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A Blessing in Disguise: The Long-Term Effects of Childhood Exposure to the Boll Weevil on Old-Age Male Longevity

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ABSTRACT

The infamous agricultural pest, the boll weevil, spread across southern US counties between 1892 and 1920. It had devastating impacts on cotton production, a highly child-labor-intensive crop. This study examines how the arrival of the boll weevil and the subsequent reductions in child labor affect later-life mortality outcomes. Using Social Security Administration death records linked with the 1940 census, we document that the staggered spread of the boll weevil improved the longevity of exposed male children. Full exposure to the boll weevil is associated with an intent-to-treat effect of 1-3 months of higher longevity. We show that the estimated effects are robust across a wide array of specifications, are not driven by sociodemographic and socioeconomic compositional change in the final sample, and are not associated with pre-existing trends in the outcome. Further, we find larger impacts among Blacks, children of lower educated mothers, whose fathers work in the farming industry, and those born in high cotton intensity counties. Moreover, the effects appear to be substantially larger among children in states with less restrictive child labor policies, implying the role of these policies in reducing the adverse effects of child labor in the absence of the boll weevil in cotton production counties. Affected children are more likely to migrate, and their destination counties are more likely to be urban and have higher socioeconomic scores. The 1940 census suggests that the exposed children attain higher levels of education and have higher socioeconomic scores. We discuss the policy implications of these results in relation to child labor and school attendance policies in developing countries.

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1. Introduction

A recently growing literature investigates determinants of disparities in aging and longevity and documents the influence of early life and childhood conditions and exposures (Aizer et al., 2016; Barker, 1992, 1994, 1995; Hayward & Gorman, 2004; Lindeboom et al., 2010; Myrskylä, 2010). Shocks in early life and childhood change the trajectory of developmental outcomes and can be detected in later-life health and longevity. For instance, one prominent line of research examines the effects of quantity and quality of education on later-life health and mortality and finds neutral (Albouy & Lequien, 2009; Meghir et al., 2018) or positive impacts (Buckles et al., 2016; Lleras-Muney, 2005; Lleras-Muney et al., 2022). Another line of research investigates the influence of family socioeconomic conditions, parental job loss, and worsening local economic conditions and documents negative consequences on an array of later-life outcomes, including mortality and longevity (Hayward & Gorman, 2004; Noghanibehambari et al., 2024; Scholte et al., 2015; Van Den Berg et al., 2006). However, many exposures are multifaceted and affect children's outcomes in several ways. For instance, negative demand-side shocks in local labor markets may reduce household resources while also inducing migration. The health consequences of migration are not necessarily beneficial: Black, Sanders, et al. (2015) find that the Great Migration increased mortality among Black Southerners, while Finkelstein et al. (2021) show that destination locations can have significant effects on longevity.

The current study joins this literature by evaluating a unique and arguably exogenous agricultural labor market shock. Specifically, we focus on the cotton production sector in the early decades of the 20th century in the US South. In this period, the cotton harvest required a significant influx of additional labor from September to December. Due to their small size and nimble fingers,

children were often hired, both officially and unofficially, to meet the high demand for seasonal workers. The arrival of the boll weevil, an insect that feeds on cotton buds and flowers, caused widespread devastation to cotton crops, thereby reducing the demand for child labor in cotton harvesting.

Despite its negative impacts on agricultural output, income, land value, and parental employment opportunities, studies suggest that the staggered arrival of boll weevil resulted in overall improvements in children's educational outcomes. Baker (2015) employs county-level data from Georgia between 1914 and 1929 and uses the appearance of the boll weevil as an instrument for cotton production. He documents that a 10% decline in cotton production results in a 2% increase in the school enrollment rate among black children with no discernible impact on white children. Using the universe of southern counties, Baker et al. (2020) use the 1940 census and document that both white and black children who were 4-9 years old at the time of boll weevil's arrival reveal 0.24-0.36 additional years of higher completed education. Clay et al. (2020) document a 6% increase in wage income of black individuals who were exposed to the boll weevil during their childhood as observed in 1940. Lange et al. (2009) find that the boll weevil substantially reduced cotton production and cotton yield. They show that farmers shifted to other crops, although they faced reductions in land values. Further, they document considerable out-migration post-arrival of the pest, especially in counties with a higher baseline cotton production. Bloome et al. (2017) document reductions in the share of married individuals among African Americans following boll weevil's arrival. Among African Americans aged 20-29, the share of married individuals fell by roughly 3.7%.

A related strand of literature examines the health and demographic consequences of the boll weevil through alternative mechanisms. Clay et al. (2019) and Clay & Schmick (2025) show

that the boll weevil reduced cotton monoculture and increased local production of niacin-rich crops, which contributed to declines in pellagra mortality and improvements in height and weight among cohorts observed in World War II enlistment records. Other studies document demographic and labor-supply responses to the shock. Ager et al. (2017) find that female labor force participation declined following the boll weevil's arrival, especially among Black women, while Clay & Schmick (2025) show reductions in fertility among Black families. These changes may have increased household resources per child and improved early-life health.

These changes in social and economic conditions can affect children's outcomes in various ways, making a priori expectations about the net effects on later-life outcomes ambiguous. For example, the increases in schooling and migration likelihood could be at least partly counteracted by the worsening economic circumstances of the children's families and communities due to boll weevil infestations. We employ Social Security Administration male death records linked to the full count 1940 census to examine the effects of early life and childhood exposure to the boll weevil on later-life old-age longevity. Recent developments in cross-census linking algorithms allow us to link individuals from the 1940 census to historical full count censuses 1900-1930 in order to infer county of birth/childhood, an essential identifier in our setting. The data also provides a wide array of family socioeconomic and sociodemographic characteristics, which enables the implementation of heterogeneity analyses. We find net positive effects on the longevity of individuals who were exposed to the infamous agricultural pest during their childhood years. Specifically, full exposure to the boll weevil throughout childhood is associated with an increase in longevity of about 1.1 months. Among African Americans, the effects are roughly 77% larger than whites. We document that the impacts are almost exclusively concentrated among low educated families and in counties with higher cotton production levels in 1900. Moreover, we find

aspects of dynamic substitutability with state-level child labor laws whereby we observe considerably larger effects in states that have more liberal regulations regarding child labor and a small and insignificant effect in states with more restrictive child labor policies. These findings are consistent with partial substitutability between child-labor regulations and the boll-weevil-induced decline in demand for child labor: the shock had larger effects where legal restrictions on child labor were weaker.

Further, we implement a wide array of sensitivity checks and document that the observed impacts are quite robust to alternative specifications, functional forms, and sample selections. A series of event studies rule out concerns regarding pre-existing trends in education and longevity outcomes. We also show that endogenous changes in the sociodemographic and socioeconomic composition of the individuals in the final sample are not likely to confound the estimated effects. We further provide arguments that the limited death window selection likely underestimates the results and that the true effects are likely larger.

Consistent with prior literature, we find that exposed individuals are more likely to migrate from their county or state of birth or childhood residence by 1940. They are also more likely to move from rural to urban areas and to counties with higher socioeconomic indices. The estimated effect of boll-weevil exposure on longevity is approximately 2.45 months among migrants, whereas the estimate among non-migrants is small and statistically insignificant. Because migration is itself affected by boll-weevil exposure, however, this comparison does not identify the causal effect of migration on longevity. We therefore interpret migration as one behavioral response to the boll-weevil shock rather than as an independently established source of the longevity gains.

Reductions in the marginal productivity of child labor might discourage parents from having additional children by increasing the shadow price of children (Becker, 1960; Becker & Lewis, 1973). The resulting decreases in quantity of children may increase per child resources and investments, with implications for their health outcomes later in life (Hanushek, 1992). Using historical censuses 1900 – 1930, we observe significant reductions in fertility rates. Interestingly, similar to the effects on longevity, we observe larger reductions among black families. Fathers in these families are more likely to change occupation away from farming and toward manufacturing, services, and other sectors. However, we do not observe an overall change in their occupational scores or measures of socioeconomic status.

To further examine the mechanisms, we use the 1940 census and assess the effects of exposure on measures of education and socioeconomic status, given the literature that documents a link between education, income, socioeconomic status, and longevity (Fletcher, 2015b; Galama et al., 2018; Lleras-Muney et al., 2022). Full exposure to the boll weevil during childhood is associated with 0.11 additional years of higher education, 7.9% higher college attendance, and about 1.5% increase in their socioeconomic index.

This study makes three important contributions to the literature. First, it adds to the small literature that evaluates the impacts of the boll weevil on children's later-life outcomes (Baker, 2015; Baker et al., 2020; Bloome et al., 2017; Clay et al., 2019; Clay & Schmick, 2025; Lange et al., 2009). Although the boll weevil was eradicated in the 1970s, many developing countries still face similar invasive pests, plant pathogen epidemics, and other viral diseases. For instance, many countries in recent decades experienced agricultural pest crises, including the infamous cotton pests in West Africa, coffee leaf rust in Central America, Maize Lethal Necrosis Disease (MLND) in East Africa, and many instances of locust outbreaks in Africa and Asia. Besides, there is

evidence that climate change significantly contributes to the spread of agricultural pests, especially in temperate zones (Schneider et al., 2022). Since policy interventions are costly, it is important to have a full picture of their impacts and the relevant pathways and settings.

Second, since the findings point to a substitution of schooling for child labor as an important pathway, this paper also adds to the literature that examines the effects of education on mortality.[4] The reduction in the marginal productivity of child labor was plausibly exogenous as it was tied to the spreading path of the boll weevil. The presence, pace of population growth, and expansionary path of the pest was difficult to anticipate as it depended on several unpredictable factors, including wind direction, humidity, temperature, trade routes for agricultural equipment and other inputs, biological resistance of each generation to certain local control measures, and other environmental barriers such as mountains, lakes, rivers, and dry regions (Fye, 1968; McKibben et al., 1991; Pierce et al., 1912). The unpredictable spatial and timing movements of the boll weevil add to the exogeneity of the shock, hence arguably unconfounded long-term links.

Third, we contribute to the growing literature that examines the impacts of early life and childhood exposures and later-life mortality.[5] We provide evidence that reducing child labor and increasing schooling outcomes in the early years of childhood could outweigh the potentially

[4] We should note that the literature on the education-health gradient in general, and education-mortality specifically, is far from conclusive and provides mixed evidence depending on the cohort, setting, method, and data (Albarrán et al., 2020; Albouy & Lequien, 2009; Black, Hsu, et al., 2015; Brunello et al., 2016; Buckles et al., 2016; Clark & Royer, 2013; D. M. Cutler & Lleras-Muney, 2006; Fischer et al., 2013; Fletcher et al., 2021; Fletcher, 2015a; Fletcher & Frisvold, 2011; J. Fletcher & Noghanibehambari, 2023; Lager & Torssander, 2012; Leuven et al., 2016; Lleras-Muney, 2005; Lleras-Muney et al., 2022; Mazzonna, 2014; Meghir et al., 2018; Noghanibehambari & Fletcher, 2023a; Spoerri et al., 2014). Several studies review this literature, including Hamad et al. (2018), Xue et al. (2021), and Galama et al. (2018).

[5] This literature examines a wide array of early life shocks, including family socioeconomic status, family structure, local economic shocks, social policies and cash transfers, natural disasters, pesticide exposures, and several county level, state-level, and federal policy reforms (Case & Paxson, 2009; Finch & Crimmins, 2004; J. Fletcher & Noghanibehambari, 2024; Hayward et al., 2013; Hayward & Gorman, 2004; Lindeboom et al., 2010; Montez & Hayward, 2011; Noghanibehambari et al., 2024; Noghanibehambari & Engelman, 2022; Noghanibehambari & Fletcher, 2023c, 2023d, 2023f, 2023a, 2023b; Noghanibehambari & Noghani, 2023; Schmitz & Duque, 2022; Scholte et al., 2015; Smith et al., 2006; Van Den Berg et al., 2006).

negative effects of adverse economic shocks. This fact carries important policy implications, especially for developing countries with weak prevailing policies regarding child labor and education (Chorny et al., 2019).

The rest of the paper is organized as follows. Section 2 reviews the historical background. Section 3 introduces data sources and the process of sample selection. Section 4 discusses the econometric method. Section 5 reviews the results. Section 6 explores mechanism channels. Section 7 concludes the paper.

2. Historical Background

The boll weevil (scientific name: *Anthonomus grandis*) is a small beetle with a keen appetite for cotton buds and flowers. It is native to Central America and Mexico. In the late 19th century, it gradually spread northwards due to the expansion of cotton cultivation, migration, trade routes, and the movement of goods and agricultural products between Mexico and the US. It was first detected in the US in 1892 near Brownsville, Texas. After its arrival in Texas, the boll weevil expanded rapidly across the Southern United States, primarily because of its ability to fly short distances and its hitchhiking on cotton shipments. By 1903, it had spread to Louisiana, and within the next two decades, it reached most of the Cotton Belt, including Mississippi, Alabama, Georgia, and the Carolinas. By the 1920s, the boll weevil had infested the entire Cotton Belt, causing widespread destruction. The top panel of Figure 1 depicts the year of boll weevil's arrival across counties in the Cotton Belt.[6]

The boll weevil lays its eggs inside cotton buds and bolls (the rounded seed capsules of the cotton plant). The larvae feed on cotton bolls, resulting in the destruction of the plant. Many of the

[6] Cotton Belt states in the final sample include Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, Missouri, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia.

control measures, such as crop rotation, destruction of cotton stalks after harvest to reduce overwintering sites, and the development of early-maturing cotton varieties, produced limited impacts. Overall, the boll weevil's invasion significantly reduced cotton yields in cotton production counties and adversely affected local economies in the Cotton Belt. Lange et al. (2009) document that cotton production dropped by roughly 50% within five years of the boll weevil's arrival in a county.

Cotton was the staple crop of the US South. Roughly 75% of the total raw cotton production of the world came from Cotton Belt counties in the US during the early decades of the 20th century (Jordan, 1910). The mechanization of cotton production advanced in the years after World War II (Fite, 1950). Therefore, in prior decades, cotton bolls were picked by hand. The physical characteristics of the children made them suitable candidates for cotton harvesting during the harvest season, which lasted from September through December. Since many families were tenant farmers, it was common to use children as substitutes for adult labor. Early surveys from this period suggest that 66% of white children and 76% of black children engaged in farm work during the harvest season, nearly all of whom were involved in picking cotton (Bradley & Williamson, 1969). The arrival of the boll weevil disrupted this long-standing equilibrium by reducing the marginal productivity of child labor.

