Tenancy, Marriage, and the Boll Weevil Infestation, 1892–1930

Deirdre Bloome, James Feigenbaum, and Christopher Muller*

August 2016

Abstract

The boll weevil infestation of 1892–1922 had a clear and lasting impact on the US South's economy. In this paper, we show that it also affected the region's demography. When the boll weevil hit the cotton South, it encountered a region populated by families of tenant farmers. Tenant farming created both economic opportunities and economic incentives for prospective tenants to marry at young ages. The boll weevil infestation undermined this family-based organization of agricultural labor. Using data from historical US Department of Agriculture maps, complete-count Census of Population data from 1900–1930, and Census of Agriculture data from 1889–1929, we show that the boll weevil's arrival reduced both the share of farms worked by tenants and the share of African Americans who married at young ages. We also document that increases in tenancy over time increased the prevalence of marriage among young people, particularly young African Americans. Our results provide new evidence about the effect of economic institutions on demographic transformations.

Key words: Marriage; Economic history; Economic institutions; Racial inequality

JEL codes: J12; J15; J43; N31; N32; N51; N52; Q12

*Authorship is alphabetical to reflect equal contributions. Contact information: Deirdre Bloome, Department of Sociology, Population Studies Center, and Survey Research Center, University of Michigan, 426 Thompson St., Ann Arbor, MI 48104, dbloome@umich.edu; James Feigenbaum, Department of Economics and Industrial Relations Section, Princeton University, A-17-H-2 Firestone Library, Princeton, NJ 08544, jjf2@princeton.edu; Christopher Muller, Department of Sociology, University of California, Berkeley, 496 Barrows Hall, Berkeley, CA 94720, cmuller@berkeley.edu. We thank Scott Walker of the Harvard Map Collection for his excellent assistance and Orlando Patterson, Paul Rhode, Eva Sierminska, Arland Thornton, and Christopher Wildeman for their helpful comments on previous drafts. We presented earlier versions of this paper at Harvard University's Workshop in History, Culture, and Society, and the annual meeting of the Population Association of America. Funding for this research was provided by the National Science Foundation and an NICHD center grant to the Population Studies Center at the University of Michigan (R24 HD041028).

Between 1892 and 1922, an insect called the boll weevil spread eastward across the southern United States, from the base of Texas to Florida. Boll weevils are tiny, measuring only about a quarter inch at maturity, but they feed voraciously on cotton. Their approach struck fear into the hearts of many southern planters, and for good reason: the weevil reduced local cotton yields by 50% within five years of its arrival, and infested counties still had not recovered ten years later (Lange, Olmstead, and Rhode 2009; Giesen 2011). Economic historians have documented that the boll weevil infestation had a clear and lasting impact on the South's economy. In this paper, we show that it also affected the region's demography.

When the boll weevil hit the cotton South, it encountered a region populated by families of tenant farmers. Tenant farmers rented land, and sometimes equipment, from landowners in exchange for a portion of their yield. Landlords signed contracts with household heads, typically husbands, who were charged with governing the labor and comportment of their families. Within a few years of the end of the Civil War, tenant farming became the predominant way of organizing agricultural work in the former Confederacy.

Tenant farming created both economic opportunities and economic incentives for prospective tenants to marry at young ages. It made land accessible to groups—such as African Americans—who were unable to purchase it, thereby removing a common barrier to marriage in agrarian societies (Hajnal 1965: 133; Landale 1989a; Landale 1989b; Tolnay 1999: 61; Thornton, Axinn and Xie 2007: 27). But landlords also recognized the economic benefits of using husbands to oversee the work of their families (Jaynes 1986: 185; Mann 1990: 141; O'Donovan 2007: 193). Over time, landlords increasingly insisted on contracting with male-headed households (Bercaw 2003: 123; Ruef 2012: 981). In the late nineteenth century, African Americans married at younger ages in counties where tenant farming was pervasive (Tolnay 1984; Bloome and Muller 2015). As more whites entered tenant farming in the late nineteenth and early twentieth centuries, they too began marrying at younger ages in counties dominated by tenant farming (Landale and Tolnay 1991; Tolnay 1999).

If tenant farming encouraged African Americans to marry at younger ages than they would have otherwise, then reductions in tenancy should have reversed this effect, leading them to marry at ages more typical of counties where tenancy was less common. In this paper, we assess this claim. We collect geographical data on the timing of the boll weevil's migration across the South, complete-count

Census of Population data for the years 1900–1930, and Census of Agriculture data for the years 1889–1929. We use these data toestimate the effect of the boll weevil infestation on the prevalence of tenancy and marriage among whites and African Americans of different ages. Then we examine how changes in tenancy affected changes in marriage over three decades. We find that the boll weevil reduced the share of young African Americans who were married, and that it did so, in part, by disrupting tenant farming.

The boll weevil infestation was just one episode in the history of southern agriculture, but it offers new insights into how economic institutions affect demographic change. In studying the infestation, we make two contributions. First, using the boll weevil as an environmental shock to tenant farming allows us to generate the best identified evidence to date relating agricultural opportunities to marriage in the postbellum South. Because farmers were powerless to prevent the weevil's arrival (Baker 2015: 1140; Lange, Olmstead, and Rhode 2009: 689), our estimates suggest that the relationship between tenancy and early marriage documented in previous research was causal (Tolnay 1984; Landale and Tolnay 1991; Tolnay 1999; Bloome and Muller 2015). Second, our longitudinal analysis adds further weight to a body of cross-sectional demographic evidence showing that in agrarian societies, people waited to marry until they could acquire land (Hajnal 1965: 133; Landale 1989a; Landale 1989b; Tolnay 1999: 61). Studying the relationship between changes in tenancy and changes in marriage among African Americans is especially informative because becoming a tenant was one of the very few ways that black farmers could access land. Our analysis thus provides new evidence about the relationship between the organization of the economy and the structure of the family.

Tenancy and marriage in the early twentieth century

During Reconstruction, white landowners clashed with freedpeople over how to organize agricultural work. Planters wanted laborers to work in large gangs monitored by an overseer, as they had during slavery (Ransom and Sutch 2001: 56–57). Freedpeople wanted instead to escape gang-labor, not only to evade the gaze of overseers, but also to avoid conflicts with fellow workers over whether it was fair for a slower worker to be paid the same fixed rate as a faster one (Jaynes 1986: 164, 186; Wright 1986: 93). The struggle between owners and workers ultimately converged on family-based tenant farming (Wright 1986:

94). Former slaveholders signed contracts with household heads regarding the labor of their entire families. They compensated tenants with a share of the crop after it had been harvested. Family-based tenancy offered freedpeople relatively more workplace autonomy than the gangs they had worked in as slaves, but it also allowed planters to use the patriarchal family's authority structure to monitor their labor force (Jaynes 1986: 185; Mann 1990: 141; O'Donovan 2007: 193).[1] As they observed the economic advantages of using husbands as overseers, planters increasingly hesitated to contract with single men and, especially, women (Bercaw 2003: 123; Ruef 2012).

Tenancy's rise extended the opportunity to farm to people who could not buy land, either because they could not afford it or because landowners refused to sell it to them. With access to land, tenants could establish an independent household, which was the typical residential arrangement for married couples in western Europe and its colonies (Thornton, Axinn, and Xie 2007: 27; Landale 1989a: 204). Historical demographers have noted that as land becomes increasingly available, the age at which people first marry tends to decline (Hajnal 1965: 133; Landale 1989a; Landale 1989b; Tolnay 1999: 61).

In the postbellum South, freedpeople married earlier in counties where tenant farming was widespread not only because tenancy allowed them to access land, but also because marrying made them more attractive to landlords (Bloome and Muller 2015). Planters' common refusal to sell land to African Americans and increasing reluctance to sign labor contracts with single women limited freedwomen's options for finding independent agricultural work. Marrying consequently became one of the few ways that they could enter the agricultural labor market. African-American couples also had special reasons to formalize their unions in law because some southern states made it a criminal offense for freedmen and freedwomen to live together without being married (Franke 1999: 277; Stanley 1998: 45). In 1880, young African Americans, but not young whites, were more likely to marry in counties dominated by tenant farming (Bloome and Muller 2015). African-American farmers in 1900 also married at younger ages in counties where the proportion of farmers who were tenants was relatively high (Tolnay 1984).

Tenant farming was far more common among African Americans than among whites, but large shares of both black and white farmers were tenants. By 1910,

[1] For a discussion of many freedwomen's dissatisfaction with their subordinate position within tenant marriages, see Bloome and Muller (2015), Foner (1988), Patterson (2000), and Stanley (1998).

about 75% of southern black farmers were tenants, compared to about 39% of southern white farmers (United States Department of Commerce 1922: 194). As more whites sank into tenancy, their shares of early marriage also increased. In 1910 and 1940, both white and black couples were more likely to marry at young ages in counties where a large proportion of farms were operated by white and black tenants, respectively (Landale and Tolnay 1991; Tolnay 1999).

