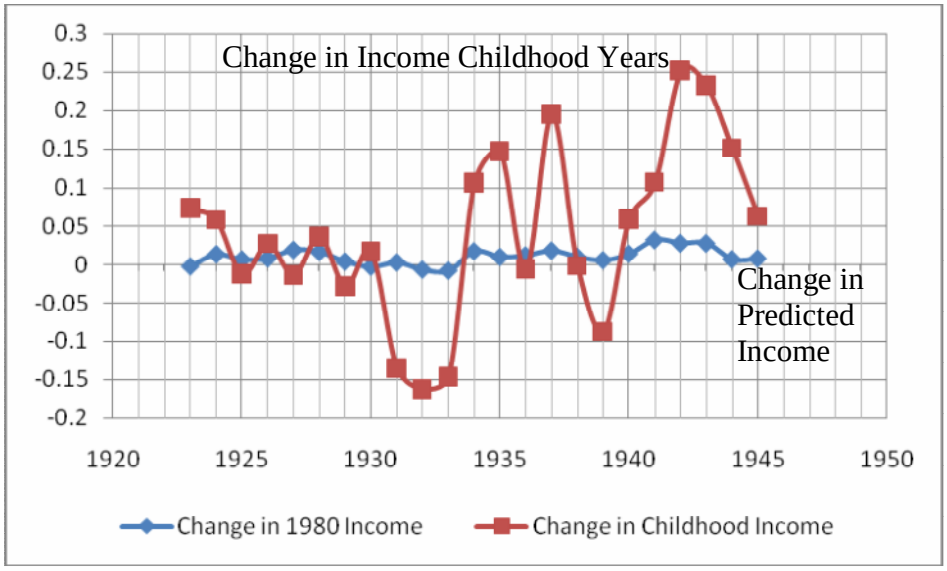


Figure 4
Predicted Natural Log of Income in 1980 By Birth Year Based on State Income Path During Childhood for White Male High School Graduates Born in Alabama and Living There in 1980 and Born in Massachusetts and Living There in 1980

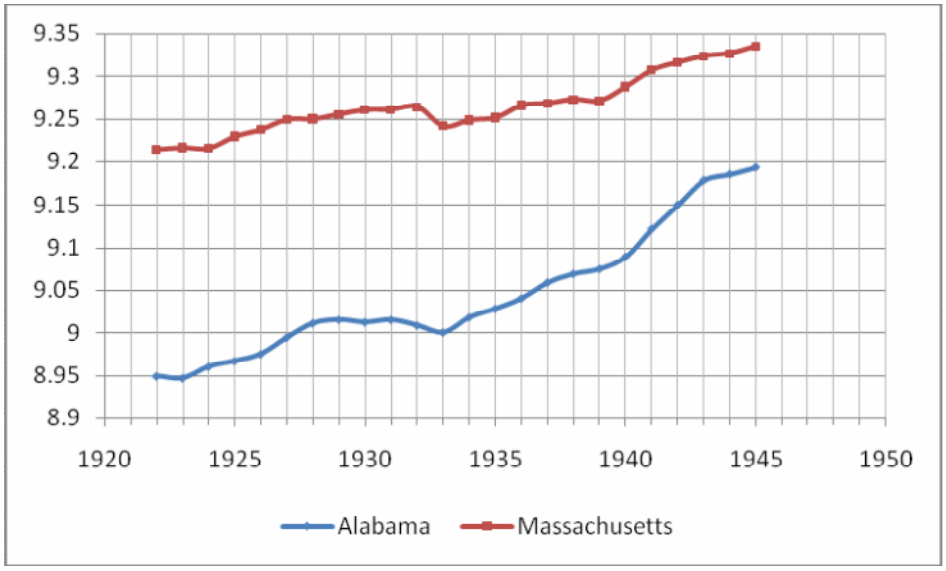


Figure 5
Natural Log of Real Per Capita Income by Year in Alabama and Massachusetts, 1922-1945

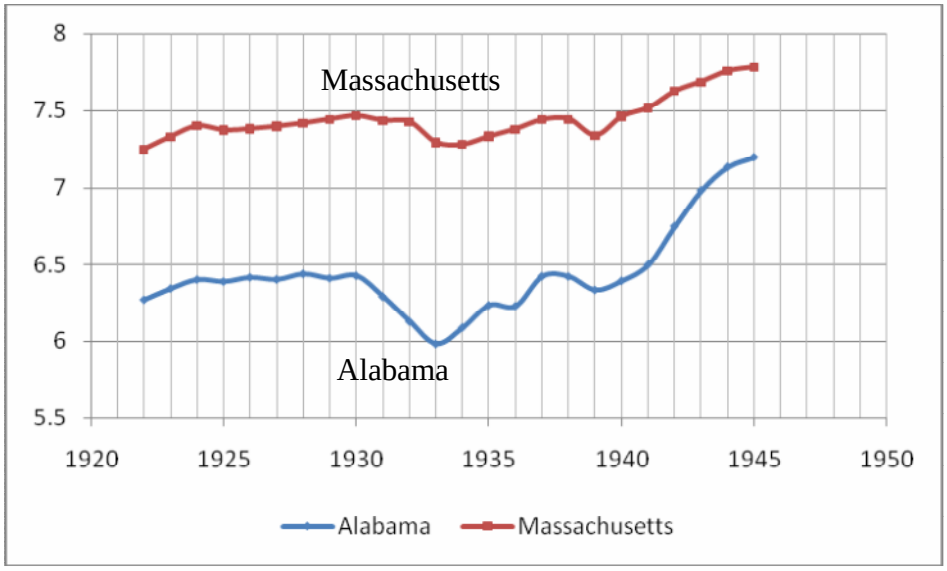
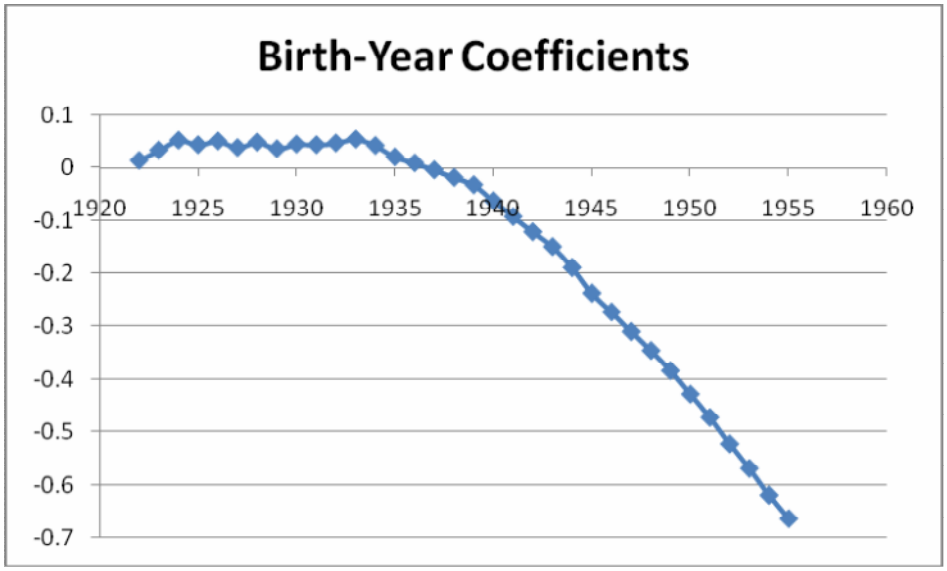