3. Data Sources

The primary source of data for this study comes from Social Security Administration Death Master Files (henceforth DMF) provided by the Censoc project (Goldstein et al., 2021). The data reports deaths that occurred among men between the years 1975-2005.

There are three advantages to using the DMF data in our setting. First, the data can be linked to the 1940 census at the individual level. The linkage allows us to observe all individual

and family level characteristics as reported in the 1940 census, including several measures of socioeconomic status, education, family structure, and granular residential location. Second, the initial data contains roughly 8 million death records. After the sample selection procedures explained below, focusing on affected cohorts in affected locations, we are still left with a relatively large sample size. This is in sharp contrast with alternative data sources that can be linked to the 1940 census, such as the Health and Retirement Study, which produces considerably smaller sample sizes on the order of several thousand. Third, since a large portion of individuals in the 1940 census can be linked back to historical censuses from 1900 to 1930, we can extract their county of residence during early life and childhood. This sub-state location identifier for place of birth, early life, and childhood allows us to examine granular shocks on long-term outcomes. It is arguably a rare piece of information in primary datasets that also report mortality and longevity.

We assign county of birth or early-life residence using a hierarchy of available sources. First, for individuals also observed in the Numerical Identification (Numident) records, we use the county of birth reported in their Social Security records. Although Numident covers a shorter death window, 1988–2005, it provides birthplace information unavailable in the DMF. For the remaining individuals, we use Census Tree Project links to connect their 1940 records to the 1900–1930 censuses (Price et al., 2021). We assign the county from the earliest available census, prioritizing 1900, then 1910, 1920, and 1930. When no earlier census location is available, we use the county of residence in 1935 reported in the 1940 Census for individuals who moved during those five years. Finally, we use the 1940 county of residence as a proxy for individuals without an earlier

location. Panel A of Appendix Figure A-1 summarizes this hierarchy and reports the share assigned through each source.[7]

We also use the historical census links to obtain maternal literacy and paternal socioeconomic status. The main sample includes men born in the South with available county-level boll weevil arrival data. We restrict the sample to birth cohorts of 1890–1940 and to individuals who were no older than 25 when the boll weevil arrived or were born within the following five years. After excluding observations without a valid mortality outcome, the final analytic sample contains 734,374 men. Panel B of Appendix Figure A-1 summarizes these restrictions.

To account for time-varying county characteristics, we construct a county-by-year panel from the 1880–1940 censuses, linearly interpolate between census years, and merge these characteristics with the individual records using early-life county and birth year.[8]

The data on the year of boll weevil's arrival is extracted from Baker et al. (2020). The data on agricultural production is taken from Gutmann (2005). All census data are extracted from Ruggles et al. (2020).

Appendix Figure A-1 provides a visual summary of the hierarchical procedure used to assign county of birth or early-life residence and the subsequent sample restrictions used to construct the final analytic sample.

[7] In Appendix A, we compare statistics of the final sample with those of the original population observed in the 1940 census. Further, we show that there is no discernible and sizable correlation between the exposure measure and successful data merging, suggesting that the process of data linking is not likely to confound our estimates.

[8] The main results of the paper are based on a sample of counties that ever experienced the boll weevil as reported by Baker et al. (2020). In Appendix C, we include all US counties and replicate the main results. We observe comparable and, in the fully parameterized model, slightly larger coefficient sizes.

Table 1 reports summary statistics for the final analytic sample of 734,374 men. For descriptive purposes, we divide individuals into two groups according to their childhood exposure to the boll weevil. The exposed group consists of individuals who experienced full exposure during ages 4–17, while the comparison group includes individuals with either no exposure or partial exposure during those ages. This grouping is used only to summarize the characteristics of the sample. In the regression analysis, exposure is measured continuously as the share of childhood years spent after the boll weevil's arrival, and the event-study specifications separately examine outcomes according to age at arrival.

Table 1 shows that exposed individuals have a lower unconditional mean age at death than non-exposed individuals, 897.4 versus 972.3 months. This difference is largely mechanical and should not be interpreted as evidence that exposure reduced longevity. The exposed group is substantially later-born, with an average birth year of 1915.7 compared with 1905.0 for the non-exposed group, while deaths are observed only between 1975 and 2005. Consequently, later-born cohorts can enter the sample after dying at younger ages, whereas earlier-born cohorts must survive to older ages for their deaths to fall within the same observation window. For example, an individual born in 1905 must survive to approximately age 70 to have a death observed beginning in 1975, whereas an individual born in 1916 can enter the sample after dying at approximately age 59. The lower mean age at death among the later-born, more-exposed group therefore reflects the mechanically different age ranges observable across birth cohorts within a fixed death window. Importantly, the empirical design does not compare these raw group means; the regressions include birth-year and birth-county fixed effects and exploit variation in childhood exposure conditional on these cohort and location differences.

Figure 2 plots the density distribution of age at death in the full analytic sample and provides a visual description of the variation in our primary outcome.

For the analysis regarding the mechanism channel, we restrict the sample to individuals above age 17 and focus on outcomes in the 1940 census. On average, individuals attain 8.4 and 8 years of schooling in exposed and unexposed groups, respectively.

4. Econometric Method

Our empirical method relies on the plausibly exogenous staggered spread of the boll weevil. The arrival of the boll weevil was likely exogenous, as it was connected to the boll weevil's unpredictable spatial and temporal diffusion. The pest's presence, population growth rate, and expansion path were challenging to forecast, influenced by various unpredictable factors, including wind patterns, humidity, temperature, agricultural trade routes, the biological resistance of each generation to local control efforts, and environmental obstacles like mountains, lakes, rivers, and arid areas. Therefore, it is unlikely that county-level arrival of the boll weevil correlates with determinants of local population health and longevity.

We implement difference-in-difference event study regressions to compare the longevity of individuals who were exposed to the boll weevil across different ages. We assume that the longevity of individuals across different ages at the time of the boll weevil's arrival would have followed the same evolutionary path in the absence of the arrival of the boll weevil. Specifically, we employ the following regressions:

$$y_{icb} = \alpha + \sum_{j \neq 13} \beta_j I(T_c^* - b = j) + \gamma X_{icb} + \lambda Z_{cb} + \xi_c + \zeta_b + \varepsilon_{icb} \quad (1)$$

The outcome, y, is age at death (measured in months) of individual i born in county c and year b. $I(.)$ equals one if the inside argument is true and zero otherwise. The parameter T^* represents county-specific year of boll weevil's arrival. Therefore, coefficients β represent longevity differences of cohorts at different ages at the time of boll weevil's arrival. We use the arbitrary age of 13 as the contrast group.[9] In matrix X, we include race and ethnicity dummies as individual covariates and paternal socioeconomic status and maternal education dummies as parental covariates. In matrix Z, we include county by cohort covariates, including per capita homeowners, number of under-five children, share of immigrants, average occupational income score, per capita literate, per capita employed, per capita workers in different industries, and share of married individuals. County fixed effects, represented by ξ, account for all unobserved characteristics of counties that affect children's outcomes and are common across birth cohorts. The parameter ζ represents birth year fixed effects, which absorb unobserved determinants of longevity that vary over time but are common across different counties. Finally, ε is a disturbance term. Standard errors are clustered at the county level to account for serial correlations in error terms.[10]

[9] We use age 13 as an early-adolescent reference category, motivated by the timing of agricultural adjustment and the remaining scope for schooling responses. The effects of the boll weevil on cotton production intensified over several years following its first arrival rather than materializing fully in the arrival year (Lange et al., 2009). Children aged 13 at arrival therefore progressed through adolescence as the agricultural shock developed, whereas younger children had more of their childhood schooling years remaining. Moreover, reductions in the opportunity cost of schooling may more readily prolong enrollment than induce a return to school after a child has already left for work (Baker et al., 2020). Age 13 thus provides an informative benchmark for comparing earlier-childhood exposure with exposure beginning in adolescence. This normalization does not require the reference group to be unaffected; the coefficients measure differences in age at death, in months, relative to individuals aged 13 when the boll weevil arrived. To assess whether the results depend on this normalization, Appendix Figure H-1 re-estimates Equation (1) using alternative omitted age-at-arrival categories. The resulting event-study profiles are qualitatively similar, indicating that the pattern of larger longevity estimates among individuals exposed at younger ages is not driven by the choice of age 13 as the reference category.

[10] The estimated coefficients and statistical significance remain virtually identical to the main results when standard errors are clustered by birth state, by state–year, or by county–year, and when Huber–White robust standard errors are used (see Appendix Table E-1). This consistency indicates that our inference is not sensitive to alternative standard error corrections.

To summarize the event study coefficients of equation 1, we construct an exposure variable that indicates a full exposure the boll weevil during ages 4-17. This variable ranges between 0 and 1, where 0 indicates no exposure during childhood (the boll weevil arrived after the individual turned 17), 1 indicates full exposure throughout childhood (the boll weevil arrived before the individual turned 4), and intermediate values capture partial exposure. For example, a child aged 10 at the time of arrival would have an exposure share of roughly 0.5, meaning half of their childhood years occurred after the boll weevil's arrival.[11] We then use this variable as the primary independent variable in regressions similar to equation 1, as follows:

$$y_{icb} = \alpha + \beta ExpShare_{cb} + \gamma X_{icb} + \lambda Z_{cb} + \xi_c + \zeta_b + \varepsilon_{icb} \quad (2)$$

All parameters are similar to those of Equation 1.

5. Results

5.1. Event Study Results

Figure 3 reports the event-study estimates from Equation (1). Relative to the omitted age category, the estimates for individuals aged 14 or older at arrival are small and statistically insignificant. The estimates become larger for those exposed at ages 6–12, although not all are statistically significant. They rise more clearly for children aged five or younger and stabilize at their highest levels among those aged two or younger.

Two considerations help explain why the largest estimates occur among younger children. First, prior research finds larger educational gains among children exposed at younger ages, particularly ages 4–6 (Baker et al., 2020). Our education event studies in Section 6.4 show a similar

[11] Appendix Table F-1 tests the sensitivity of the main results to alternative definitions of childhood exposure age cutoffs. The estimated coefficients show that the positive longevity effects of exposure to the boll weevil become larger and more statistically significant when restricting exposure to younger ages, peaking at a 3.1-month increase in lifespan for those exposed between ages 0–7 relative to those first exposed after 18.

age pattern. Second, the boll weevil's effects did not fully materialize in the year it first appeared in a county. Establishment within farms and diffusion across the county took time (Lange et al., 2009). The larger estimates at younger ages may therefore reflect both greater childhood exposure and delays in the shock's economic effects, rather than a sharply defined critical age.

In Appendix Figure D-1, we employ the method developed by De Chaisemartin & D'haultfoeuille (2020) that employs only not-yet treated groups for comparisons of two-way fixed effects. We observe comparable patterns and coefficient magnitudes. In Appendix Figure D-2, we show that the results are quite robust when accounting for treatment heterogeneity using the method developed by Sun & Abraham (2021).

5.2. Difference-in-Difference Results

The main results of Equation 2 are reported in Table 2. We start with a parsimonious specification in column 1 and add more covariates across consecutive columns. The coefficients are fairly robust. The fully parameterized regression of column 3 suggests that full exposure during childhood to the boll weevil is associated with about 1.1 months increases in longevity.

We can understand the economic significance of this effect by looking at other long-term determinants of longevity. For instance, Noghanibehambari & Fletcher (2023e) examine the long-lasting legacies of early-life exposure to the Dust Bowl of the 1930s for later-life mortality. They find that the longevity of male individuals from farmer families who were exposed to topsoil erosions due to the Dust Bowl drops by about 2.5 months. Therefore, the benefits of reductions in child labor due to the boll weevil are roughly 45% of the adverse impacts of substantial drops in agricultural income as a result of the Dust Bowl. Aizer et al. (2016) examine the impacts of the Mother Pension (MP) program under which poor single-mother families received cash transfers for up to three years in the early 20th century. These transfers accounted for about 40% of pre-

transfer family income. They document that the MP is associated with roughly 12-month increases in longevity of male children. Therefore, the intent-to-treat the effects of the arrival of the boll weevil is about 10% of treatment-on-treated effects of a relatively generous and long-lived social program. Chetty et al. (2016) use tax return data linked to death records and examine the relationship between income and longevity. They document that each additional income percentile is associated with roughly 1.4 months higher longevity. Therefore, the longevity effect of the boll weevil is equivalent to a rise in income distribution of about 0.8 percentiles. This is roughly a $6,400 change from the mean of income (in 2020 dollars).

5.3. Heterogeneity Analyses

Black children were more likely to work as child laborers in cotton cultivation forms than their white counterparts. Baker (2015) and Baker et al. (2020) find considerably larger impacts on school enrollment and completed education among black children compared to white children. Clay et al. (2020) also find larger impacts on the wage income of Blacks than whites for their early life and childhood exposure to the boll weevil. Therefore, one would expect to observe a similar pattern for longevity. These racial differences are partly driven from the distinct structural positions of Black and White families within the agricultural economy of the Jim Crow South. Black farmers were disproportionately tenant farmers and sharecroppers, occupying the lowest rungs of the agricultural hierarchy (Alston & Ferrie, 2005). When the boll weevil reduced cotton yields and land values, it weakened the economic ties binding Black families to the land and, in some cases, created opportunities to move or transition into non-farm occupations (Bloome et al., 2017; Lange et al., 2009). The same shock constrained many White landowners who faced substantial capital losses due to declining land values and crop revenues. As a result, the boll weevil's arrival may have produced both a larger reduction in child labor and greater potential for

geographic and occupational mobility among Black families. The combination of these forces, together with the higher prevalence of child labor among African Americans, likely amplified the long-term effects of the boll weevil on the educational and health outcomes of Black children.

To examine potential racial heterogeneity, we re-estimate the model separately for White and Black subsamples. These results are reported in columns 1-2 of Table 3. We observe a considerably larger coefficient among Blacks, suggesting increases in longevity of about 1.7 months, 77% larger than the effects on whites in column 1.

In columns 3-4, we examine heterogeneity based on maternal literacy. we observe a larger effect for children of illiterate mothers compared with literate mothers (2.4 versus 0.8 months), consistent with studies documenting heterogenous impacts of early life exposures by maternal education (Fletcher & Noghanibehambari, 2024; Rauscher & Cao, 2024) (columns 3-4). families of low educated parents are more likely to be farm laborers, and it is not uncommon for them to employ children as extra hands during the harvest seasons. Moreover, these low educated parents are also less likely to invest in the human capital of their children, hence more likely to encourage child labor (Emerson & Souza, 2003; Mukherjee & Das, 2008). Therefore, it is not surprising that the impacts are exclusively concentrated among families with low education.