To date, studies of tenancy and marriage in the postbellum South have relied on cross-sectional data, using differences in the prevalence of tenant farming and early marriage across counties to estimate tenancy's effect (Tolnay 1984; Landale and Tolnay 1991; Tolnay 1999; Bloome and Muller 2015). With data on marriage from the complete-count 1900, 1910, 1920, and 1930 Censuses of Population, we can use changes in tenancy and marriage over time to improve our estimates. Data on changes in tenancy and marriage also enable us to study the impact of a well-known environmental shock to tenant farming: the boll weevil infestation of the late nineteenth and early twentieth centuries.

The boll weevil and agricultural tenancy

The boll weevil had a large and lasting impact on southern cotton production. Although aggregate cotton yields grew during the infestation, they grew by less than they would have if the weevil had never entered the South (Lange, Olmstead, and Rhode 2009: 687). Many farmers shifted to growing corn—a crop whose cultivation required comparatively less labor and a type of practical knowledge that tenants who had only grown cotton lacked (Giesen 2011: 109–110; Lange, Olmstead, and Rhode 2009; Leavell 1919: 17; Olmstead and Rhode 2008: 83; Reid 1979: 39; Scott 1920: 15). Black tenants were much more likely than white tenants to grow cotton over corn and struggled to access credit to grow the latter crop (Giesen 2001: 109; Leavell 1919: 17; Marks 1989: 59; Scott 1920: 16; United States Department of Commerce 1918: 623–624). The transition to corn thus generated "additional unemployment for negro tenant farmers" (Scott 1920: 15–16).

With fewer opportunities to work as tenants, and landlords who sometimes actively encouraged them to go, many black tenant farmers in infested counties moved to other areas or other jobs (Scott 1920: 15). For once, exclusion from landownership may have briefly worked in their favor. Historian James Giesen (2011: 34) has noted that during the infestation "it could be an advantage not

to own land, so that one could move away from the insect invader." John Van Hook, a freedman in Athens, Georgia, told a Works Progress Administration (WPA) interviewer, "After the boll weevil got bad I came to the other side of the river yonder, where I stayed 7 years" (Van Hook 1938: 22). Sometimes workers flooded counties to farm as much cotton as possible before the weevil arrived, then moved away (Giesen 2011: 57). Lange, Olmstead, and Rhode (2009: 715) find that the weevil "appears to have unleashed a wave of internal migration, leading to local population gains before contact and substantial losses after the onset of significant crop damage."[2] Other tenants left agriculture altogether (Marks 1989: 38; Snavely 1919: 63). Aleck Trimble of Texas, for instance, told a WPA interviewer that he switched from farming to "sawmillin' and public works" after the boll weevil arrived (Trimble n.d.: 115).[3] African-American women may have turned instead to domestic service (Amott and Matthaei 1996: 158; Goldin 1977; Hunter 1997: 50).

Meanwhile, the planters who continued to grow cotton after the infestation may have replaced some tenant contracts with other arrangements for compensating their workers. Although planters could not determine whether or when the boll weevil would infest their land, they could adopt methods to minimize the damage (Helms 1980: 118; Hunter and Coad 1923). Some of the most important control methods required farmers to burn or plow under cotton stalks as soon as the harvest was over (Olmstead and Rhode 2008: 145–146). But tenants on a yearly contract had little incentive to improve infested land when they could move to a nearby plantation (Helms 1980: 119, 122–123). Growing cotton in an infested area became more like growing sugar or rice: the coordination and long-term investment it required was incompatible with paying individual families in yearly shares (Jaynes 1986: 237–238).

A temporary influx of labor would have increased the prevalence of tenancy in counties just about to be hit by the weevil relative to counties already hit by it. In the counties left behind, planters might have abandoned tenant contracts, and former tenants might have found other kinds of work. We expect that the weevil's arrival decreased the share of farms operated by tenants and thereby mechanically increased the share of farms operated by landowners, the vast majority of whom were whites.

[2] They also find that more land was put into cotton in the year of contact (Lange, Olmstead, and Rhode 2009: 703).

[3] The term public works "was commonly used to refer to a job with minimal entry standards, like a mine or sawmill or blast furnace that would take any able-bodied male" (Wright 1986: 97).

The boll weevil and marriage

In the early twentieth century, tenant farming and early marriage went hand in hand. When the boll weevil invaded southern counties, some planters transitioned away from growing cotton and contracting with tenants. With less land for rent, African Americans had fewer ways to support independent households and fewer reasons to marry early. Men who gave up sharecropping for public works left a "family-based system" for jobs typically offered to "single men or men living apart from their families" (Wright 1986: 94, 97). Families who remained in agriculture sometimes moved to uninfested areas to farm as much cotton as possible before it was destroyed, draining counties hit by the weevil of young married couples. Young and unmarried people who moved in anticipation of the weevil also shrunk the pool of potential spouses for those who stayed behind.

Because tenant farming was less common among whites than among African Americans, and because there was no proscription against selling land to whites, we expect that the boll weevil infestation affected African Americans' marital decisions more than whites'. In particular, we anticipate that the weevil caused African Americans to marry later than they had before the infestation, thus decreasing the prevalence of marriage among young people. The prevalence of marriage among older people, in contrast, should not have been affected since most older people would have married long before the weevil arrived. In 1900, 25% of African-American women living in states that the weevil would ultimately infest had married by age 17.8, 50% had married by age 19.8 and 75% had married by age 23.4.[4] Consequently, we expect that the weevil affected marriage shares among people under 30 but not among older people, most of whom would have married prior to the weevil's infestation.

We estimate the direct effect of the infestation on the prevalence of early marriage rather than using the infestation as an instrument for tenancy because

[4] These numbers are based on all southern states hit by the boll weevil except Oklahoma, which we exclude here as well as in our analysis because Oklahoma was not incorporated until 1907. We estimate these ages using the procedure for indirect estimation described in Fitch and Ruggles (2000: 60). This procedure produces unbiased, age-independent estimates of the median age at first marriage. These estimates are more accurate than the widely-used singulate mean age of marriage estimates when peoples' ages at marriage are rapidly changing (see also Shyrock and Siegal 1980). In 1900, we estimate that 25% of African-American men living in states that the weevil would eventually infest were married by age 20.5, 50% were married by age 22.7, and 75% were married by age 26.7. The corresponding ages for native-born white men and women were 21.4 and 18.0, 24.3 and 20.4, and 28.8 and 24.3, respectively.

the boll weevil could have affected marriage patterns in other ways. For instance, to the extent that the infestation impoverished farmers irrespective of their tenure, it could have limited the resources they had to support a household. However, by showing that the infestation reduced the prevalence of tenancy, and that changes in tenancy were associated with changes in early marriage, we establish that the boll weevil's effect on tenant farming was one way that the infestation reduced the share of young African Americans who were married.

Data and methods

To study the effects of the boll weevil infestation on tenancy and marriage in the US South, we draw on three historical data sources: maps of the extent of the boll weevil infestation, the complete-count Census of Population, which we use to measure marriage and demographic covariates, and the Census of Agriculture, which we use to measure tenancy and agricultural covariates.

We follow the path of the boll weevil using a series of three maps published in US Department of Agriculture (USDA) reports. The maps chart the weevil's advance as it migrated northward and eastward out of Texas. The first map captures the weevil's migration as of 1913, the second map captures its advance as of 1917, and the final map captures its complete path through 1923 (Hunter and Pierce 1913; Hunter 1917; Hunter and Coad 1923).[5] Each map depicts the boundaries of southern counties intersected by smooth lines; these lines indicate the weevil's farthest extent in a given year. We digitized and georeferenced these maps, using consistent 1920 county borders to ensure that we compare the same geographic units over time. By the publication of the 1923 map, the weevil's path across counties was obscured by a tangle of lines (Figure 1, Panel A). Consequently, we generated our infestation data sequentially, beginning with the map with the fewest lines, published in 1913 (Figure 1, Panel B), and ending with the map depicting the weevil's entire migration by 1923. Our sequential procedure results in a single, composite digitized map. We use the composite map to record the year each county was hit by the weevil. Figure 2 shows the distribution of weevil arrivals by year.

We combine county-level information on the timing of the boll weevil infestation with county-level measures of marriage among different demographic

[5] Several previous studies have used the USDA maps to study the effects of the infestation on migration, agricultural production, and schooling (Fligstein 1981; Lange, Olmstead, and Rhode 2009; Baker 2015).

groups using complete-count Census of Population data for the years 1900, 1910, 1920 and 1930.[6] We generate two measures of the prevalence of marriage within demographic groups defined by racial classification, nativity, and age: the share of each group that had ever married and the share of each group that was currently married.[7] At young ages, when the two measures largely coincide, we anticipate that the boll weevil affected both. At older ages, we do not expect the boll weevil to have affected either whether people had ever married or whether they were currently married, since most marriages among older people would have formed before the weevil's arrival.[8] We consider the analysis of older people a type of placebo test: since marriages formed before the weevil's arrival cannot logically be affected by the infestation, observing an effect of the infestation on marriage at older ages would undermine our claim that the weevil causally affected marriage decisions at younger ages (Imbens and Rubin 2015: 483). Because women's and men's marriage decisions were interdependent in the twentieth century US, we combine women's and men's

[6] Complete-count census data for the years 1900, 1910, 1920, and 1930 were originally digitized by Ancestry.com and are available at the National Bureau of Economic Research through an agreement with the Minnesota Population Center. Census schedules for the year 1890 were destroyed before they could be digitized.