Figure 6
Birth Year Coefficients for the Natural Log of Income Regressions in 1980 from Table 3



Appendix I

Discussion of 1980 Results With a More Limited Specification

In the main text we focused on a specification that incorporated information on state per capita income in the year before birth all the way through a person's childhood up to age 14. We have also estimated a variety of sparer specifications. Generally, as the number of growth rates during childhood years decreases, the coefficient on the log level of real per capita state income in the year before birth gets smaller, as do the coefficients on the growth rates in real per capita state incomes. It turns out, however, that the dollar-for-dollar comparisons of the impact of an additional dollar or stream of dollars during childhood on the number of additional dollars in income in 1980 are similar across the specification. This appendix walks through the comparisons that we performed in the text.

The specifications show that income during the prenatal period and the growth rate in income during the year of birth were both important. A one percent increase in birth state real income in the year before birth was associated with personal income as an adult in 1980 that was 0.17 percent higher. We can also put this into a dollar-for-dollar comparison. Consider a white male high school graduate who was born in Alabama in 1923 and lived in Alabama in 1980. The coefficient implies that adding an additional dollar (1967$) per capita to Alabama state income in 1922, the year before he was born, holding all else constant, would have been associated with an increase in his income in 1980 of $1.43 (1967$) (In the main text this was $1.53). This is a sizeable effect but does not take into account the rates of return on investment over time. Had the Alabama man's father invested one dollar in a retirement account for his anticipated son in 1922 and earned an average real rate of return of 2 percent, the Alabama man could have withdrawn $3.15 from the account in 1980.

There is also an additional effect of adding a percentage point of state personal income growth during the birth year. The statistically significant coefficient implies that percentage point rise in the year of birth raised income as an adult in 1980 by 0.09 percent.

Since the pre-natal year and the year of birth growth rate both contribute to adult income, it is important to look at the impact of the combination of the two effects during childhood. Consider a white male high school graduate born in Alabama in 1923 and living in Alabama in 1980. If Alabama state income per capita in the year before birth was one percent higher than a baseline and the growth rate of state income in the year of birth was one percent, the combination would have been associated with an income in 1980 that was 0.26 percent higher.

Another comparison, this time in dollar terms, would be to add one dollar (in 1967 dollars) to per capita income in Alabama in the year before birth and a dollar during the year of birth. This stream of dollars would have been associated with an increase of 0.05 percent in the Alabama man's income in 1980, or about $5.43 in 1980 income. After converting to 1967 dollars, the rise is $2.20. As before, it is too optimistic to say that an additional $2 in state income per capita during the person's youth led to $2.20 in income at age 58 in 1980. We need to take into account the opportunity cost of investments. For the purpose of discounting, assume a two-percent real discount rate for the long run. At the beginning of 1921, the present value of the stream of dollars in the prenatal and birth years is $1.94 in 1967 dollars. If the Alabama man's parents could have invested that $1.94 at the beginning of the year before he was born and earned a two percent real return over 58 years, the value in 1980 would have been $6.12. This is about a 0.36 ratio of gain in 1980 earnings to gain from investment of the amount in 1922. [In the main text, a dollar was handed out each year through age 14, leading to a rise in 1980 income (in $1967) of $11.57. The present value of the stream of dollars starting in 1922 was $13.68 in 1922, which when invested at a 2 percent real return from 1922 through 1980 became $42.82. This

would be about a 0.27 ratio of gain in 1980 income to gain from investment of the equivalent of investing the childhood income gain at the real rate of return until 1980.]

As before, it is too optimistic to say that an additional $16 in state income per capita during the person's youth led to $11.57 in income at age 58 in 1980. We need to take into account the opportunity cost of investments. For the purpose of discounting, assume a two-percent real discount rate for the long run. At the beginning of 1922, the year before the man was born, the present value of the stream of dollars each year from the year before birth through age 14 was $13.58 in 1967 dollars. If the Alabama man's parents could have invested that $13.58 at the beginning of the year before he was born and earned a two percent real return over 58 years, the value in 1980 would have been $42.82.