Additionally, we observe substantially larger impacts in counties that have above-median share of farmers (columns 5-6). We also find heterogeneity based on the intensity of cotton production in the year 1900. The effects become larger for the subsample of the top quartile of 1900 cotton production and become smaller and statistically insignificant for the subsample of the bottom-three quartiles of 1900 cotton production (columns 7-8).

Children of farmers may be considered productive assets, as they can help parents reduce production and harvesting costs or increase efficiency. Studies suggest that reductions in the value

and productivity of child labor in agricultural production post-World War II were associated with decreases in foreign-born fertility rates (Rosenzweig, 1977). Therefore, one would expect differential impacts based on parents' farm-related occupational status. Indeed, we observe significantly larger impacts among children whose fathers' occupations are farm-related. The coefficient suggests an increase of 2.4 months in their longevity, although estimated noisily.

Early life Exposures and policies may interact to influence long-term outcomes (Conti et al., 2016; Cunha & Heckman, 2007; Johnson & Jackson, 2019). In our setting, an important factor that could dynamically interact with the aftermath of the boll weevil is the presence and stringency of child labor policies. We use data from Acemoglu & Angrist (2000) and assign different measures of child labor to individuals based on their state of birth. We then split the sample based on stringency and rigidity of child labor policies and replicate the results in columns 1-2 of Table 4. We observe an increase in longevity of about 1.4 months for full exposure of children to the boll weevil in states with liberal or no child labor policies. For states with more restrictive child labor laws, we observe an effect size of 0.3 months, although statistically insignificant. These results suggest that there is a degree of substitutability between child labor policies and changes in marginal productivity of child labor as a result of the arrival of the boll weevil.

5.4. Sensitivity Analyses

In Table 5, we investigate robustness checks to alternative specifications. To have a benchmark comparison, we replicate the results of column 3 of Table 2 in column 1 of this table. In column 2, we allow for the influence of time-invariant county characteristics to have a differential impact on longevity based on individual race, maternal literacy, and paternal socioeconomic status. The estimated coefficient is comparable to that of column 1. To account for cross-cohort differential evolution of longevity across different census divisions, we interact

census-division-of-birth by birth-year fixed effects in column 3. The estimated effect is slightly smaller than the main results but remains economically and statistically meaningful.

To account for cross-state migration and specifically the influence of the great migration of Southerners to Northern states, we add the interaction of birth state fixed effects by state of residence in 1940 fixed effects. The results, reported in column 4, are almost identical to that of column 1.

A small strand of research documents the influence of the season of birth on later-life longevity (Vaiserman, 2021; Vaiserman et al., 2002). In addition, there is a narrow literature that documents the phenomenon of seasonality in mortality outcomes (Falagas et al., 2009; Seretakis et al., 1997). To address such seasonality concerns, we add birth month and death month fixed effects into our regressions. The results, reported in column 5, reveal a comparable coefficient to that of column 1.

In columns 6-9, we examine the robustness to alternative functional forms. In column 6, we replace the outcome with the log age-at-death. Full exposure is associated with 0.12% rise in longevity, which is similar to the implied percentage change with respect to the mean of the outcome in column 1. In columns 7-9, we examine the effects on longevity beyond ages 70, 75, and 80, respectively. Full exposure is associated with 46, 63, and 49 basis points increases in the probability of longevity beyond age 70, 75, and 80, respectively. Comparing with the mean of the outcomes, these effects can be translated into a change of 0.6%, 1%, and 1.2%, respectively.

In column 10, we weight regressions by the share of farmers in 1900 to assign higher weights to counties with a higher share of farmlands. Although the estimated coefficient drops slightly, it remains comparable to that of column 1.

A research strand examines the influence of exposure to the 1918 influenza and later-life outcomes, including mortality and longevity (Almond, 2006; Fletcher, 2018a, 2018b, 2018c; Myrskylä et al., 2013; Noghanibehambari & Fletcher, 2023e). To mitigate the 1918 influenza's confounding influence on our results, we remove cohorts born between 1918 and 1919 and replicate the results. The estimated coefficient, reported in column 11, is larger than column 1.

During the same period in the southern counties, there were two prominent public health interventions to eradicate hookworm (during 1910s) and malaria (during 1920s) diseases. Studies suggest that these eradication campaigns are associated with improvements in later life human capital and measures of socioeconomic status (Bleakley, 2007, 2010; Bleakley & Lange, 2009; Elman et al., 2019; Henderson, 2018). To control for the potential confounding influence of these eradication campaigns, we extract county level hookworm treatment data from Henderson (2018) and state-level malaria risk index data from Bleakley (2010). We then interact these measures with birth year fixed effects to flexibly allow these exposures to vary across cohorts and include them in the regressions. Although the point estimate drops slightly, it remains comparable to that of column 1.

Another concern is that exposure to the boll weevil may be associated with changes in the composition of individuals observed in the final linked sample. To examine this possibility, we regress observable individual and parental characteristics on the exposure measure, conditional on county and birth-year fixed effects. The results are reported in Table 6.

We find small but statistically significant changes in racial composition: full exposure is associated with a 0.59-percentage-point increase in the share of White individuals and a 0.60-percentage-point decrease in the share of Black individuals. In contrast, we find no statistically significant association between exposure and paternal socioeconomic status, missing paternal

socioeconomic status, maternal literacy, or missing maternal literacy. We therefore interpret Table 6 as indicating modest changes in racial composition but no detectable changes in the observed parental socioeconomic characteristics of the final sample.

To complement the analysis of this section, we also implement similar balancing tests using the original population of these cohorts in the 1940 census prior to merging with the DMF data. These results, reported and discussed in Appendix C, provide a similar story and do not support concerns regarding endogenous compositional changes.

5.5. Truncation

The baseline CenSoc-DMF data cover deaths between 1975 and 2005, a period during which the DMF provides a high coverage of deaths at older ages. After 2005, however, the public version of the DMF became incomplete due to policy changes that removed many state-reported death records, leading to sharp declines in coverage over time. As a result, the post-2005 data include only a fraction of all deaths, and the degree of under-coverage varies across states, cohorts, and demographic groups, raising concerns about potential selection in the observed mortality records. For this reason, we use the main death window of 1975 – 2005 as the main analytic sample. However, in Appendix Table G-1, we show that the results are very similar to the baseline estimates when we extend the sample using the updated mortality data that cover deaths through 2023, suggesting that the main findings are not driven by the limited death observation window.

6. Mediatory Outcomes

6.1. Agricultural Production

In Appendix B, we investigate the effects on several agricultural production outcomes using data for a subset of counties. In so doing, we employ data from Gutmann (2005) that reports production data for decennial years and merge with the boll weevil's arrival date database. We

Investigate the associations between production and a dummy variable indicating post-boll weevil year, conditional on year and county fixed effects. We observe a decrease of roughly 55% in cotton production post-arrival of the boll weevil. This is quite comparable to the estimates of Lange et al. (2009). Further, we do not find significant changes in the production of other crops, including barley, rye, or other legume production.[12]

6.2. County-level socioeconomic and sociodemographic outcomes

The arrival of the boll weevil can change the landscape of affected counties in many ways, including compositional changes in sociodemographic characteristics or compositional changes in occupations and measures of occupational standing. We use decennial censuses between the years 1880-1940 to construct a county-by-year panel and examine the evolution of county-level characteristics using event studies of the following form:

$$y_{ct} = \alpha + \sum_{i \neq -1} \beta_i I(t - T_C^* = i) + \xi_c + \zeta_t + \varepsilon_{ct} \quad (3)$$

The parameters ξ and ζ represent county and year fixed effects. The parameters β_i $(i < -1)$ and β_i $(i > 0)$ represent the difference between the outcome in years before and after the boll weevil's arrival year (T^*) relative to the outcome in one year prior to the arrival (i.e., $i = -1$). To ease the interpretation, we standardize outcomes with respect to the mean and standard deviation of the full sample.

The estimates of equation 3 are reported in different panels of Figure 5 through Figure 7. We observe a discernible drop in the share of individuals working on farms but increases in other

[12] Clay et al. (2019) and Clay & Schmick (2025) document that the decline in cotton monoculture following the boll weevil's arrival led to increased cultivation and availability of food crops, particularly niacin-rich foods. These changes contributed to substantial reductions in pellagra mortality and improvements in height and weight among affected cohorts. Such improvements in early-life nutrition and physical development are likely to translate into better health trajectories and increased longevity later in life.

blue-collar occupations and all other occupations. However, there is no overall impact on occupational income score (Figure 5).

We observe large and significant reductions in the share of married individuals, consistent with the findings of Bloome et al. (2017). Additionally, we observe reductions in the number of children under five years old, implying decreases in fertility (top right panel of Figure 6). Despite these changes, we do not observe discernible changes in the share of whites or Blacks (bottom panels of Figure 6). We also do not observe significant changes in the average socioeconomic index, the share of literate people, the share of homeowners, or population (Figure 7).

Although these results point to sharp drops in employment in the farming sector, the substitution of other occupations and other sectors appears to offset the overall negative impacts. This can partly explain why we do not observe significant changes in occupational income scores and socioeconomic index. Therefore, these substitutions limit the overall negative impacts of worsening local economic conditions on later-life outcomes. Further, although we observe reductions in marriage and fertility, Figure 6 shows little change in the county-level racial composition following the arrival of the boll weevil. This county-level result should be distinguished from Table 6, which examines the composition of the final linked analytic sample and shows small but statistically significant changes: full exposure is associated with a 0.59-percentage-point increase in the share of White individuals and a 0.60-percentage-point decrease in the share of Black individuals. We therefore interpret the county-level evidence as indicating limited demographic re-sorting at the aggregate level, while acknowledging the modest compositional differences observed in the linked analytic sample.

6.3. Migration

Prior research suggests in-migration to cotton production counties in years prior to the boll weevil and out-migration in years after the arrival of the boll weevil (Lange et al., 2009). By comparing county and state of birth with county and state of residence in 1940, we can construct measures of cross state and cross county migration and examine the role of migration in our analysis. These results are reported in Table 7.

First, we examine cross state migrations. We observe significant increases in the probability of moving to Northern states (Midwest or Northeast). The effect implies a change of 3.2% (column 1). However, the implied effect of moving to another southern state is slightly larger, 4.5% (column 2). We do not observe a discernible change in South – West migration (column 3). Additionally, we observe increases in cross county migration by about 0.8% with respect to the mean (column 4).

Further, we find that exposure is associated with rural-to-urban migration and residence in counties with higher socioeconomic indices (columns 5–6). These measures describe destination characteristics but do not establish that migrants experienced healthier environments. The estimated longevity coefficient is approximately 2.45 months among cross-county migrants, whereas the estimate among non-migrants is small and statistically insignificant (columns 7–8).

Migration can expose individuals to locations with either beneficial or adverse consequences for later-life health (Black, Sanders, et al., 2015; Finkelstein et al., 2021). In particular, Black, Sanders, et al. (2015) find that the Great Migration increased mortality among Black Americans born in the South. They discuss several potential mechanisms, including stress associated with separation from families and communities and behavioral changes involving smoking and alcohol consumption. Our setting differs in several important respects. Black,

Sanders, et al. (2015) study the effect of South-to-North migration among Black Southerners, whereas our treatment is childhood exposure to the boll weevil and our migration measures include both South-to-North and within-South migration among Black and White men. Moreover, migration is a post-treatment outcome in our setting, so conditioning on migrant status does not isolate its causal contribution to longevity.

To further examine whether the longevity association among migrants differs across migration destinations, Appendix Table I-1 re-estimates the main specification separately for South-to-North, South-to-South, and South-to-West migrants. The estimated coefficient is small and statistically insignificant among South-to-North migrants (0.42 months) and South-to-West migrants (0.62 months), while it is considerably larger among South-to-South migrants (2.94 months) and statistically significant at the 10% level. Thus, the positive longevity association observed among migrants does not appear to be driven by South-to-North migration, the migration margin emphasized by Black, Sanders, et al. (2015). Because migration destination is itself a post-treatment outcome, however, these subsample estimates should be interpreted as descriptive heterogeneity rather than as causal effects of particular migration destinations.

The two sets of findings are therefore not necessarily contradictory. Boll-weevil exposure could improve longevity through reductions in child labor and increases in schooling even if some forms of induced migration had adverse health consequences. Aaronson et al. (2021) document a closely related pattern in the context of Rosenwald schools: improved school quality increased longevity despite also inducing migration that could adversely affect health. We therefore interpret migration as one component of the broader behavioral response to the boll weevil rather than as an independently identified beneficial mechanism.

6.4. Education and Socioeconomic Status

Several studies provide evidence that better-educated individuals and those with higher measures of socioeconomic status are healthier and live longer lives (Chetty et al., 2016; Fletcher et al., 2021; Galama et al., 2018; Lleras-Muney, 2005). Since reductions in the availability of child-labor-intensive cotton cultivation lower the opportunity cost of schooling and incentivize school attendance, affected children might attain higher education and socioeconomic status levels later in life (Baker et al., 2020). To investigate these mechanism channels, we limit the sample to individuals above age 18 and explore the effects of exposure on outcomes in the 1940 census.

These results are reported in Table 8. We observe an increase of roughly 0.11 years in schooling (column 1). Moreover, we observe a reduction of 0.7 and 0.8 percentage points in the probability of education less than high school and education less than 12 years, respectively (columns 2-3). We further find an increase of 0.7 percentage points in the probability of any college education, equivalent to a change of 7.9% comparing with the mean of the outcome (column 4). Finally, we observe an increase of about 0.4 units in the socioeconomic index, off a mean of 24.1 (column 5).

In Figure 4, we examine the overall pattern and evolution of coefficients across different cohorts using event studies of equation 1 for several measures of education. There are two facts worth mentioning here. First, we do not observe discernible pre-existing trends in educational outcomes. Second, the overall patterns are quite similar to those of Figure 3, specifically that there is a possible lag in the effects that appear for these outcomes.

Lleras-Muney et al. (2022) use a sibling fixed effect strategy and examine the effects of education on longevity. They find that each additional year of schooling is associated with approximately 5 months higher longevity. Using their results and the estimated coefficient of

column 1 of Table 8, we can calculate an increase of 0.55 months in longevity as a result of improvements in education. This is about 50% of the reduced form effect we observe in Table 2. Fletcher & Noghanibehambari (2023) examine the effects of college openings on college education and later-life longevity. They estimate that any college education is associated with about 15.6 months higher longevity. Combining their estimate with the 0.74-percentage-point increase in college attendance reported in column 4 of Table 8 implies an increase of approximately 0.12 months in longevity, equivalent to roughly 10% of the reduced-form effect documented in Table 2. Together with the calculation based on years of schooling above, these comparisons are consistent with improvements in education representing one potential pathway through which childhood exposure to the boll weevil may affect later-life longevity.