[7] A small minority of people reported as currently married in these data did not have a spouse present in their household when the census was taken. There is some evidence that single African-American women overreported being married (Preston, Lim, and Morgan 1992). We report results based on reported marriage irrespective of whether both spouses were present in the household because in the complete-count census microdata, the household composition variables have not yet been cleaned or standardized across census years. Nonetheless, we obtain similar results using a more conservative measure of current marital status that includes only those people we identify as having a spouse present in their household. To construct this measure, we use the role variable for each census record and the fact that the data were entered as they appear in the census manuscript schedules, with one household following another. We identify a new household each time a new "head" appears in the microdata. However, because the household composition variables are not standardized, for larger households with more than two married people, we are unable to identify who is married to whom and whose partner is or is not present in the household.

[8] High levels of inter-county migration, which we suspect varies with marital status and the arrival of the boll weevil, prevent us from studying marriage rates at older or younger ages. It is theoretically possible to study the marriage decisions of single people at risk of transitioning into marriage at each age by following cohorts across census years and comparing changes in the share ever married to the share previously never married. However, this procedure does not work well when the number of never-married people within a cohort and county could decline due to out-migration from the county rather than marriage within the area (nor, similarly, when the population of ever-married people within in a cohort and county could increase due to in-migration to the county rather than marriage of single people previously present in the county). Because our analysis requires county-level measures, high rates of inter-county migration prevent us from calculating marriage rates within groups defined by age, race, nativity and county.

marriage shares to simplify the presentation of our results.[9] The population counted as currently married may contain some people who were cohabiting but not legally wed. However, even if it were possible to distinguish these people in census data, it would not be necessary, because legal marriage and cohabitation should respond similarly to local economic shocks (Landale and Tolnay 1991: 38; Bloome and Muller 2015: 1416).

Finally, we use county-level data on the population and the economy from the 1900, 1910, 1920, and 1930 Censuses of Population and the 1889, 1899, 1909, 1919, and 1929 Censuses of Agriculture. We measure population density and male-to-female ratios by age and racial classification using the Censuses of Population. We gather data on the prevalence of tenant farming and cotton production from the Censuses of Agriculture. We calculate separately the share of all county farms worked by black tenant farmers, white tenant farmers, black non-tenant farmers, and white non-tenant farmers. We measure the share of improved acres devoted to cotton in 1889, before the boll weevil had entered the US. Measuring counties' initial dependence on cotton allows us to examine whether the weevil's effect on tenancy was larger in the cotton belt, as well as to adjust our estimates for differential time trends in counties that relied more or less heavily on cotton farming.[10]

We include in our sample all counties that were eventually infested by the boll weevil, except those in Oklahoma, which did not become a state until 1907. The boll weevil did not reach every county in the states that it infested. For example, the boll weevil did not infest some counties located in western Texas and northern Missouri, Kentucky, and Virginia. To ensure that we study units that are comparable over time, we standardize all county measures using 1920 county boundaries following the standardization procedure described in Hornbeck (2010).

We estimate the boll weevil's effect on marriage using a within-county fixed-effects model of the form

$$y_{ict} = \tau \mathrm{BW}_{ct} + \gamma \mathbf{X}_{ict} + \alpha_c + \delta_t + \epsilon_{ict},$$

[9] We obtain the same results if we restrict our sample to men or women alone.

[10] If omitted from our estimating equations, the growth in cotton production between 1900 and 1930 could induce a correlation between the timing of the weevil's arrival and county-level marriage shares because the weevil was attracted to cotton and cotton farming was associated with early marriage through its relationship to tenancy.

where y_{ict} is the outcome variable of interest at time t in county c among demographic group i. Our two outcomes are logged population shares currently married or ever married per 1,000 people in each demographic-county-year group.[11] We study the marriage shares of African-American and white southerners aged 15–19, 20–29, 30–39, 40–49, and 50+. We include marriages between native-born southerners and foreign-born southerners but exclude marriages between two foreign-born southerners because these latter marriages could have taken place outside of the United States and, if so, would not have been affected by the infestation.[12] Because African Americans were more likely than whites to be tenant farmers, and because whites had more opportunities to purchase land, we expect that the boll weevil infestation had the strongest effects on the timing of their marriages.

We estimate our model separately for each group. Our key predictor is BW_{ct}, which is a dummy variable that equals zero prior to the boll weevil's arrival in county c and one in the arrival year and every year thereafter. If t_c^* represents the year the boll weevil entered county c, then $\text{BW}_{ct} = 0$ if $t < t_c^*$ and 1 if $t \geq t_c^*$.[13] The vector of covariates, $\mathbf{X}_{ict}$, includes population density, sex ratios by age and racial classification, and linear and quadratic time trends interacted with the share of improved farm acres devoted to cotton in 1889. α_c is a county fixed effect capturing differences across counties that are invariant over time; δ_t is a year fixed effect capturing decadal changes that are common across counties; and ϵ_{ict} captures the remaining within-county variation over time for demographic group i. We cluster the residuals at the county level. The fact that farmers could not control whether or when their land was infested (Hunter and Coad 1923; Baker 2015) suggests that the errors and the boll weevil indicator are independent. Consequently, τ should capture the causal effect of the boll weevil on our outcomes.

We argue that the boll weevil infestation reduced the prevalence of early marriages in southern counties, in part, by undermining tenant farming, which itself encouraged early marriage. To evaluate this claim, we regress the share of county farms worked by black or white tenants on the boll weevil indicator,

[11] We log our outcomes to reduce skewness and increase the normality of the residuals.

[12] The vast majority of white southerners were native-born: between 1900 and 1930, the foreign-born share of the southern population never exceeded 2.6% (Gibson and Lennon 1999).

[13] Lange, Olmstead, and Rhode (2009) also measure the time to and from the boll weevil's arrival in a county, but these measures are less well-suited to our study because we have only four years of census data, each separated by a decade.

along with county and year fixed effects and time-varying covariates including population density and linear and quadratic time trends interacted with the 1889 county-level cotton share. We then predict marriage shares with the share of farms worked by black or white tenants using county and year fixed effects along with all time-varying covariates described above, including male-to-female ratios by age, race, and sex.

Results

In this section, we show that the boll weevil's entry into counties across the US South led fewer African Americans to marry at young ages than would have if their county had never been infested. Using panel data on tenant farming and marriage, we then show that increases in tenant farming within counties increased the prevalence of marriage among young people, particularly young African Americans. Finally, we demonstrate that the boll weevil's spread reduced the share of farms that were worked by black tenants, particularly in areas that historically relied on cotton farming. In short, tenancy increased the prevalence of early marriage among African Americans, and disruptions to tenancy had the opposite effect.

The boll weevil infestation was associated with reductions in the share of African Americans aged 15–19 and 20–29 who had ever married. The share of African Americans aged 15–19 who had ever married decreased by 5.6% after the weevil hit. The share ever married among African Americans aged 20–29 decreased by 3.7%. In contrast, the relationship between the boll weevil infestation and the share of African Americans aged 30 and older who had ever married, most of whom married before the infestation, was statistically indistinguishable from zero. The effects of the boll weevil were much more pronounced at younger ages; we can reject the null hypothesis of uniform effects across age groups.

These results are detailed in Table 1 and Figure 3. Table 1 reports the results of our first set of regressions, which estimate the effect of the boll weevil on group-specific shares ever married. Each row contains the coefficient on the boll weevil indicator for a different age group. The first three columns show the results for African Americans and the second three columns show the results for whites. Within each group, we report estimates from three separate models: first, models without covariates or fixed effects (M1 and M4), second, models

with county and year fixed effects (M2 and M5), and, third, models with county and year fixed effects as well as time-varying covariates (M3 and M6). The final column (M7) shows differences in the boll weevil coefficient for African Americans and whites from the most parameterized model (M3 and M6). Figure 3 depicts point estimates and 95% confidence intervals from models 3 and 6. The results suggest that the boll weevil led African Americans to marry later in life than they would have otherwise.

The boll weevil's effect on African Americans was much larger than its effect on whites, who were less likely to be tenant farmers and had comparatively more opportunities to purchase land. For instance, the infestation's effect on the share of African Americans aged 20–29 who had ever married was about nine times larger than its effect on whites of the same age. Among people aged 15–19, the effect was about four times larger among African Americans. Both of these racial group differences are statistically significant as well as substantively large. We find no effect of the infestation on marriage among older people of either racial group.