6.5. Parental Fertility Decisions

Decreases in the marginal productivity of child labor could discourage parents from having more children by raising their shadow price (Becker, 1960; Becker & Lewis, 1973; Frenette, 2011). This decline in the number of children may lead to increased resources and investments per child, potentially improving their health outcomes later in life (Bleakley & Lange, 2009; Hanushek, 1992). To examine changes in fertility due to the arrival of the boll weevil, we construct a longitudinal data by linking individuals in historical censuses 1900 – 1930. In so doing, we link individuals from 1900 to 1910 – 1930 and exclude unlinked individuals. We also link individuals from 1910 to 1920 – 1930 and restrict the sample to link individuals only. We then pool these linked data. We further restrict the sample to male individuals aged 20 – 55. We implement regressions of the following form:

$$y_{icy} = \beta BWPost_{ict} + \gamma_i + \theta_c + \eta_t + \varepsilon_{ict} \quad (4)$$

Where $BWPost$ is a dummy indicating that boll weevil has arrived in county c in decennial census t. Individual, county, and decennial census year fixed effects are represented by γ, θ, and η, respectively. Standard errors are clustered on county.

The results are reported in Table 9. We observe a reduction in the number of under-5 children in the family post-boll weevil. The estimated coefficient implies a change of 1.3% with respect to the mean. We find larger reductions among black individuals than white individuals (columns 2-3). Additionally, we observe larger reductions among individuals in non-farming sectors, consistent with the fact that post-boll weevil arrival individuals are more likely to change occupations (reported in columns 8-11). The estimates are robust when we use dummy variables indicating the number of under-5 children more than two and three, equivalent to decreases of roughly 3.5% and 7.3% from the mean of these outcomes (columns 6-7).

In columns 8-11, we find that exposed individuals are less likely to be employed in the farming sector and more likely to work in manufacturing, service, and other industries. However, as reported in columns 12 – 13, there is no change in occupational income score and socioeconomic index of affected individuals. We also do not observe discernible change in their literacy (column 14).

7. Conclusion

In the early 20th century in the US South, between 30-50% of school-aged children were employed in agriculture and other industries (Walters & Briggs, 1993). Despite significant reductions in child labor and increases in education due to policy changes, growing social awareness, and higher returns to education, the enduring impacts of child labor and education remain important topics for policy analysis. Moreover, many countries today experience similar social and economic developmental stages as the early 20th century US. For instance, among poor

and middle-income countries, between 5-28% of children aged 5-17 are engaged in child labor (UNICEF, 2024). Therefore, it is important for policymakers in developing countries to understand the benefits of reductions in child labor and improvements in their schooling.

In this paper, we exploited sudden and unexpected reductions in labor demand for a child-labor-intensive industry to examine its impacts on later-life mortality. Specifically, we focused on the Cotton Belt counties in the US South. We examined how the arrival of the infamous boll weevil, the destructive pest for cotton cultivation, in a county affected children's later-life outcomes. We found a large decrease in cotton production and agricultural employment in the county following the arrival of the boll weevil. Further, exposed children revealed considerable improvements in education and socioeconomic status during midlife, as observed in the 1940 census. The exposed children are also more likely to migrate out of their county of birth and to counties with a higher socioeconomic index. Employing Social Security Administration death records linked with the 1940 census, we found improvements in the longevity of men. Full exposure to the boll weevil during childhood is associated with about 1.1 months higher longevity. This effect is larger among Blacks and concentrated among children of low educated families residing in counties with high cotton production intensity. Moreover, the effects appear to be substantially larger among children in states with less restrictive child labor policies, implying the role of these policies in reducing the adverse effects of child labor in the absence of the boll weevil in cotton production counties. We showed that the results are quite robust across a wide range of specification checks and alternative functional forms.

Between 1900 and 1940, remaining life expectancy among men in the U.S. Social Security area conditional on survival to age 46 increased from 23.29 to 24.58 years, an increase of approximately 1.29 years, or 15.48 months (Bell & Miller, 2005). We use age 46 because it is the

minimum age at death observed in our final analytic sample. The estimated intent-to-treat effect of full childhood exposure to the boll weevil, approximately 1.13 additional months of longevity, is therefore equivalent in magnitude to about 7.3% of the increase in male remaining life expectancy at age 46 between 1900 and 1940, as measured by these period life tables.

In the full-count 1940 census, 5,801,422 individuals belonged to the 1890–1940 birth cohorts and had an early-life county in the Cotton Belt (Appendix Table A-1). The average childhood exposure share among these individuals is approximately 0.46, corresponding to about 2.67 million full-exposure equivalents. Applying the estimated longevity gain of 1.13 months associated with full exposure in column 3 of Table 2 yields approximately 3.02 million person-months of additional longevity, or roughly 251,300 life-years.

To illustrate the monetary magnitude of these longevity gains, we use a Value of a Statistical Life (VSL) of approximately $10 million (Kniesner & Viscusi, 2019; Viscusi, 2018). The average age at death in the final analytic sample is approximately 78.6 years, implying a simple back-of-the-envelope value of about $127,000 per additional life-year. Applying this value to the estimated aggregate gain of approximately 251,300 life-years yields an illustrative monetary equivalent of roughly $32 billion. This calculation assumes that the estimated longevity effect generalizes to the corresponding full-count 1940 census population and assigns a constant monetary value to each additional life-year; it should therefore be interpreted as an illustrative valuation rather than a formal welfare estimate.

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Tables

Table 1 - Summary Statistics

	Exposed by Age 17		Non-Exposed by Age 17	
	Mean	**SD**	**Mean**	**SD**
Age at death (months)	897.38	110.63	972.26	97.45
Log age at death	6.79	.13	6.87	.1
Age at death > 70	.66	.47	.88	.33
Age at death > 75	.47	.5	.73	.44
Age at death > 80	.27	.44	.52	.5
Birth year	1915.67	6.61	1904.96	7.26
Death year	1990.46	8.44	1986.01	7.76
White	.78	.41	.78	.41
Black	.22	.41	.22	.41
Year of first arrival of boll weevil	1911.61	6.8	1914.06	5.97
Father socioeconomic index	21.22	18.18	20.29	17.49
Father socioeconomic index missing	.18	.38	.2	.4
Mother literate	.75	.43	.74	.44
Mother literacy missing	.18	.38	.17	.37
County covariates:				
Share of homeowners	.43	.12	.42	.14
Number of under-five children	.61	.16	.69	.15
Share of immigrants	.03	.06	.02	.05
Occupational income score	18.18	2.87	17.49	2.54
Per capita literate	.85	.1	.82	.11
Per capita employed	.57	.08	.62	.1
Per capita workers in manufacturing sector	.1	.09	.07	.07
Per capita workers in mining sector	.01	.04	.01	.03
Per capita workers in construction sector	.03	.02	.03	.02
Per capita workers in transportation sector	.05	.04	.04	.04
Per capita farmers	.24	.12	.26	.11
Share of married	.61	.03	.59	.03
Observations	281,516		452,858	
Mechanism sample:				
Years of schooling	8.35	3.62	8.04	3.83
Education less than high school	.51	.5	.58	.49
Education less than 12 years	.75	.44	.76	.43
Any college education	.09	.28	.1	.3
School attendance	.11	.32	.01	.11
Socioeconomic index	21.91	18.76	25.18	21.11
Observations	251,661		452,859	

Notes. The data covers men from birth cohorts of 1890-1940 born in cotton counties and died between 1975-2005.

Table 2 - Exposure to boll weevil During Childhood and Later-Life Old-Age Longevity

	Outcome: Age-at-Death (months)		
	(1)	(2)	(3)
Exposure Share	1.43***	1.42***	1.13***
	(.39)	(.39)	(.42)
Observations	734374	734374	734374
R-squared	.32	.32	.32
Mean DV	943.554	943.554	943.554
Birth county FE	✓	✓	✓
Birth year FE	✓	✓	✓
Individual/family controls		✓	✓
Birth county covariates			✓

Notes. Standard errors, clustered on county, are in parentheses. Individual controls include dummies for race and ethnicity. Family controls include dummies for maternal literacy and paternal socioeconomic status. Birth county covariates include the share of homeowners, number of under-five children, the share of immigrants, average occupational income score, per capita literate, per capita employed, per capita workers in the manufacturing sector, per capita workers in the mining sector, per capita workers in the construction sector, per capita workers in the transportation sector, per capita farmers, and share of married.
*** p<0.01, ** p<0.05, * p<0.1

Table 3 - Heterogeneity Analysis in the Effects of Childhood Exposure to boll weevil and Later-Life Longevity

	Whites	Blacks	Literate mother	Illiterate mother	Below median share of farmers
	(1)	(2)	(3)	(4)	(5)
Exposure Share	.97**	1.72*	.79*	2.35***	.79
	(.46)	(.9)	(.48)	(.79)	(.57)
Observations	572879	159208	544035	190339	367171
R-squared	.31	.36	.32	.35	.32
Mean DV	945.350	937.476	941.457	949.550	950.809
	Above median share of farmers	Top quartile of 1900 cotton production	Bottom-three quartiles of 1900 cotton production	Father occupation farm-labor	Father occupation other
	(6)	(7)	(8)	(9)	(10)
Exposure Share	1.14*	1.68*	.15	2.36	1.13***
	(.67)	(.93)	(.47)	(1.94)	(.43)
Observations	367202	166310	568064	34550	699820
R-squared	.32	.28	.32	.36	.32
Mean DV	936.301	965.471	937.138	927.709	944.336

Notes. Standard errors, clustered on county, are in parentheses. All regressions include birth county fixed effects, birth year fixed effects, individual/family controls, and birth county covariates. Individual controls include dummies for race and ethnicity. Family controls include dummies for maternal literacy and paternal socioeconomic status. Birth county covariates include the share of homeowners, number of under-five children, the share of immigrants, average occupational income score, per capita literate, per capita employed, per capita workers in the manufacturing sector, per capita workers in the mining sector, per capita workers in the construction sector, per capita workers in the transportation sector, per capita farmers, and share of married.
*** p<0.01, ** p<0.05, * p<0.1

Table 4 - Heterogeneity in the Effects Based on Restrictiveness of State-Level Child Labor Laws

	Outcome: Age-at-Death (months), Subsamples:	
	Less restrictive child labor law states	More restrictive child labor laws states
	(1)	(2)
Exposure Share	1.44***	.26
	(.44)	(1.53)
Observations	610904	123470
R-squared	.25	.1
Mean DV	961.340	855.554

Notes. Standard errors, clustered on county, are in parentheses. All regressions include birth county fixed effects, birth year fixed effects, individual/family controls, and birth county covariates. Individual controls include dummies for race and ethnicity. Family controls include dummies for maternal literacy and paternal socioeconomic status. Birth county covariates include the share of homeowners, number of under-five children, the share of immigrants, average occupational income score, per capita literate, per capita employed, per capita workers in the manufacturing sector, per capita workers in the mining sector, per capita workers in the construction sector, per capita workers in the transportation sector, per capita farmers, and share of married.
*** p<0.01, ** p<0.05, * p<0.1

Table 5 - Robustness Checks to Alternative Specifications

	Column 3 of Table 2	Interacting birth county fixed effects by individual/family dummies	Adding birth region by birth year fixed effects	Adding birth state by 1940 state fixed effects	Adding birth month and death month fixed effects	Outcome: log age at death
	(1)	(2)	(3)	(4)	(5)	(6)
Exposure Share	1.13***	1.1589***	1.0457**	1.1488***	1.12***	.0012***
	(.4239)	(.4257)	(.428)	(.4318)	(.4235)	(.0005)
Observations	734374	734362	726071	733729	734374	734374
R-squared	.3234	.3259	.3217	.3253	.3241	.325
Mean DV	943.554	943.553	942.822	943.521	943.554	6.843

	Outcome: age at death > 70	Outcome: age at death > 75	Outcome: age at death > 80	Weighted by county share of farmers in 1900	Removing birth cohorts of 1918-1919	Controlling for Hookworm and Malaria Campaigns
	(7)	(8)	(9)	(10)	(11)	(12)
Exposure Share	.0046***	.0063***	.0049**	.9875**	1.3821***	.9844**
	(.0017)	(.002)	(.0021)	(.4451)	(.4455)	(.4475)
Observations	734375	734375	734375	722931	692725	639378
R-squared	.192	.2128	.2141	.3272	.3237	.3301
Mean DV	0.795	0.632	0.425	945.014	947.553	944.811

Notes. Standard errors, clustered on county, are in parentheses. All regressions include birth county fixed effects, birth year fixed effects, individual/family controls, and birth county covariates. Individual controls include dummies for race and ethnicity. Family controls include dummies for maternal literacy and paternal socioeconomic status. Birth county covariates include the share of homeowners, number of under-five children, the share of immigrants, average occupational income score, per capita literate, per capita employed, per capita workers in the manufacturing sector, per capita workers in the mining sector, per capita workers in the construction sector, per capita workers in the transportation sector, per capita farmers, and share of married. The outcome in columns 1-5 and 10-12 is age at death measured in months.
*** p<0.01, ** p<0.05, * p<0.1

Table 6 - Examining Changes in Sociodemographic and Socioeconomic Composition of the Final Sample Due to Childhood Exposure to boll weevil

	Outcomes:					
	White	Black	Father socioeconomic index	Father socioeconomic index missing	Mother literate	Mother literacy missing
	(1)	(2)	(3)	(4)	(5)	(6)
Exposure Share	.0059***	-.006***	.096	-.0009	-.0003	-.0012
	(.0018)	(.0018)	(.0975)	(.0026)	(.0024)	(.0025)
Observations	726072	726072	590743	726072	726072	726072
R-squared	.1631	.1658	.0818	.0499	.0608	.0442
Mean DV	0.778	0.219	20.640	0.186	0.746	0.166

Notes. Standard errors, clustered on county, are in parentheses. All regressions include birth county fixed effects and birth year fixed effects.
*** p<0.01, ** p<0.05, * p<0.1

Table 7 - Childhood Exposure to boll weevil, Migration, and Later-Life Longevity

	Outcomes and Subsamples:			
	South-North Migrant	South-South Migrant	South-West Migrant	Cross-county migrant from birth to 1940
	(1)	(2)	(3)	(4)
Exposure Share	.0022*	.0042***	-.0007	.0044*
	(.0012)	(.0014)	(.001)	(.0023)
Observations	734375	734375	734375	734375
R-squared	.1135	.0827	.0709	.106
Mean DV	0.069	0.094	0.043	0.521
	Rural-Urban Migrant	Average 1940 County level socioeconomic index	Subsample of migrants Outcome: age-at-death	Subsample of non-migrants Outcome: age-at-death
	(5)	(6)	(7)	(8)
Exposure Share	.0038*	.0683***	2.4458***	-.3317
	(.0022)	(.0253)	(.5501)	(.6511)
Observations	734375	734349	382966	351408
R-squared	.0813	.3252	.2914	.3386
Mean DV	0.218	25.548	955.640	930.384

Notes. Standard errors, clustered on county, are in parentheses. All regressions include birth county fixed effects, birth year fixed effects, individual/family controls, and birth county covariates. Individual controls include dummies for race and ethnicity. Family controls include dummies for maternal literacy and paternal socioeconomic status. Birth county covariates include the share of homeowners, number of under-five children, the share of immigrants, average occupational income score, per capita literate, per capita employed, per capita workers in the manufacturing sector, per capita workers in the mining sector, per capita workers in the construction sector, per capita workers in the transportation sector, per capita farmers, and share of married.
*** p<0.01, ** p<0.05, * p<0.1

Table 8 - Exploring Mechanism Channels between Childhood Exposure to boll weevil and Later-Life Longevity

	Outcomes:				
	Years of schooling	Education less than high school	Education less than 12 years	Education college-and-more	Socioeconomic index
	(1)	(2)	(3)	(4)	(5)
Exposure Share	.1045***	-.007***	-.0081***	.0074***	.3718***
	(.0173)	(.0023)	(.0022)	(.0013)	(.0897)
Observations	684993	704520	704520	704520	637416
R-squared	.2691	.183	.1387	.0872	.201
Mean DV	8.148	0.554	0.753	0.094	24.098

Notes. Standard errors, clustered on county, are in parentheses. All regressions include birth county fixed effects, birth year fixed effects, individual/family controls, and birth county covariates. Individual controls include dummies for race and ethnicity. Family controls include dummies for maternal literacy and paternal socioeconomic status. Birth county covariates include the share of homeowners, number of under-five children, the share of immigrants, average occupational income score, per capita literate, per capita employed, per capita workers in the manufacturing sector, per capita workers in the mining sector, per capita workers in the construction sector, per capita workers in the transportation sector, per capita farmers, and share of married.

*** p<0.01, ** p<0.05, * p<0.1

Table 9 - Exploring Mechanism: Parental Changes in Fertility, Occupation, and Socioeconomic Status

	Outcomes:						
	Number of Under-5 Children	Number of Under-5 Children, Whites	Number of Under-5 Children, Blacks	Number of Under-5 Children, Non-Farmers	Number of Under-5 Children, Farmers	Number of Under-5 Children > 2	Number of Under-5 Children > 3
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Exposure Share	-.00619*	-.00327	-.01301**	-.01663***	.00561	-.00469***	-.00194***
	(.00357)	(.00385)	(.00536)	(.00529)	(.00414)	(.00157)	(.00054)
Observations	25709445	19320526	5705726	10897767	11004304	25709445	25709445
R-squared	.39387	.38564	.47001	.42472	.42295	.37996	.35783
Mean DV	0.479	0.477	0.500	0.351	0.629	0.136	0.026
	Occupation: Farming	Occupation: Manufacturing	Occupation: Services	Occupation: Other	Occupational Income Score	Socioeconomic Index	Literate
	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Exposure Share	-.01074***	.00583**	.00038	.00452*	.01568	-.07237	-.00129
	(.00301)	(.00263)	(.00043)	(.0024)	(.04403)	(.07521)	(.00194)
Observations	24367809	24367809	24367809	24367809	22313404	22224392	25709445
R-squared	.68072	.52803	.4984	.6234	.70832	.69962	.56307
Mean DV	0.500	0.169	0.024	0.306	19.986	22.431	0.911

Notes. Standard errors, clustered on county, are in parentheses. All regressions include county fixed effects, year fixed effects, and individual fixed effects. The data covers individuals linked in historical censuses 1900-1940.
*** p<0.01, ** p<0.05, * p<0.1

Figures

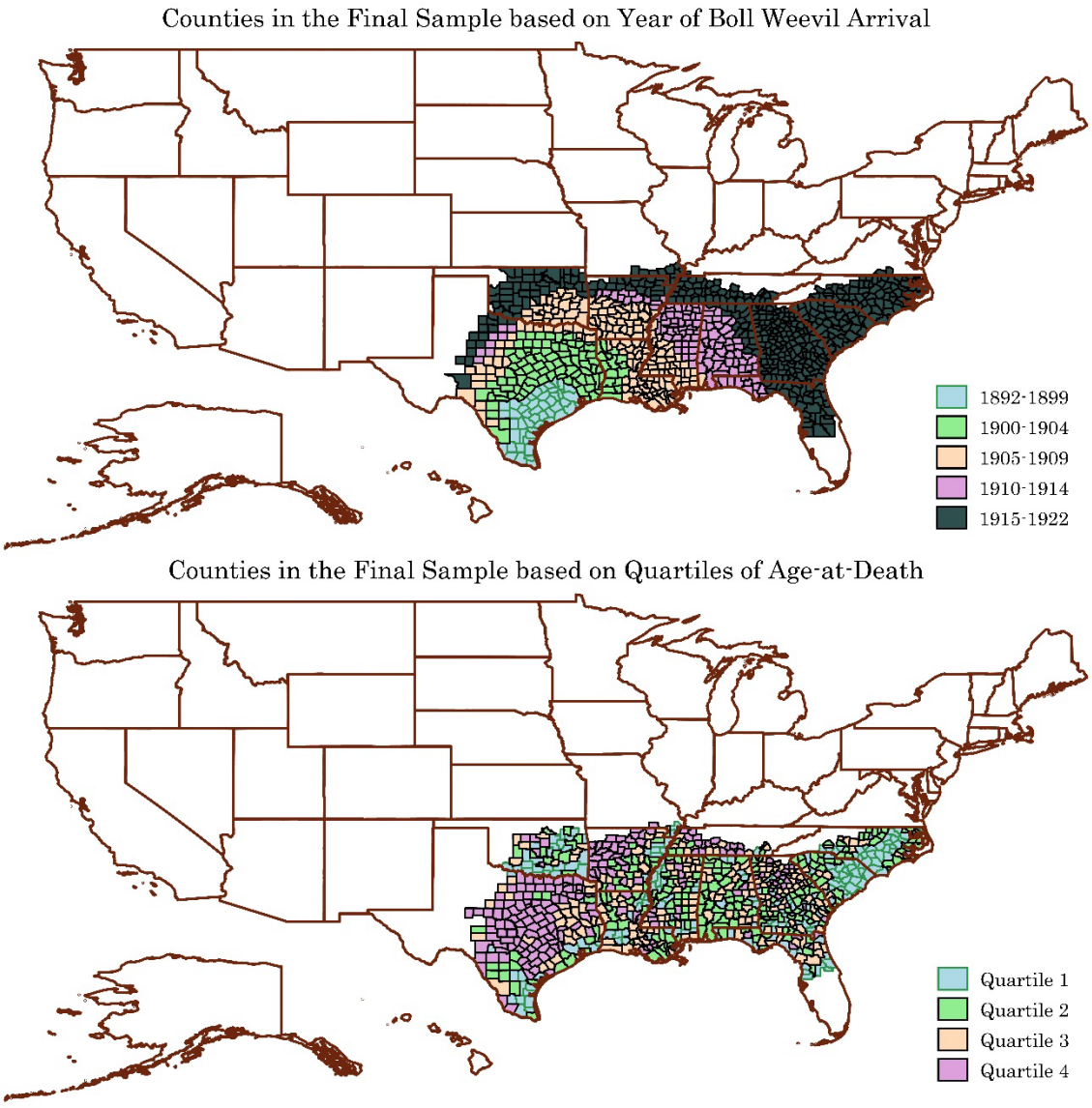


Figure 1 - Geographic Distribution of Arrival of boll weevil and Longevity across Affected Counties

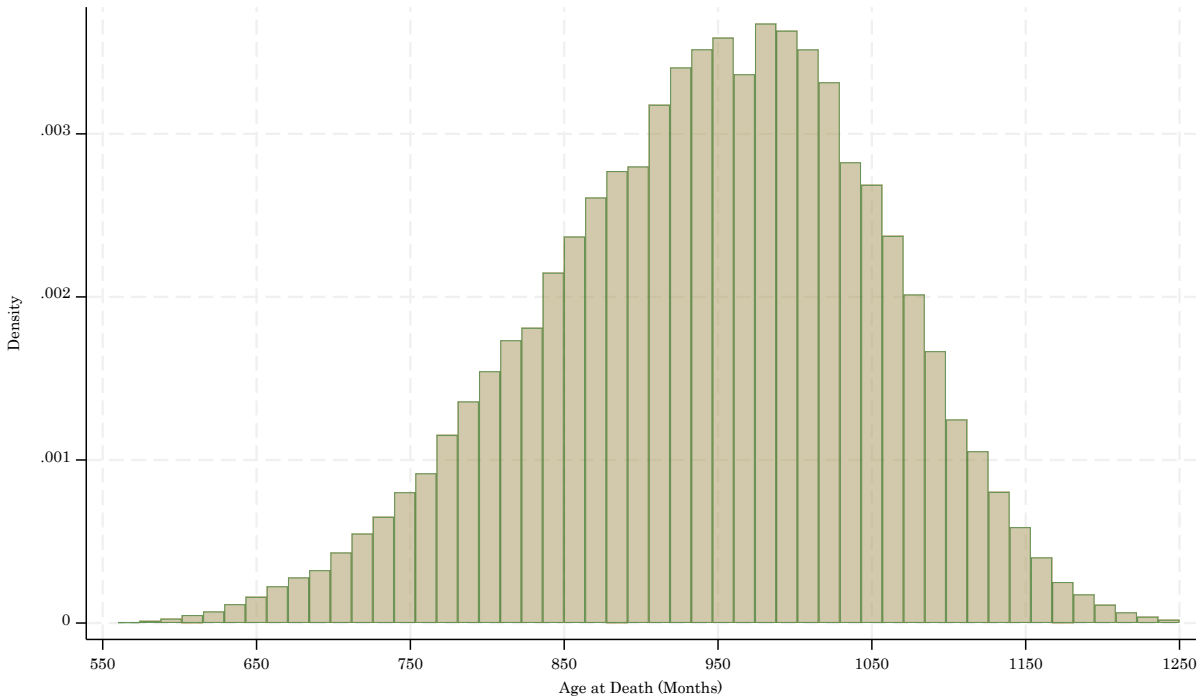


Figure 2 - Density Distribution of Age-at-Death in the Final Sample

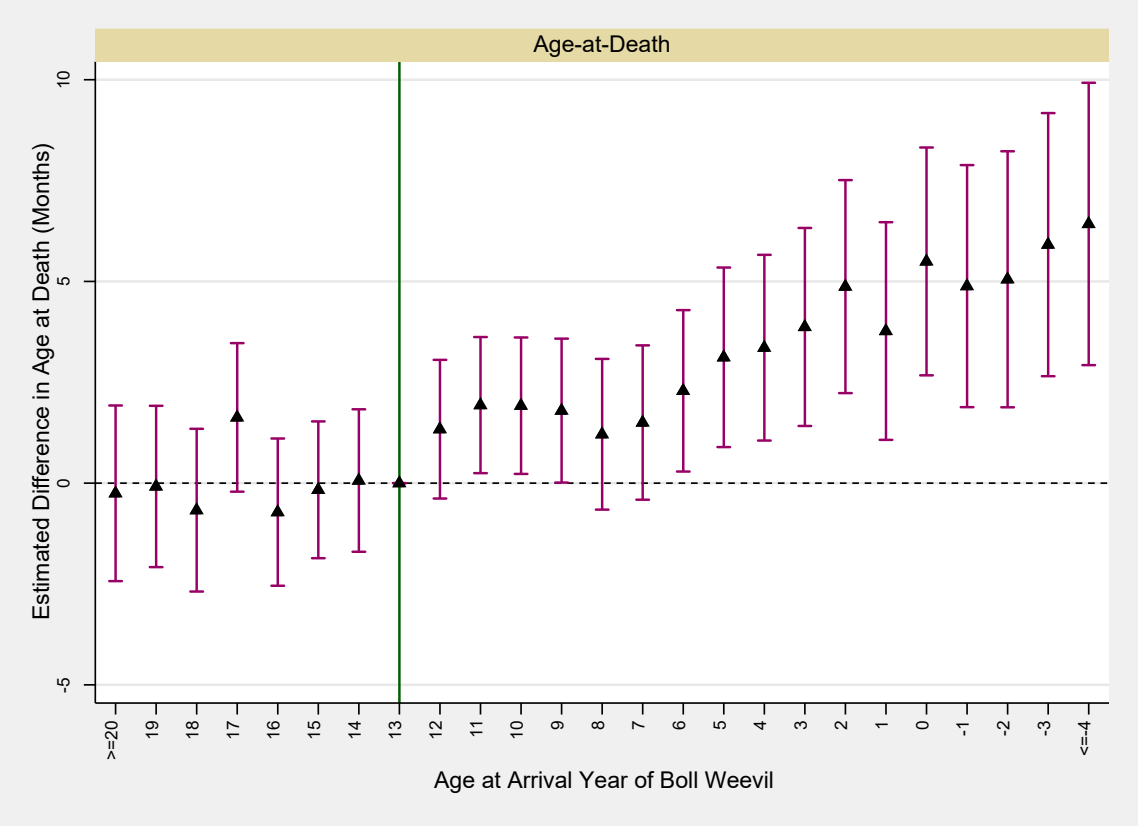


Figure 3 - Event Study Analysis to Examine the Effects of Childhood Exposure to Boll Weevil on Later-Life Longevity

Notes. Point estimates and 95% county-clustered confidence intervals are illustrated. All regressions include birth county fixed effects, birth year fixed effects, individual/family controls, and birth county covariates. Individual controls include dummies for race and ethnicity. Family controls include dummies for maternal literacy and paternal socioeconomic status. Birth county covariates include share of homeowners, number of under-five children, share of immigrants, average occupational income score, per capita literate, per capita employed, per capita workers in manufacturing sector, per capita workers in mining sector, per capita workers in construction sector, per capita workers in transportation sector, per capita farmers, and share of married.