The boll weevil infestation also reduced the share of young African Americans who were currently married. Table 2 and Figure 4 mirror Table 1 and Figure 3, but they examine population shares currently married rather than ever married. As expected, we observe the same pattern of results across these two outcomes. After the boll weevil infested a county, the share of African Americans aged 15–19 who were currently married declined by about 5.2% and the share of African Americans aged 20–29 who were currently married declined by about 3.7%. The boll weevil's effect on shares currently married among whites aged 15–19 and 20–29 cannot be distinguished from zero, and differences in the boll weevil's effect on African Americans and whites at these ages are large. As expected, at older ages, there is no evidence of a relationship between the boll weevil infestation and shares currently married among either African Americans or whites. Our findings suggest that the boll weevil infestation lowered the share of African Americans who married at young ages relative to what would have been expected without the infestation.

The results reported in Tables 1 and 2 and Figures 3 and 4 are consistent with the claim that the boll weevil disrupted tenant farming, particularly among African Americans, thereby reducing their opportunities and removing their incentives to marry early. In our next set of results, presented in Table 3 and Figure 5, we introduce new evidence about tenancy's effect on early marriage.

In Figure 6, we show that the boll weevil infestation reduced the share of tenant farmers.

Increases in the share of farms operated by African-American tenants encouraged African Americans to marry at younger ages. Previous research has used cross-sectional census data to document that early marriage was more common among African Americans where tenant farming was more prevalent in the late nineteenth and early twentieth centuries. In Table 3, we use both spatial and temporal variation to show that as the prevalence of tenancy increased within counties between 1900 and 1930, so did the share of people who married at young ages. A 25 percentage-point increase in the share of farms worked by African-American tenants—just under one standard deviation in our sample—was associated with roughly an 8.1% increase in the share of 15–19-year-old African Americans who had ever married ($.25 * .325 = .081$) and a 7.7% increase in the share of 15–19-year-old African Americans who were currently married. Similar increases in tenancy also raised the share of African Americans aged 20–29 who had ever married by about 4.5% ($.25 * .181 = .045$) and the share of African Americans aged 20–29 who were currently married by 4.3%. The relationship between tenant farming and marriage was stronger for African Americans aged 15–19 and 20–29 than for whites aged 15–19 and 20–29, but the difference in these effects across racial groups was statistically significant only at age 20–29. Above age 40, neither the share of whites nor the share of African Americans who had ever married was affected by changes in tenancy. Figure 5 illustrates the age pattern in our results. Again, we see that where tenant farming among African Americans increased, so did African Americans' likelihood of marrying early in life.

The boll weevil infestation also reduced the extent of farming, particularly tenant farming, among African Americans. As we document in Figure 6, Panel A, the share of farms worked by African Americans fell by about 0.9 percentage points on average after the boll weevil infestation. Mechanically, the infestation thus increased the share of farms worked by whites by the same amount. Panel B shows that the entire decrease in farming among African Americans was driven by reductions in tenant farming, which declined by 1.1 percentage points.[14] Tenant farming among whites also declined after the infestation, but this decline should have been less consequential for whites' marriage decisions

[14] The results reported in Figure 6 normalize group-specific farm counts by the total number of farms in the county, but separate analyses of the raw counts indicate that the weevil decreased the number of farms worked by African Americans and by African-American tenants.

because whites had comparatively more economic opportunities outside of tenant farming. Figure 6, Panel C shows that African Americans' withdrawal from tenant farming following the weevil's infestation was especially pronounced in counties that historically relied heavily on cotton cultivation. The weevil's arrival was associated with a decline of about 1.7 percentage points in the share of farms worked by black tenants in counties whose share of improved acres devoted to cotton cultivation was above the median in 1889. In areas below the median, the association was both substantively and statistically weaker, with only a .6 percentage point decline.[15] Because the boll weevil fed on cotton, it had the most profound effects in areas heavily devoted to cotton farming before its arrival. The magnitude of the weevil's effect on tenancy is large: the 1.1 percentage point decline in the share of farms worked by African-American tenants caused by the boll weevil constitutes nearly one-third of the standard deviation in changes in tenancy over time.[16] Still, the change in tenancy caused by the infestation can explain only part of the weevil's effect on marriage among young African Americans.[17]

Discussion

A large body of demographic and sociological research has documented that tenant farming gave African Americans in the postbellum South both opportunities and incentives to marry early in life. Few white planters were willing to sell land to African Americans (Ransom and Sutch 2001: 86–87), but tenancy allowed them to rent it. White tenants often waited to marry until they could purchase land, but black tenants had few such opportunities (Hagood 1939: 35; Landale and Tolnay 1991: 37). Instead, planters' preferences for contracting with male-headed households actively encouraged them to marry early. In

[15] We also observe a strong and statistically significant interaction between the weevil's arrival and the historical share of acres devoted to cotton when we enter this share linearly into the estimating equation.

[16] There is more variation in the share of farms worked by black or white tenants across counties than within them, so our estimated effect constitutes a smaller portion of the total standard deviation in our sample. However, our estimate comes from a model with county and year fixed effects, so it is more appropriate to compare it to the residual standard deviation than to the total standard deviation.

[17] Decomposing the total effect of the infestation into portions that are mediated, moderated, and independent of tenancy would require us to assume that no counfounders of the tenancy-marriage relationship were affected by the infestation (VanderWeele 2015). We do not believe that this assumption is tenable, nor have any sensitivity analyses for violations of this assumption been developed.

counties throughout the South from 1880 to 1940, African Americans married at younger ages in counties dominated by tenant farming (Tolnay 1984; Landale and Tolnay 1991; Tolnay 1999; Bloome and Muller 2015).

Previous research on the relationship between tenancy and marriage has used cross-sectional data, comparing the age-specific prevalence of marriage in counties with a greater or lesser reliance on tenant farming. However, if the argument that tenant farming incentivized African Americans to marry early is correct, then changes in tenant farming should have altered these incentives. In this paper, we use exogenous variation in tenant farming induced by the boll weevil infestation to provide the strongest causal evidence to date on the relationship between tenancy and early marriage.

Our analysis yields three primary findings. First, as the boll weevil made its way across the South, African Americans became less likely to marry young than they had been before its arrival. The weevil's entry into southern counties reduced the share of African Americans aged 15–19 and 20–29 who had ever married. The estimates for whites aged 15–19 and 20–29 were also negative, but they were not statistically distinguishable from zero. The weevil's effects were larger among African Americans than among whites, and they were larger among younger African Americans than among older African Americans. These results are consistent with our argument that the infestation affected African Americans' decisions about when to marry, in part, by weakening tenancy's grip on southern agriculture. Our second and third findings provide further support for this interpretation. We show both that increases in tenancy between 1900 and 1930 led to increases in early marriage and that the weevil's arrival in a county reduced the share of farms operated by African-American and white tenant farmers. The decline in tenant farming had a larger impact on African Americans than whites because African Americans were more likely than whites to be tenant farmers and because whites had more opportunities than African Americans to purchase land.

The boll weevil's infestation of the US South between 1892 and 1922 offers new insight into the causal effects of economic change on marital patterns. Moreover, studying the infestation may help us understand long-run trends in marriage among African Americans. Until 1960, African Americans married at younger ages than whites (Fitch and Ruggles 2000: 65–66). Some scholars have noted that the relative reversal in the black and white median ages at marriage coincided with the mechanization of southern agriculture (Fitch and Ruggles

2000: 75, 79). Beginning in the early 1920s, agricultural depressions shook the southern US, forcing many former landowners into tenancy and inspiring others to swap tenants for machines (Fligstein 1981). The percentage of the US cotton crop harvested by machine "went from 5 in 1950 to 50 in 1960, and was over 90 by the end of the 1960s" (Wright 1986: 243). With this transformation came "the destruction of tens of thousands of sharecropper and tenant houses" (Wright 1986: 246). In 1940, 31.7% of young black men were employed in agriculture, but that figured dropped by half by 1950, and by half again by 1960 (Fitch and Ruggles 2000: 75, 79). If the boll weevil increased the age at which African Americans married, then the much larger changes induced by agricultural mechanization could have had a greater and more lasting effect. Future research should continue to study how the organization of the economy affects family life, including how agricultural transformations affected long-run trends in the marriage patterns of black and white Americans.

References

Amott, Teresa L. and Julie A. Matthaei. 1996. *Race, Gender, and Work: A Multi-cultural Economic History of Women in the United States,* Revised Edition. Boston: South End Press.

Baker, Richard B. 2015. "From the Field to the Classroom: The Boll Weevil's Impact on Education in Rural Georgia." *Journal of Economic History* 75:1128–1160.

Bercaw, Nancy. 2003. *Gendered Freedoms: Race, Rights, and the Politics of Household in the Delta, 1861–1875.* Gainesville: University Press of Florida.

Bloome, Deirdre and Christopher Muller. 2015. "Tenancy and African American Marriage in the Postbellum South." *Demography* 52:1409–1430.

Fitch, Catherine A. and Steven Ruggles. 2000. "Historical Trends in Marriage Formation: The United States 1850–1990." Pp. 59–88 in Linda J. Waite, Christine Bacharach, Michelle Hindi, Elizabeth Thomson, and Arland Thornton, eds., *The Ties that Bind: Perspectives on Marriage and Cohabitation.* New York: Aldine de Gruyter.