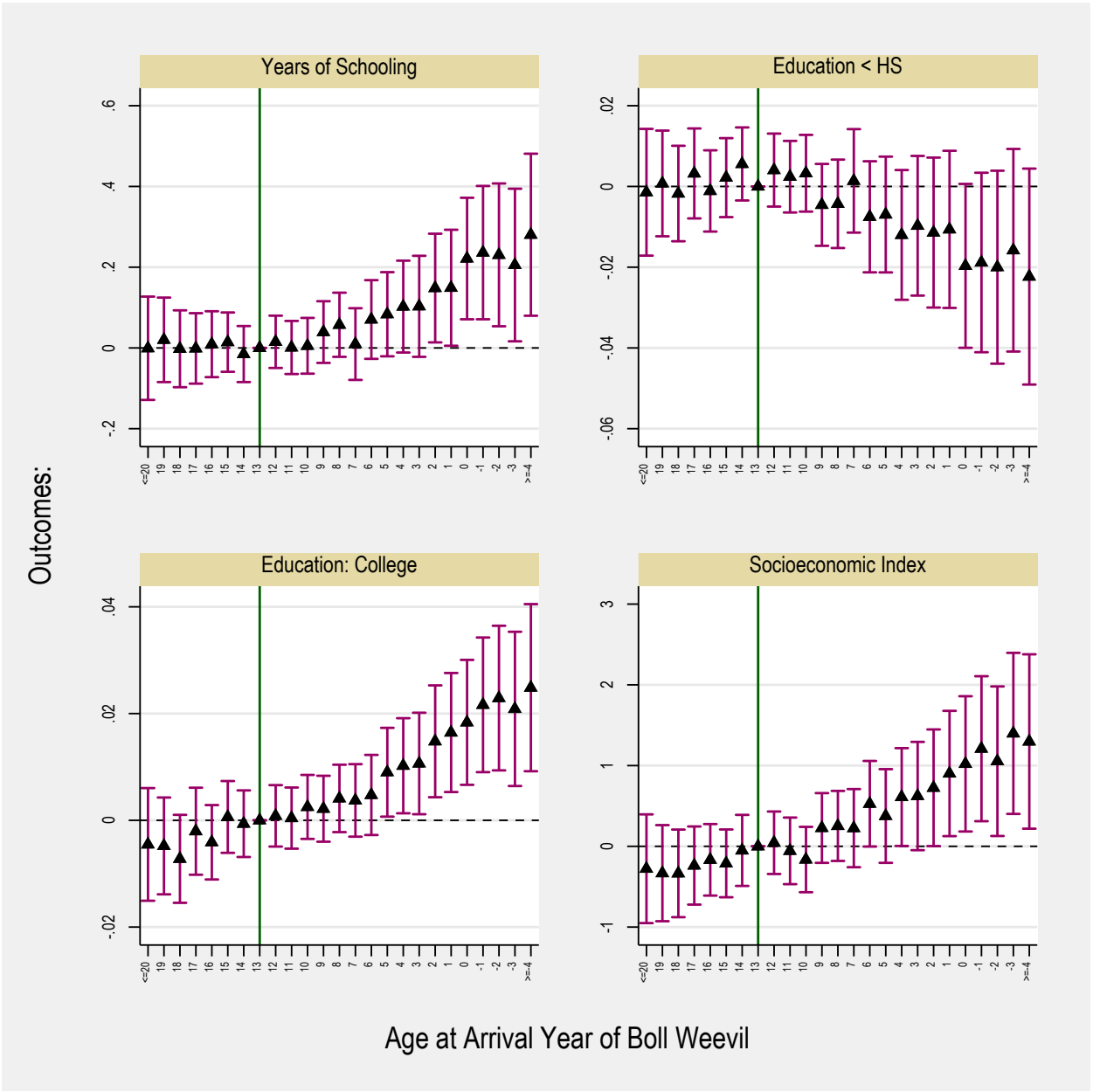


Figure 4 - Event Study Analysis to Examine Mechanism Channels between Childhood Exposure to Boll Weevil on Later-Life Longevity

Notes. Point estimates and 95% county-clustered confidence intervals are illustrated. All regressions include birth county fixed effects, birth year fixed effects, individual/family controls, and birth county covariates. Individual controls include dummies for race and ethnicity. Family controls include dummies for maternal literacy and paternal socioeconomic status. Birth county covariates include share of homeowners, number of under-five children, share of immigrants, average occupational income score, per capita literate, per capita employed, per capita workers in manufacturing sector, per capita workers in mining sector, per capita workers in construction sector, per capita workers in transportation sector, per capita farmers, and share of married. The sample is restricted to individuals above age 18.

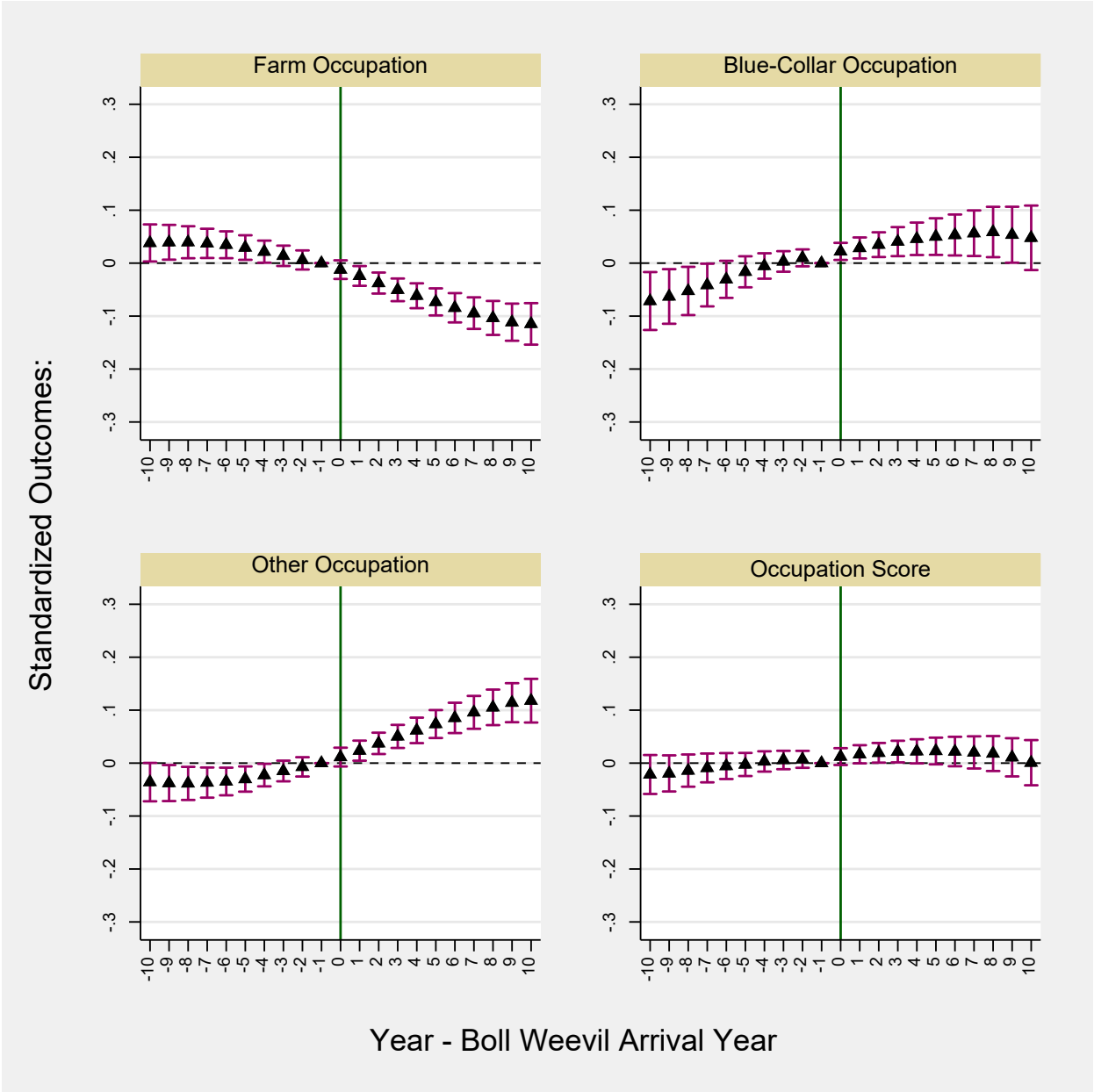


Figure 5 - Event Study Analysis to Examine the Evolution of County Characteristics in Years Before and After the Arrival of Boll Weevil

Notes. Point estimates and 95% confidence intervals are depicted. All regressions include county and year fixed effects. Regressions are weighted using county level population. The county by year panel is extracted from decennial censuses 1890 – 1940 and interpolated for inter-decennial years.

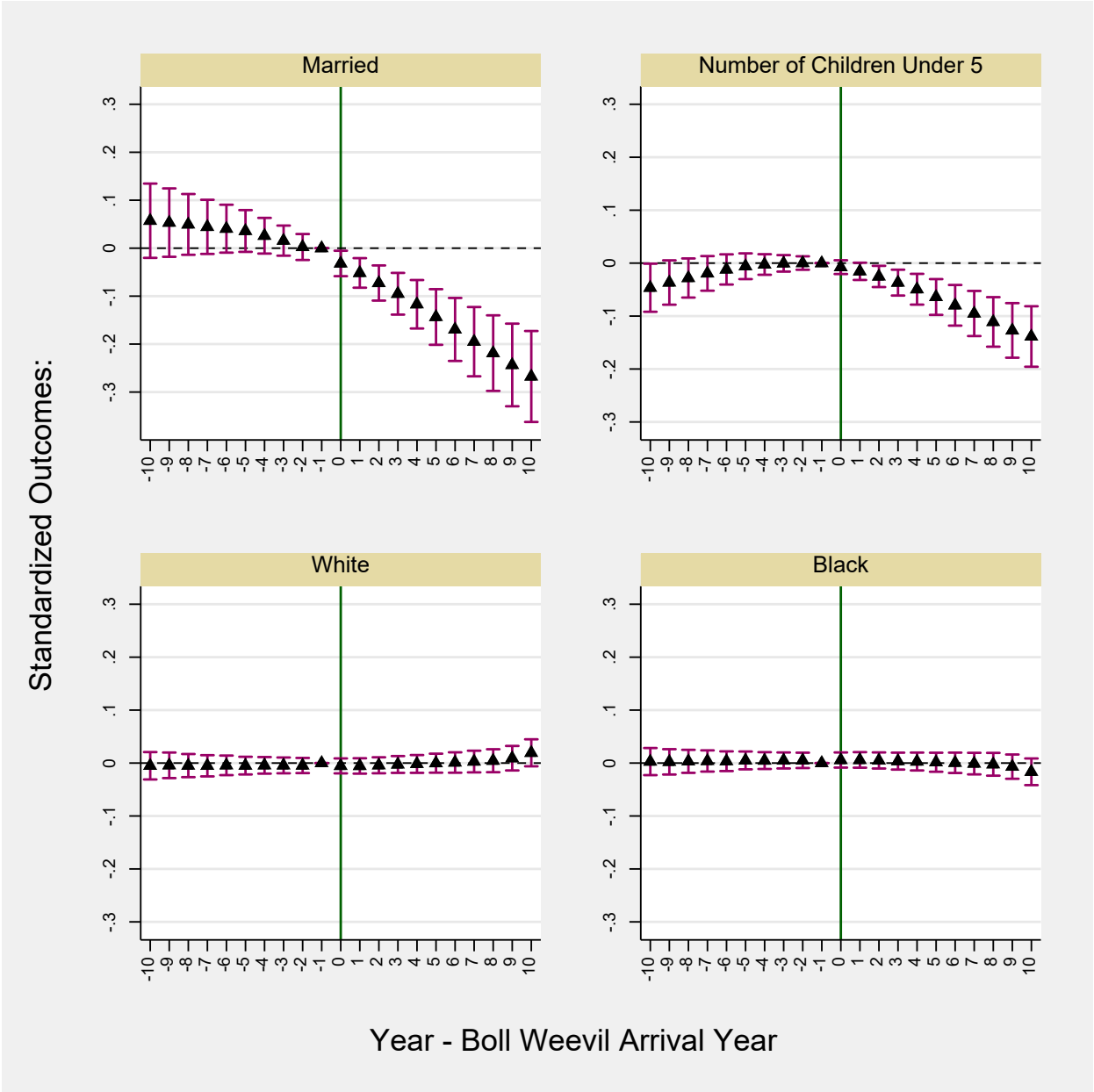


Figure 6 - Event Study Analysis to Examine the Evolution of County Characteristics in Years Before and After the Arrival of Boll Weevil

Notes. Point estimates and 95% confidence intervals are depicted. All regressions include county and year fixed effects. Regressions are weighted using county level population. The county by year panel is extracted from decennial censuses 1890 – 1940 and interpolated for inter-decennial years.

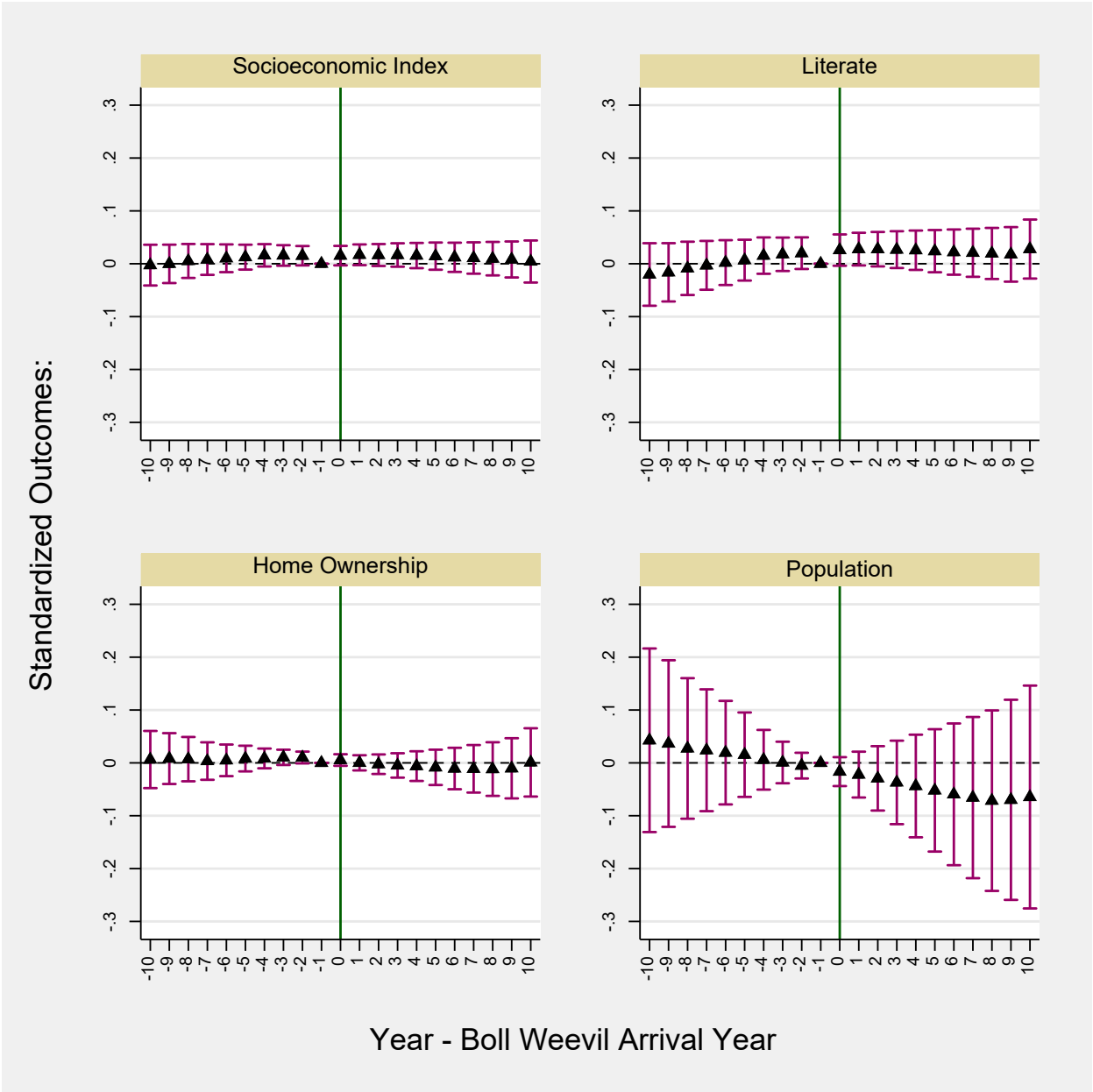


Figure 7 - Event Study Analysis to Examine the Evolution of County Characteristics in Years Before and After the Arrival of Boll Weevil

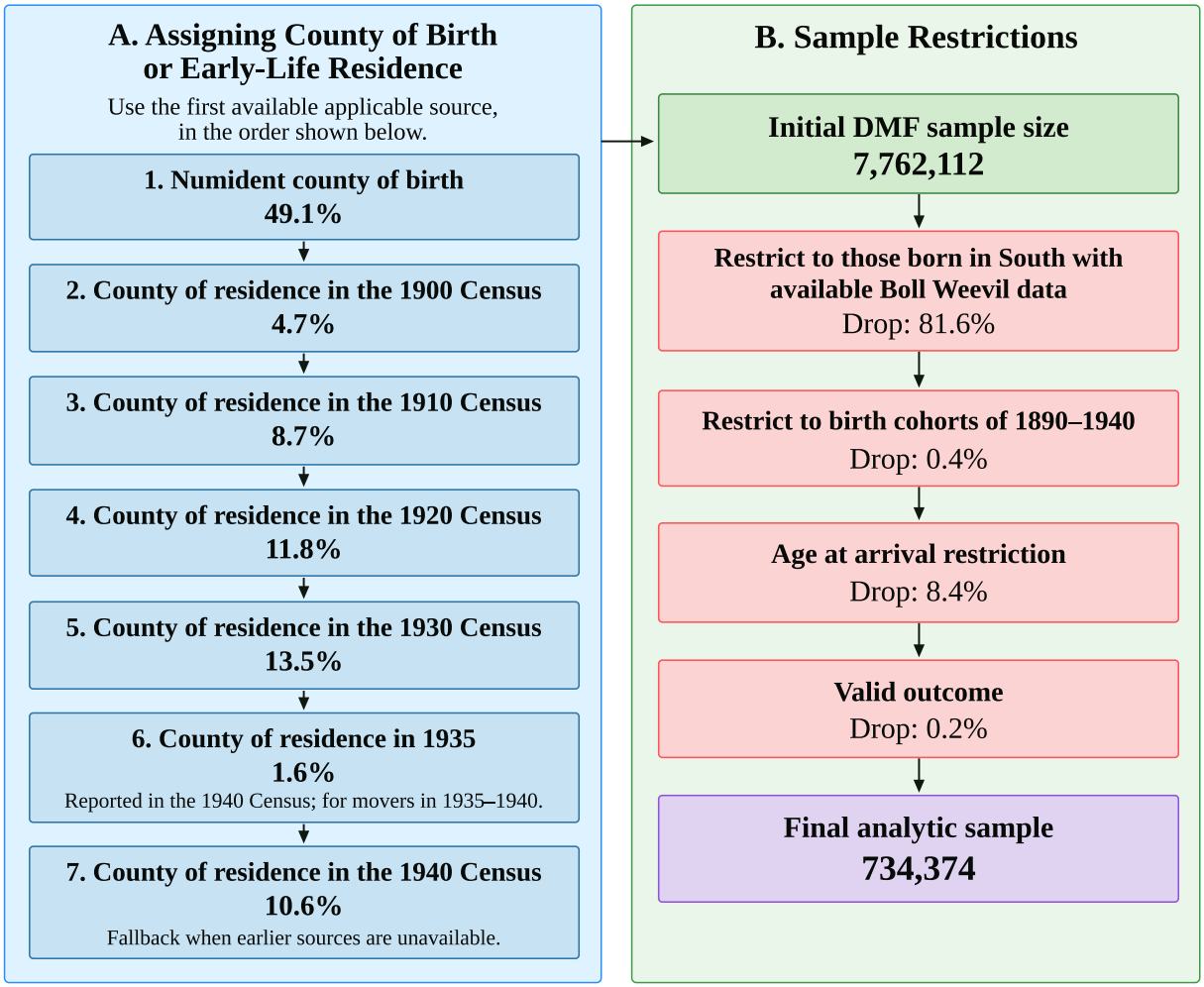
Notes. Point estimates and 95% confidence intervals are depicted. All regressions include county and year fixed effects. Regressions are weighted using county level population. The county-by-year panel is extracted from decennial censuses 1890-1940 and interpolated for inter-decennial years.

Appendix A

Appendix Figure A-1 illustrates the construction of the analytic sample. Panel A summarizes the hierarchical procedure used to assign county of birth or early-life residence, while Panel B summarizes the sample restrictions applied to obtain the final analytic sample.

Appendix Table A-1 reports selected summary statistics in the final sample (first panel) versus the original population of 1940 whose early life county was in the Cotton Belt and who belong to birth cohorts of 1890-1940 (second panel). We observe a higher share of whites and a lower share of Blacks in the final sample compared with the original population. Breen & Osborne (2022) suggest that Although the DMF data overrepresents white populations and underrepresents Blacks, black and white subpopulations contain fairly similar characteristics as those in the original 1940 census population. As we look at other statistics related to maternal education and paternal socioeconomic status, we observe comparable values in the final sample to the original population.

Next, we empirically examine the association between exposure and successful data linking. In so doing, we merge the final sample (left panel of Appendix Table A-1) to the original population (right panel of Appendix Table A-1) and generate a dummy variable indicating successful merging. We then regress the merging indicator on exposure measure, conditional on county and birth year fixed effects. The results are reported in Appendix Table A-2. Exposed individuals are more likely to be in the final sample. However, the estimated coefficient is extremely small and statistically insignificant, suggesting a change of 0.5% with respect to the mean. We also observe small and insignificant coefficients when we look at subsample of whites and nonwhites (columns 2-3).



Appendix Figure A-1 - Construction of the Analytic Sample and Assignment of County of Birth/Early-Life Residence

Appendix Table A-1 - Comparing Characteristics of the Final Sample with Original Population of 1940 Census

	Final sample		*Original population*	
	Mean	SD	Mean	SD
Birth year	1909.07	8.74	1906.91	9.56
White	.78	.41	.69	.46
Black	.22	.41	.3	.46
Year of boll weevil's arrival	1913.12	6.41	1913.35	6.37
Exposure share	.56	.5	.46	.5
Mother education less than high school	.2	.4	.16	.37
Mother education high school	.05	.22	.04	.19
Mother education college	.01	.11	.01	.1
Mother education missing	.74	.44	.79	.41
Father socioeconomic status first quartile	.05	.22	.04	.21
Father socioeconomic status second quartile	.09	.29	.07	.26
Father socioeconomic status third quartile	.02	.14	.01	.12
Father socioeconomic status fourth quartile	.05	.21	.04	.19
Father socioeconomic status missing	.79	.41	.83	.37
County covariates:				
Share of homeowners	.42	.13	.4	.13
Number of under-five children	.66	.16	.66	.16
Share of immigrants	.02	.05	.02	.05
Occupational income score	17.77	2.7	17.64	2.68
Per capita literate	.83	.11	.82	.11
Per capita employed	.6	.09	.61	.1
Per capita workers in manufacturing sector	.08	.08	.08	.07
Per capita workers in mining sector	.01	.04	.01	.04
Per capita workers in construction sector	.03	.02	.03	.02
Per capita workers in transportation sector	.04	.04	.04	.04
Per capita farmers	.25	.11	.25	.11
Share of married	.6	.04	.6	.04
Observations	734,375		5,801,422	

Notes.

Appendix Table A-2 - Examining the Association Between Exposure to boll weevil and Successful DMF-Census Merging

	Outcome: successful merging between DMF (final sample records) and 1940 census, Subsamples:		
	Full sample	Whites	Nonwhites
	(1)	(2)	(3)
Exposure Share	.00067	.00113	-.00165
	(.00098)	(.00116)	(.00107)
Observations	5801422	4019388	1782034
R-squared	.02187	.01849	.01579
Mean DV	0.127	0.143	0.091

Notes. Standard errors, clustered on county, are in parentheses. All regressions include birth county fixed effects, birth year fixed effects, individual/family controls, and birth county covariates. Individual controls include dummies for race and ethnicity. Family controls include dummies for maternal literacy and paternal socioeconomic status. Birth county covariates include the share of homeowners, number of under-five children, the share of immigrants, average occupational income score, per capita literate, per capita employed, per capita workers in the manufacturing sector, per capita workers in the mining sector, per capita workers in the construction sector, per capita workers in the transportation sector, per capita farmers, and share of married.
*** p<0.01, ** p<0.05, * p<0.1

Appendix B

Gutmann (2005) reports county-level agricultural production data for a limited number of counties in decennial years. We restrict the sample to the years between 1890-1940 and counties in the Cotton Belt. Based on the county-specific year of arrival of the boll weevil, we generate a dummy variable indicating post-weevil years. We then regress cotton production (in bales) on the post-weevil dummy, conditional on county and year fixed effects. The results are reported in Appendix Table B-1. We observe significant reductions in cotton production. In the years following the arrival of the boll weevil, cotton production dropped by roughly 55%. Although there are changes in the production of other crops, the estimated coefficients remain comparably small and statistically insignificant.

Appendix Table B-1 - Examining the Effects of County Exposure to boll weevil and Agricultural Productions

	Outcomes:			
	Log cotton production (bales)	Log barley production (bales)	Log rye production (bales)	Log Pea/Bean production (bales)
	(1)	(2)	(3)	(4)
Post boll weevil	-.54629***	-.15373	.01442	-.27668
	(.15698)	(.31578)	(.392)	(.20518)
Observations	1312	588	565	705
R-squared	.77073	.76648	.67377	.7703
Mean DV	8.263	6.811	5.676	5.723

Notes. Standard errors, clustered on county, are in parentheses. All regressions include county and year fixed effects. Regressions are weighted using share of farmland in the county in 1900.
*** p<0.01, ** p<0.05, * p<0.1

Appendix C

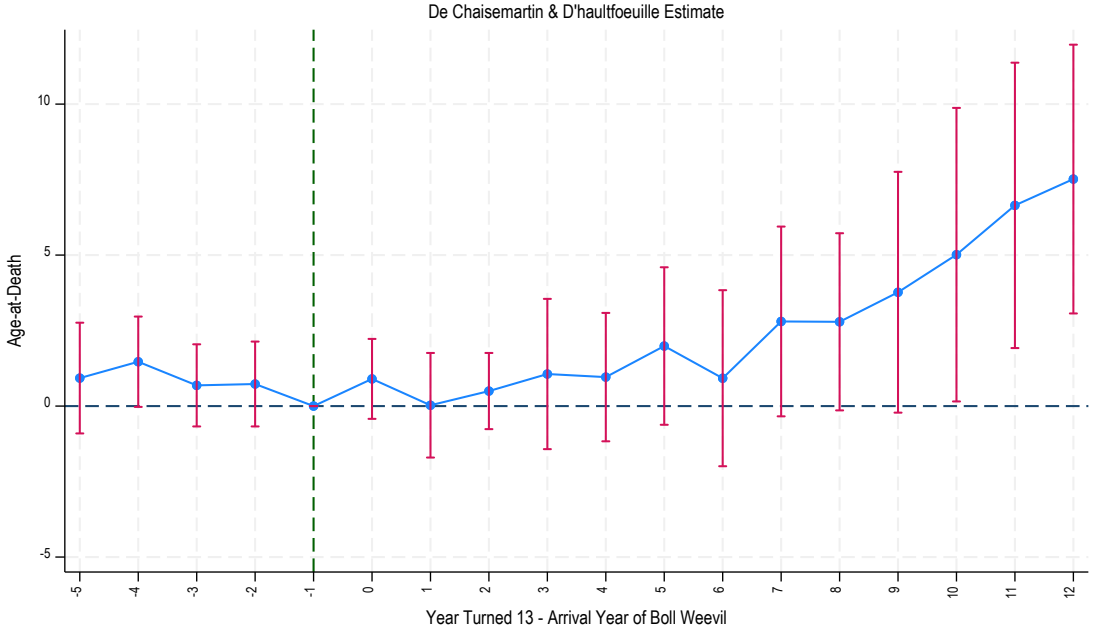
In this appendix, we complement the analysis regarding the balancing test of Table 6. Specifically, we examine changes in socioeconomic and sociodemographic characteristics of individuals in the 1940 census (prior to merging with the DMF data) as a function of boll weevil exposure in regressions similar to equation 2. The results are reported in Appendix Table C-1. We find significant increases in the share of whites and increases in the share of Blacks. However, the implied change with respect to the mean is extremely small (0.8%). In addition we do not observe any significant change in parental characteristics.