Fligstein, Neil. 1981. *Going North: Migration of Blacks and Whites from the South, 1900–1950.* New York: Academic Press.

Foner, Eric. 1988. *Reconstruction: America's Unfinished Revolution: 1863–1877.* New York: Harper Collins.

Franke, Katherine. 1999. "Becoming a Citizen: Reconstruction Era Regulation of African American Marriages." *Yale Journal of Law & the Humanities* 11: 251–309.

Gibson, Campbell J. and Emily Lennon. 1999."Historical Census Statistics on the Foreign-born Population of the United States: 1850-1990." US Bureau of the Census, Population Division Working Paper No. 29.

Giesen, James. 2011. *Boll Weevil Blues: Cotton, Myth, and Power in the American South.* Chicago: University of Chicago Press.

Goldin, Claudia. 1997. "Female Labor Force Participation: The Origin of Black and White Differences, 1870 and 1880." *Journal of Economic History* 37:87–108.

Hagood, Margaret Jarman. 1939. *Mothers of the New South: Portraiture of the White Tenant Farm Woman.* Chapel Hill, NC: University of North Carolina Press.

Hajnal, John. 1965. "European Marriage Patterns in Perspective." Pp. 101–43 in D. V. Glass and D. E. C. Eversley, eds., *Population in History.* London: Arnold.

Helms, Douglas. 1980. "Revision and Reversion: Changing Cultural Control Practices for the Cotton Boll Weevil." *Agricultural History* 54:108–125.

Hornbeck, Richard. 2010. "Barbed Wire: Property Rights and Agricultural Development." *Quarterly Journal of Economics* 125:767–810.

Hunter, Tera W. 1997. *To 'Joy My Freedom: Southern Black Women's Lives and Labors After the Civil War*. Cambridge: MA: Harvard University Press.

Hunter, Walter D. and W. D. Pierce. 1913. *The Movement of the Cotton Boll Weevil in 1912*. US Department of Agriculture Circular No. 167: Washington, DC.

Hunter, Walter D. 1917. *The Boll-Weevil Problem With Special Reference to Means of Reducing Damage*. US Department of Agriculture Farmers' Bulletin 848: Washington, DC.

Hunter, Walter D. and B. R. Coad. 1923. *The Boll Weevil Problem*. US Department of Agriculture Farmers' Bulletin No. 1329: Washington, DC.

Imbens, Guido W. and Donald B. Rubin. *Causal Inference for Statistics, Social, and Biomedical Sciences.* New York: Cambridge University Press.

Jaynes, Gerald David. 1986. *Branches Without Roots: Genesis of the Black Working Class in the American South, 1862–1882*. Oxford: Oxford University Press.

Landale, Nancy S. 1989a. "Agricultural Opportunity and Marriage: The United States at the Turn of the Century." *Demography* 26:203–218.

Landale, Nancy S. 1989b. "Opportunity, Movement, and Marriage: US Farm Sons at the Turn of the Century." *Journal of Family History* 14:365–386.

Landale, Nancy S. and Stewart E. Tolnay. 1991. "Group Differences in Economic Opportunity and the Timing of Marriage: Blacks and Whites in the Rural South, 1910." *American Sociological Review* 56:33–45.

Lange, Fabian, Alan L. Olmstead and Paul W. Rhode. 2009. "The Impact of the Boll Weevil, 1892–1932." *Journal of Economic History* 69:685–718.

Leavell, R. H. 1919. "The Negro Migration From Mississippi with Special Reference to the Exodus to Northern Communities in 1916–1917." In *Negro Migration in 1916–1917*. Washington, D.C.: Government Printing Office.

Mann, Susan A. 1990. "Slavery, Sharecropping, and Sexual Inequality." Pp. 133–158 in Micheline R. Malson, Elisabeth Mudimbe-Boyi, Jean F. O'Barr, and Mary Wyer, eds., *Black Women in America: Social Science Perspectives*. Chicago: University of Chicago Press.

Marks, Carole. 1989. *Farewell—We're Good and Gone: The Great Black Migration*. Bloomington, IN: Indiana University Press.

O'Donovan, Susan Eva. 2007. *Becoming Free in the Cotton South*. Cambridge, MA: Harvard University Press.

Olmstead, Alan L. and Paul W. Rhode. 2008. *Creating Abundance: Biological Innovation and American Agricultural Development*. Cambridge: Cambridge University Press.

Patterson, Orlando. 2000. "Taking Culture Seriously: A Framework and an Afro- American Illustration." Pp. 202–281 in *Culture Matters: How Values Shape Human Progress*, edited by Lawrence E. Harrison and Samuel P. Huntington. New York: Basic Books.

Preston, Samuel H., Suet Lim, and S. Philip Morgan. 1992. "African-American Marriage in 1910: Beneath the Surface of Census Data." *Demography* 29:1–15.

Ransom, Roger L., and Richard Sutch. 2001. *One Kind of Freedom: The Economic Consequences of Emancipation*. Cambridge: Cambridge University Press.

Reid, Joseph D., Jr. 1979. "White Land, Black Labor, and Agricultural Stagnation: The Causes and Effects of Sharecropping in the Postbellum South." *Explorations in Economic History* 16:31–55.

Ruef, Martin. 2012. "Constructing Labor Markets: The Valuation of Black Labor in the US South, 1831 to 1867." *American Sociological Review* 77: 970–998.

Scott, Emmett J. 1920. *Negro Migration during the War*. Oxford: Oxford University Press.

Shyrock, Henry S., and Jacob S. Siegal. 1980. *The Methods and Materials of Demography*, Vol. 1. Washington, DC: US Government Printing Office.

Snavely, Tipton Ray. 1919. "The Exodus of Negroes from the Southern States: Alabama and North Carolina." In *Negro Migration in 1916–1917*. Washington, D.C.: Government Printing Office.

Stanley, Amy Dru. 1998. *From Bondage to Contract: Wage Labor, Marriage, and the Market in the Age of Slave Emancipation*. Cambridge: Cambridge University Press.

Thornton, Arland, William G. Axinn, and Yu Xie. 2007. *Marriage and Cohabitation*. Chicago: University of Chicago Press.

Tolnay, Stewart E. 1984. "Black Family Formation and Tenancy in the Farm South, 1900." *American Journal of Sociology* 90:305–325.

Tolnay, Stewart E. 1999. *The Bottom Rung: African American Family Life on Southern Farms*. Chicago: University of Illinois Press.

Trimble, Aleck. n.d. Interviewed by Fred Dibble and Rheba Beehler. *Born in Slavery: Slave Narratives from the Federal Writers' Project, 1936–1939*. Washington, DC: Library of Congress, Manuscript Division.

United States Department of Commerce. 1918. *Negro Population, 1790–1915*. Washington, DC: Government Printing Office.

United States Department of Commerce. 1922. *Fourteenth Census of the United States, Volume V: Agriculture, General Report and Analytic Tables.* Washington, DC: Government Printing Office.

Van Hook, John F. 1938. "Plantation Life as Viewed by Ex-Slave." Written by Sadie B. Hornsby. *Born in Slavery: Slave Narratives from the Federal Writers' Project, 1936–1939.* Washington, DC: Library of Congress, Manuscript Division.

VanderWeele, Tyler. 2015. *Explanation in Causal Inference: Methods for Mediation and Interaction.* New York: Oxford University Press.

Wright, Gavin. 1986. *Old South, New South: Revolutions in the Southern Economy Since the Civil War.* New York: Basic Books.

Table (1) Predicting age-specific shares ever married (number per 1000 age-specific population, logged) with the boll weevil, county–level data by race and age. Southern counties experiencing boll weevil infestation. Standard errors shown in parentheses (clustered by county). Census and USDA data.

	Black			White			Black-White
	M1	M2	M3	M4	M5	M6	M7
Age 15-19							
Boll Weevil	.129	-.083	-.056	.053	-.003	-.013	-.044
	(.013)	(.023)	(.018)	(.009)	(.012)	(.012)	(.021)
Age 20-29							
Boll Weevil	.044	-.047	-.037	.048	-.002	-.004	-.033
	(.005)	(.016)	(.009)	(.004)	(.004)	(.003)	(.009)
Age 30-39							
Boll Weevil	.020	-.005	-.001	.017	-.001	-.002	.001
	(.005)	(.013)	(.008)	(.001)	(.002)	(.002)	(.009)
Age 40-49							
Boll Weevil	.015	-.006	-.001	.006	-.000	-.002	.002
	(.005)	(.013)	(.010)	(.001)	(.001)	(.001)	(.010)
Age 50+							
Boll Weevil	.016	-.025	-.007	.005	-.004	-.002	-.005
	(.007)	(.016)	(.006)	(.001)	(.002)	(.002)	(.006)
County fixed effects		✓	✓		✓	✓	✓
Year fixed effects		✓	✓		✓	✓	✓
Covariates			✓			✓	✓

Note: County covariates include female-to-male population ratios for ages 15–19, 20–29, 30–39, 40–49, and 50+ for both racial groups, plus population density and linear and quadratic time trends interacted with 1889 cotton share of improved farm acres. The intercept is also included and suppressed from the output. Sample size varies by group, as some age-by-race-by-county-by-year cells are empty. N range = (3255, 3480) for white shares and (3255, 3403) for black shares.

Table (2) Predicting age-specific shares currently married (number per 1000 age-specific population, logged) with the boll weevil, county–level data by race and age. Southern counties experiencing boll weevil infestation. Standard errors shown in parentheses (clustered by county). Census and USDA data.

	Black			White			Black-White
	M1	M2	M3	M4	M5	M6	M7
Age 15-19							
Boll Weevil	.123	-.075	-.052	.053	.000	-.009	-.042
	(.014)	(.023)	(.019)	(.009)	(.012)	(.012)	(.022)
Age 20-29							
Boll Weevil	.033	-.051	-.037	.050	-.002	-.004	-.034
	(.006)	(.017)	(.010)	(.004)	(.004)	(.003)	(.010)
Age 30-39							
Boll Weevil	.013	.006	.003	.026	-.001	-.003	.006
	(.005)	(.014)	(.009)	(.002)	(.002)	(.002)	(.010)
Age 40-49							
Boll Weevil	.019	.004	.003	.022	-.000	-.004	.007
	(.006)	(.015)	(.011)	(.001)	(.002)	(.002)	(.011)
Age 50+							
Boll Weevil	-.003	-.014	-.005	.026	-.002	-.006	.001
	(.008)	(.019)	(.010)	(.002)	(.003)	(.003)	(.010)
County fixed effects		✓	✓		✓	✓	✓
Year fixed effects		✓	✓		✓	✓	✓
Covariates			✓			✓	✓

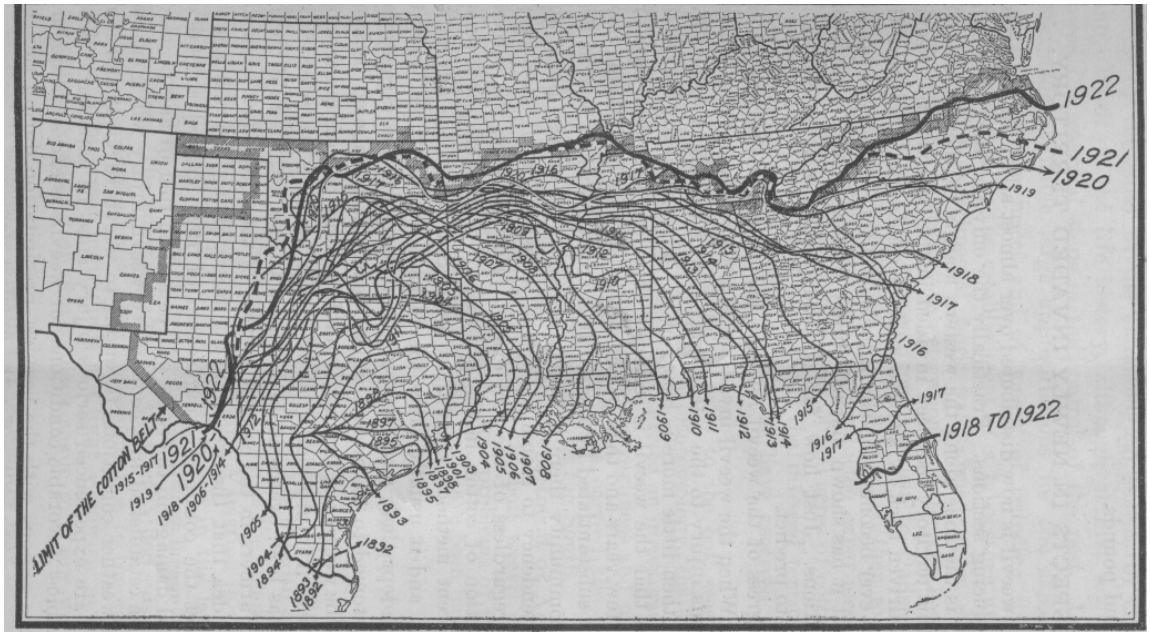
Note: County covariates include female-to-male population ratios for ages 15–19, 20–29, 30–39, 40–49, and 50+ for both racial groups, plus population density and linear and quadratic time trends interacted with 1889 cotton share of improved farm acres. The intercept is also included and suppressed from the output. Sample size varies by group, as some age-by-race-by-county-by-year cells are empty. N range = (3255, 3480) for white shares and (3255, 3403) for black shares.

Table (3) Predicting age-specific shares ever married and currently married (number per 1000 age-specific population, logged) with tenancy (race-specific number of tenant farms per total farms), county–level data by race and age. Southern counties experiencing boll weevil infestation. Standard errors shown in parentheses (clustered by county). Census data.

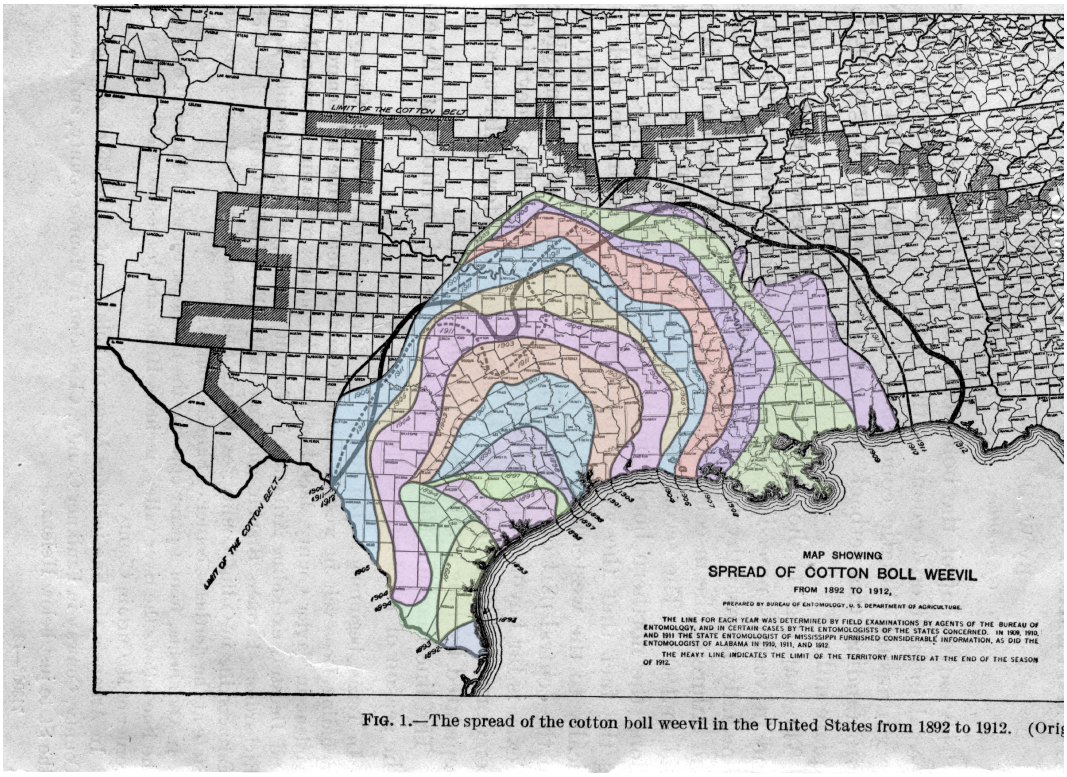
	Ever Married			Currently Married		
	Black	White	Black-White	Black	White	Black-White
	M1	M2	M3	M4	M5	M6
Age 15-19						
Proportion of farms worked by	.325	.074	.250	.307	.074	.233
black/white tenants (race-specific)	(.107)	(.068)	(.127)	(.109)	(.070)	(.130)
Age 20-29						
Proportion of farms worked by	.181	-.005	.186	.172	-.011	.183
black/white tenants (race-specific)	(.035)	(.021)	(.041)	(.039)	(.022)	(.045)
Age 30-39						
Proportion of farms worked by	.076	-.019	.095	.084	-.036	.120
black/white tenants (race-specific)	(.027)	(.011)	(.029)	(.032)	(.012)	(.034)
Age 40-49						
Proportion of farms worked by	.013	.001	.012	-.037	-.025	.061
black/white tenants (race-specific)	(.027)	(.008)	(.028)	(.034)	(.013)	(.036)
Age 50+						
Proportion of farms worked by	.022	.022	-.000	.130	-.014	.143
black/white tenants (race-specific)	(.021)	(.007)	(.023)	(.038)	(.019)	(.042)
County fixed effects	✓	✓	✓	✓	✓	✓
Year fixed effects	✓	✓	✓	✓	✓	✓
Covariates	✓	✓	✓	✓	✓	✓

Note: County covariates include female-to-male population ratios for ages 15–19, 20–29, 30–39, 40–49, and 50+ for both racial groups, plus population density and linear and quadratic time trends interacted with 1889 cotton share of improved farm acres. The intercept is also included and suppressed from the output. Sample size varies by group, as some age-by-race-by-county-by-year cells are empty. N range = (3255, 3480) for white shares and (3255, 3403) for black shares.