Appendix Table C-1 - Examining Changes in Sociodemographic and Socioeconomic Composition Due to Childhood Exposure to Boll Weevil Using the Full-Count 1940 Census

	Outcomes:					
	White	Black	Father socioeconomic index	Father socioeconomic index missing	Mother literate	Mother literacy missing
	(1)	(2)	(3)	(4)	(5)	(6)
Exposure Share	.00628***	-.00635***	-.01619	-.00378	.00012	-.00395
	(.00149)	(.00144)	(.06888)	(.00286)	(.0026)	(.00288)
Observations	6110549	6110549	4396499	6110549	6110549	6110549
R-squared	.17472	.17783	.06652	.07969	.07799	.06915
Mean DV	0.694	0.303	19.852	0.281	0.639	0.256

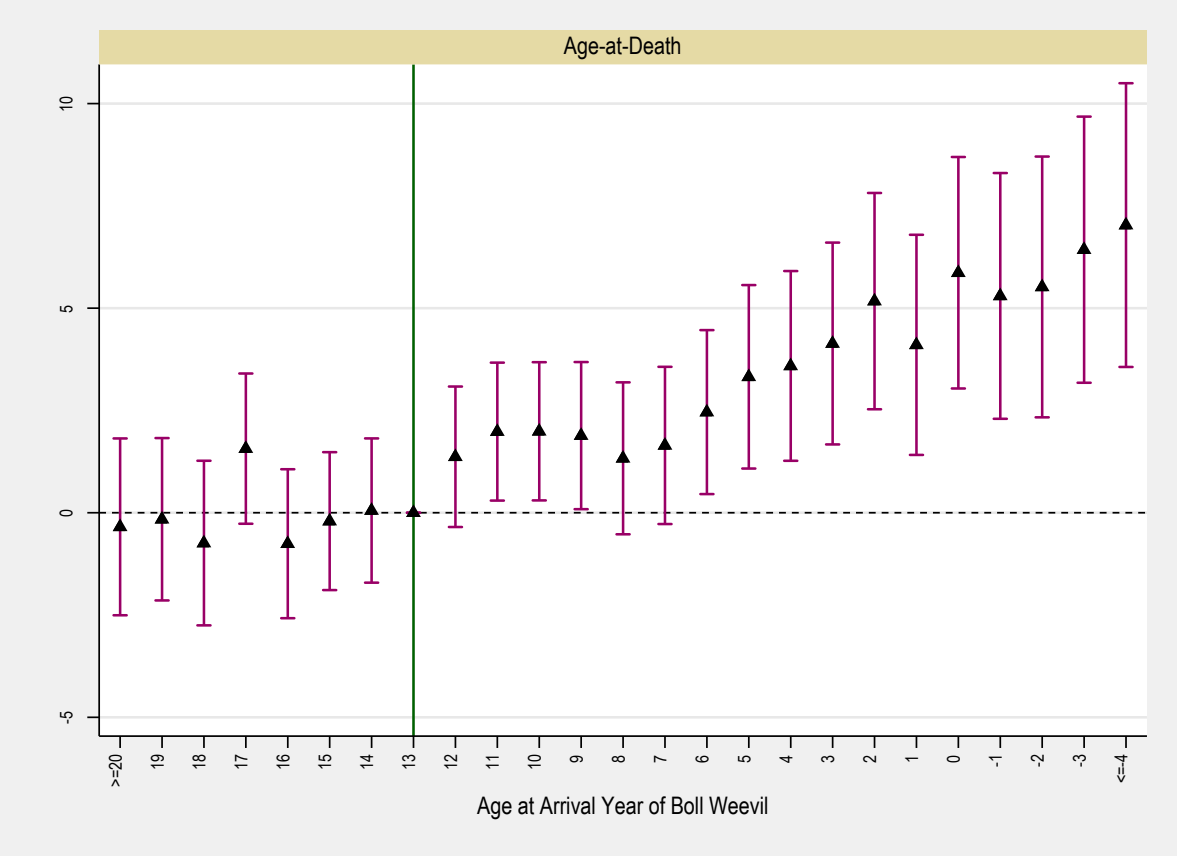
Notes. Standard errors, clustered on county, are in parentheses. All regressions include birth county fixed effects and birth year fixed effects.
*** p<0.01, ** p<0.05, * p<0.1

Appendix D



Appendix Figure D-1 - Event Study Analysis to Examine the Effects of Childhood Exposure to Boll Weevil on Later-Life Longevity Using De Chaisemartin & D'haultfoeuille (2020)

Notes. Point estimates and 95% county-clustered confidence intervals are illustrated. All regressions include birth county fixed effects, birth year fixed effects, individual/family controls, and birth county covariates. Individual controls include dummies for race and ethnicity. Family controls include dummies for maternal literacy and paternal socioeconomic status. Birth county covariates include share of homeowners, number of under-five children, share of immigrants, average occupational income score, per capita literate, per capita employed, per capita workers in manufacturing sector, per capita workers in mining sector, per capita workers in construction sector, per capita workers in transportation sector, per capita farmers, and share of married.



Appendix Figure D-2 - Event Study Analysis to Examine the Effects of Childhood Exposure to Boll Weevil on Later-Life Longevity Using Sun & Abraham (2021)

Notes. Point estimates and 95% county-clustered confidence intervals are illustrated. All regressions include birth county fixed effects, birth year fixed effects, individual/family controls, and birth county covariates. Individual controls include dummies for race and ethnicity. Family controls include dummies for maternal literacy and paternal socioeconomic status. Birth county covariates include share of homeowners, number of under-five children, share of immigrants, average occupational income score, per capita literate, per capita employed, per capita workers in manufacturing sector, per capita workers in mining sector, per capita workers in construction sector, per capita workers in transportation sector, per capita farmers, and share of married.

Appendix E

Appendix Table E-1 - Robustness of the Estimated Effect of Boll Weevil Exposure to Alternative Standard Error Adjustments

	Outcome: Age at Death (Months)				
	Clustering on birth county	Clustering on birth state	Two-way clustering on birth state and birth year	Two-way clustering on birth county and birth year	Huber-White robust SE
	(1)	(2)	(3)	(4)	(5)
Exposure Share	1.13***	1.13*	1.13***	1.13***	1.13***
	(.42)	(.61)	(.36)	(.38)	(.39)
Observations	734374	734374	734374	734374	734374
R-squared	.32	.32	.32	.32	.32
Mean DV	943.554	943.554	943.554	943.554	943.554

Notes. Standard errors, clustered on county, are in parentheses. All regressions include birth county fixed effects, birth year fixed effects, individual/family controls, and birth county covariates. Individual controls include dummies for race and ethnicity. Family controls include dummies for maternal literacy and paternal socioeconomic status. Birth county covariates include the share of homeowners, number of under-five children, the share of immigrants, average occupational income score, per capita literate, per capita employed, per capita workers in the manufacturing sector, per capita workers in the mining sector, per capita workers in the construction sector, per capita workers in the transportation sector, per capita farmers, and share of married.
*** p<0.01, ** p<0.05, * p<0.1

Appendix F

Appendix Table F-1 - Alternative Exposure Ages

	Outcome: Age at Death (Months)					
	(1)	(2)	(3)	(4)	(5)	(6)
Exposure Age 0-17 vs 18-above	1*					
	(.6)					
Exposure Age 0-15 vs 18-above		1.7***				
		(.6)				
Exposure Age 0-13 vs 18-above			1.7***			
			(.6)			
Exposure Age 0-11 vs 18-above				1.6**		
				(.6)		
Exposure Age 0-9 vs 18-above					2.2***	
					(.7)	
Exposure Age 0-7 vs 18-above						3.1***
						(.8)
Observations	734374	707010	674181	635316	590336	538906
R-squared	.3	.3	.3	.3	.3	.3
Mean DV	943.554	941.219	938.702	936.012	933.115	930.209

Notes. Standard errors, clustered on county, are in parentheses. All regressions include birth county fixed effects, birth year fixed effects, individual/family controls, and birth county covariates. Individual controls include dummies for race and ethnicity. Family controls include dummies for maternal literacy and paternal socioeconomic status. Birth county covariates include the share of homeowners, number of under-five children, the share of immigrants, average occupational income score, per capita literate, per capita employed, per capita workers in the manufacturing sector, per capita workers in the mining sector, per capita workers in the construction sector, per capita workers in the transportation sector, per capita farmers, and share of married.
*** p<0.01, ** p<0.05, * p<0.1

Appendix G

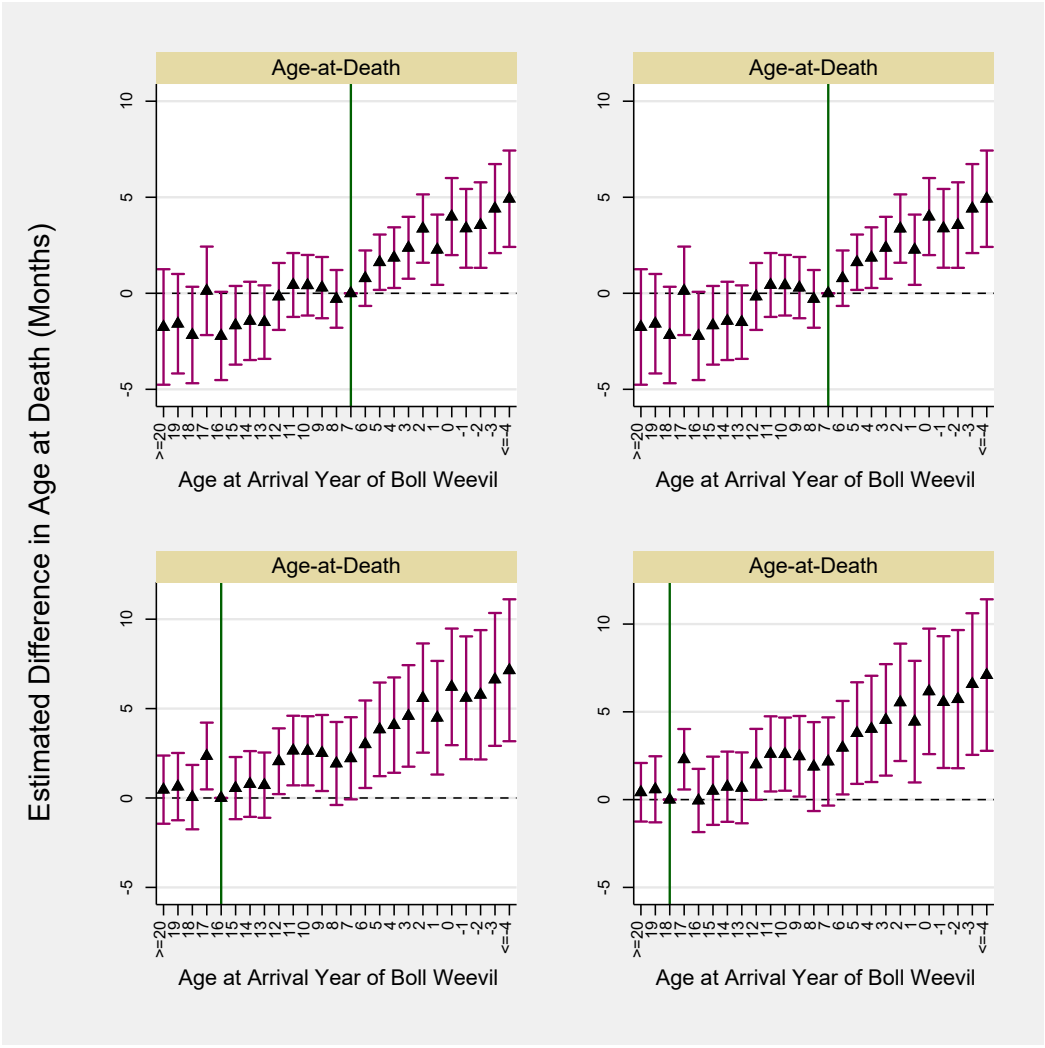
Appendix Table G-1 - Exposure to boll weevil During Childhood and Later-Life Old-Age Longevity: Robustness to Extending Death Window to 1975-2023

	Outcome: Age-at-Death (months)		
	(1)	(2)	(3)
Exposure Share	1.43***	1.42***	1.13***
	(.39)	(.39)	(.42)
Observations	734374	734374	734374
R-squared	.32	.32	.32
Mean DV	943.554	943.554	943.554
Birth county FE	✓	✓	✓
Birth year FE	✓	✓	✓
Individual/family controls		✓	✓
Birth county covariates			✓

Notes. Standard errors, clustered on county, are in parentheses. Individual controls include dummies for race and ethnicity. Family controls include dummies for maternal literacy and paternal socioeconomic status. Birth county covariates include the share of homeowners, number of under-five children, the share of immigrants, average occupational income score, per capita literate, per capita employed, per capita workers in the manufacturing sector, per capita workers in the mining sector, per capita workers in the construction sector, per capita workers in the transportation sector, per capita farmers, and share of married.
*** p<0.01, ** p<0.05, * p<0.1

Appendix H

Appendix Figure H-1 examines the sensitivity of the event-study results to the choice of the omitted age-at-arrival category. Each panel re-estimates Equation (1) using an alternative reference age. Although changing the omitted category shifts the normalization of the coefficients, the overall age-at-exposure pattern remains similar to that reported in Figure 3.



Appendix Figure H-1 - Sensitivity of the Event-Study Estimates to Alternative Omitted Age-at-Arrival Categories

Notes. Each panel reports estimates from Equation (1) using a different omitted age-at-arrival category, indicated by the vertical green line. The y-axis reports estimated differences in age at death, measured in months, relative to the omitted category in each panel. Point estimates and 95% confidence intervals based on standard errors clustered at the county level are shown. All regressions include birth-county fixed effects, birth-year fixed effects, individual and family controls, and birth-county covariates.

Appendix I

Appendix Table I-1 – Replicating the Main Results among Migrants

	Outcome: Age-at-Death (months), Subsamples:		
	South-North Migrants	South-South Migrants	South-West Migrants
	(1)	(2)	
Exposure Share	.418	2.937*	.6161
	(1.6153)	(1.5117)	(1.7417)
Observations	50453	68953	31256
R-squared	.3073	.312	.2813
Mean DV	955.893	945.917	959.490

Notes. Standard errors, clustered on county, are in parentheses. All regressions include birth county fixed effects, birth year fixed effects, individual/family controls, and birth county covariates. Individual controls include dummies for race and ethnicity. Family controls include dummies for maternal literacy and paternal socioeconomic status. Birth county covariates include the share of homeowners, number of under-five children, the share of immigrants, average occupational income score, per capita literate, per capita employed, per capita workers in the manufacturing sector, per capita workers in the mining sector, per capita workers in the construction sector, per capita workers in the transportation sector, per capita farmers, and share of married.
*** p<0.01, ** p<0.05, * p<0.1