Figure (1) USDA maps and georeferencing.

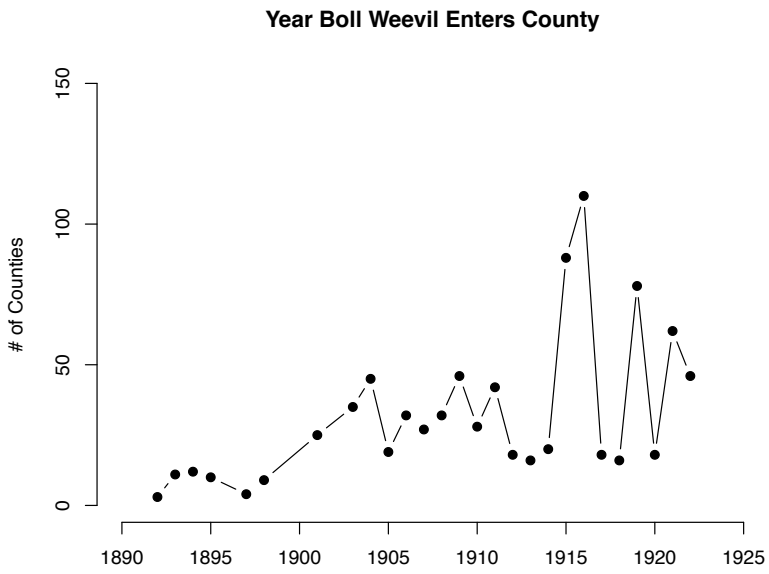


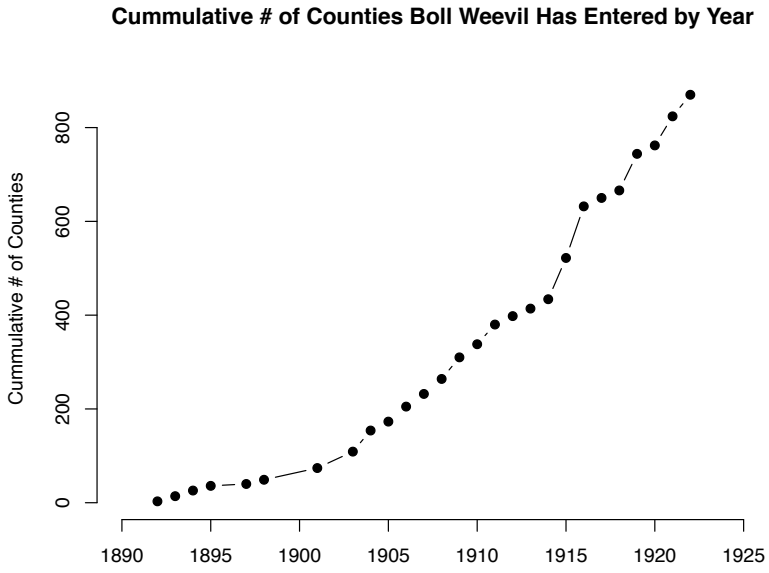
(a) 1923 map



(b) 1913 map, georeferencing initiated

Figure (2) Boll weevil infestation of southern US counties by year.





Note: Oklahoma counties are excluded for consistency with analysis.

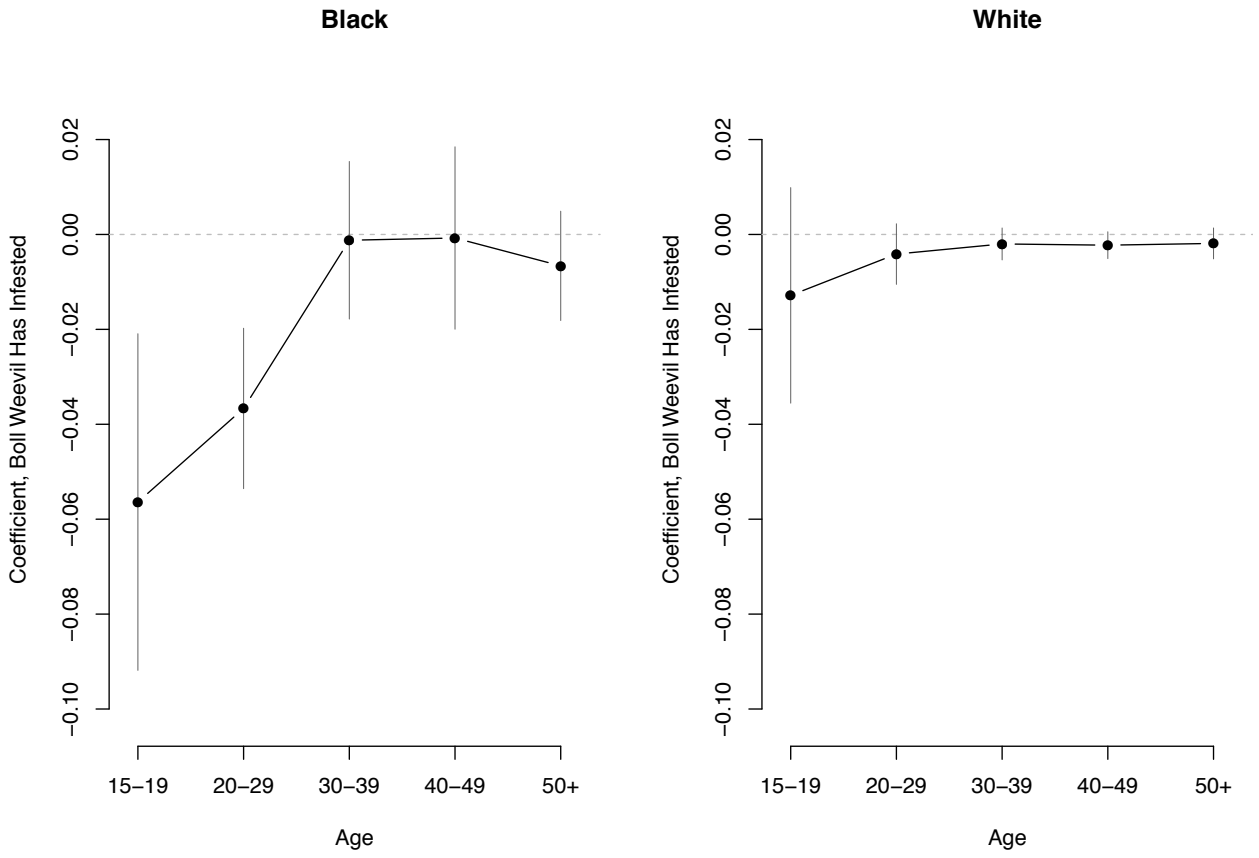


Figure (3) Coefficient on boll weevil indicator by age and racial group. Predicting group-specific shares of the population ever married (conditional on year and county fixed effects and time-varying county covariates; see table for details). Point estimates with 95% confidence intervals (standard errors clustered by county). Southern counties experiencing boll weevil infestation. Census and USDA data.

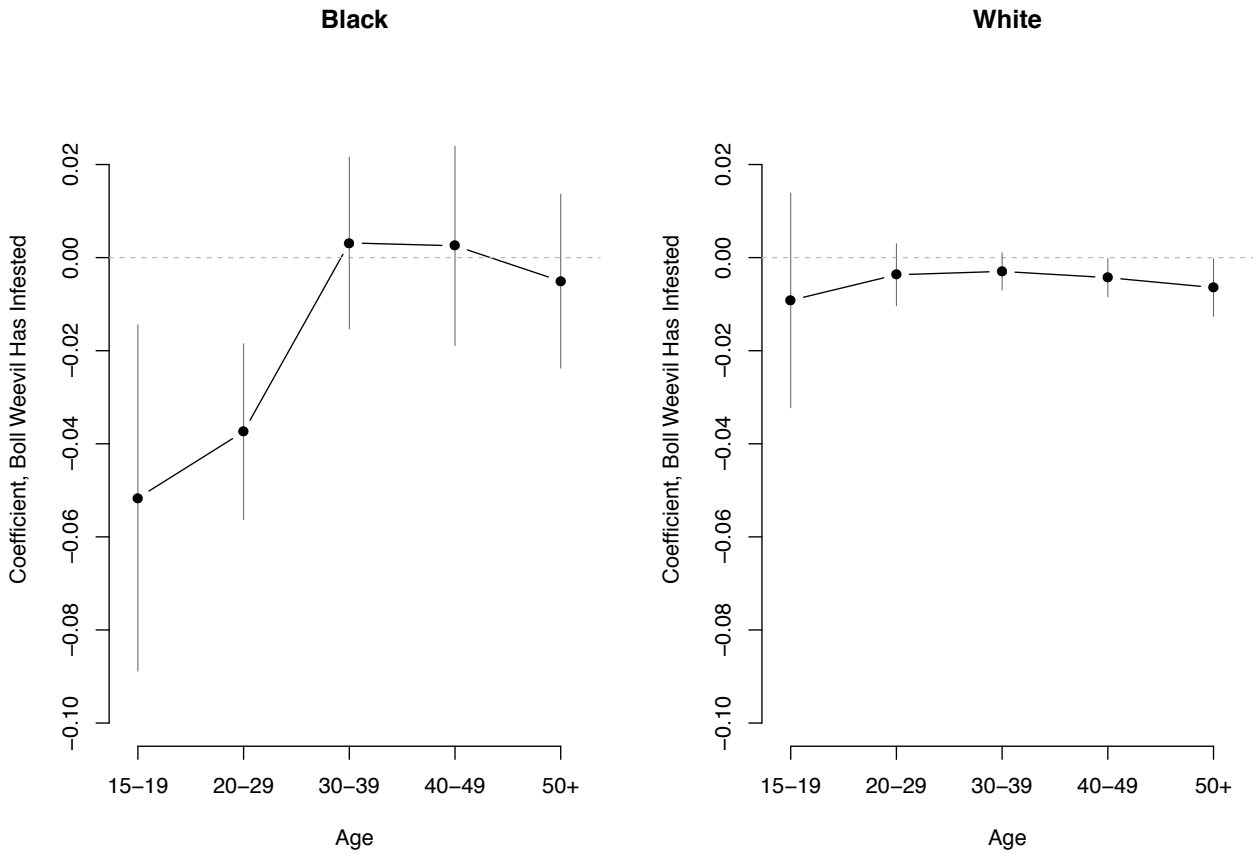


Figure (4) Coefficient on boll weevil indicator by age and racial group. Predicting group-specific shares of the population currently married (conditional on year and county fixed effects and time-varying county covariates; see tables for details). Point estimates with 95% confidence intervals (standard errors clustered by county). Southern counties experiencing boll weevil infestation. Census and USDA data.

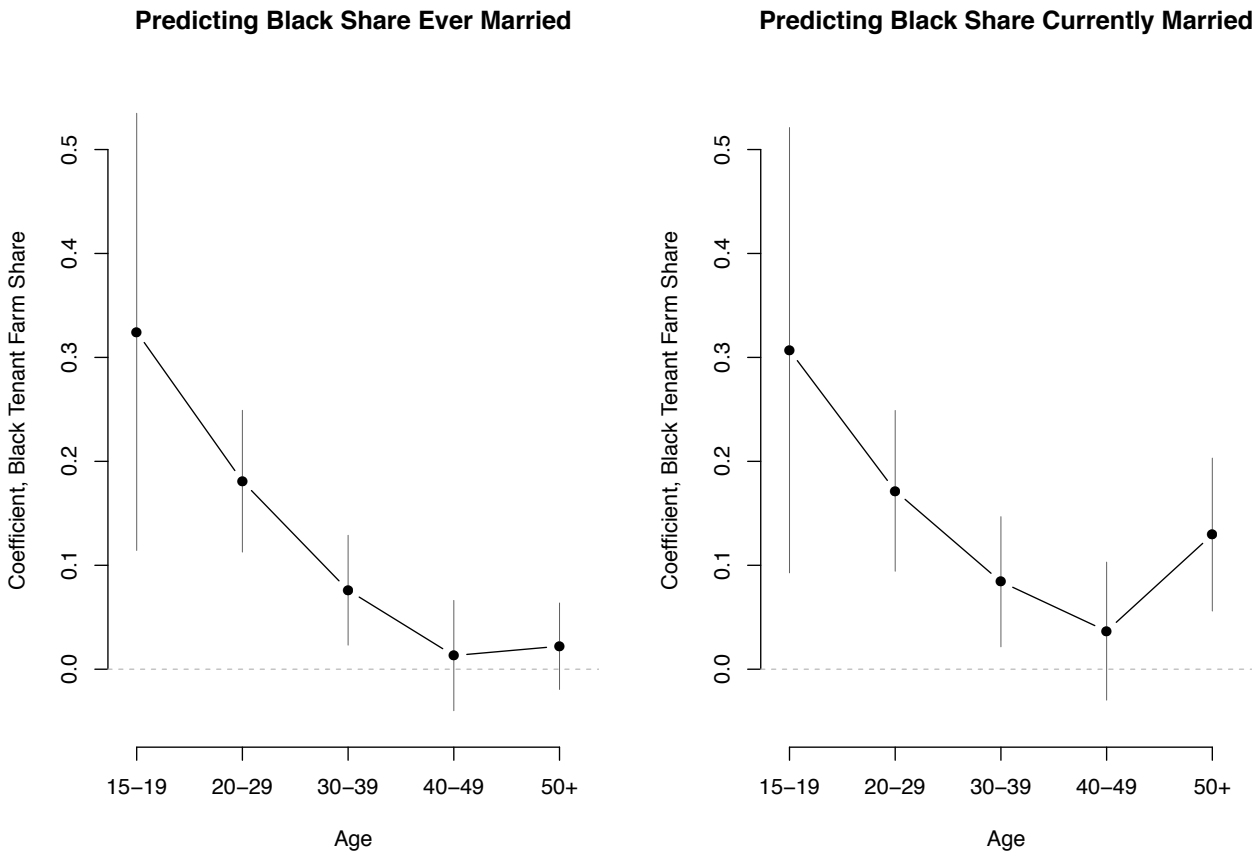


Figure (5) Coefficient on tenancy (share of farms worked by black tenants) by age. Predicting group-specific shares of the population ever married (left-hand panel) and currently married (right-hand panel) (conditional on year and county fixed effects and time-varying county covariates; see table for details). Point estimates with 95% confidence intervals (standard errors clustered by county). Southern counties experiencing boll weevil infestation. Census data.

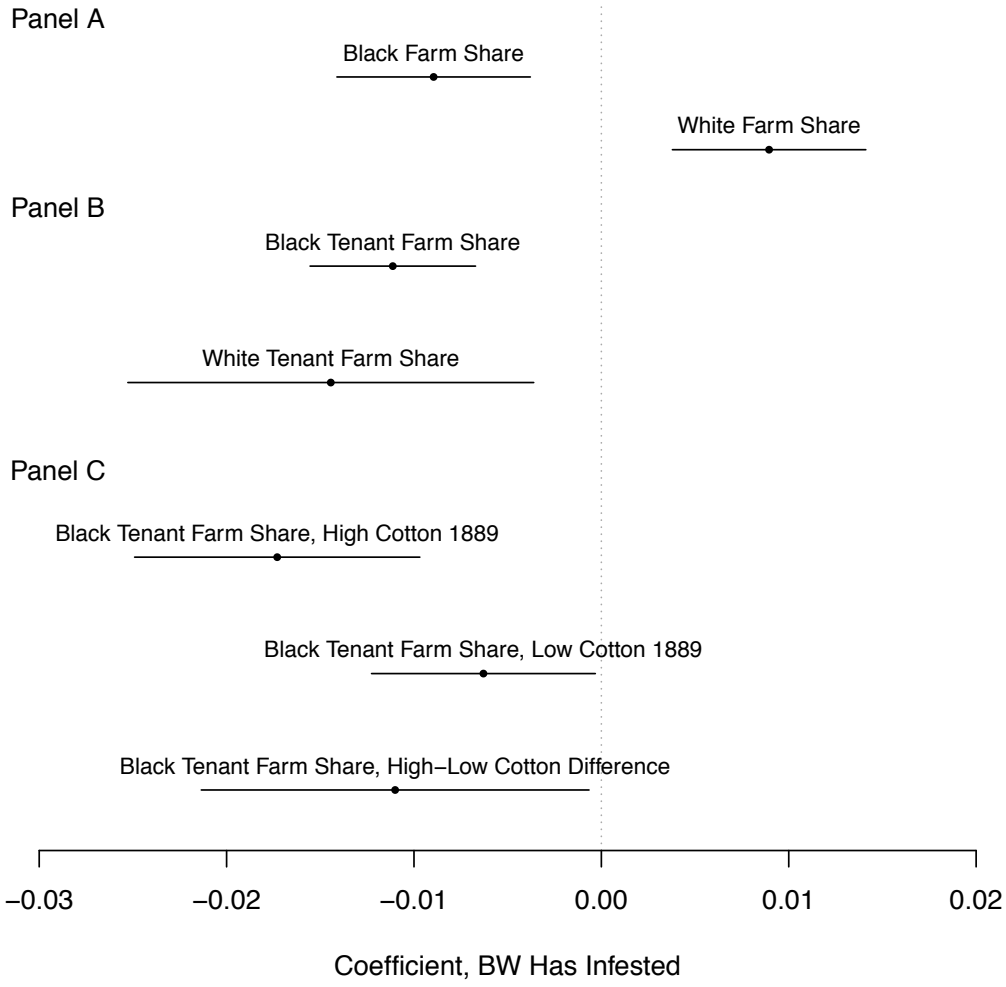


Figure (6) Coefficient on boll weevil indicator. Predicting farm outcomes (conditional on year and county fixed effects and time-varying county covariates: population density and linear and quadratic time trends interacted with 1889 cotton share of improved acres). Point estimates with 95% confidence intervals (standard errors clustered by county). Southern counties experiencing boll weevil infestation. Census and USDA data.