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Abstract

A large theoretical literature in sociology connects increasing rates of incarceration to contractions in the labor market. But evidence for the economic causes of incarceration is mixed. We use a shock to the southern agricultural labor market to study the political economy of incarceration in the U.S. South in the early twentieth century. From 1915 to 1920, a beetle called the boll weevil spread across the state of Georgia, causing cotton yields and the prevalence of tenant farming to fall. Using archival records of incarceration in Georgia, we find that the boll weevil infestation increased the rate at which African Americans were admitted to prison for property crimes. The effects for whites and for prison admissions for homicide were much smaller and not statistically significant.

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The idea that the number of people in prison rises and falls with changes in the labor market has a long history in sociology. Both Marx ([1867] 1990, p. 896) and Engels ([1845] 2005, p. 143) stressed that people expelled from the labor force must find some way to live. Frankfurt School theorists Rusche and Kirchheimer ([1939] 2003) took the argument further by claiming that not just crime but punishment as well moved in tandem with the labor market: When the demand for workers fell short of their supply, incarceration rates rose accordingly (Greenberg 1977, p. 648; Braithwaite 1980, p. 193; Darity and Myers 2000, p. 279; D’Alessio and Stolzenberg 2002, p. 178). Rusche and Kirchheimer’s ([1939] 2003, p. 67) argument implied that, when meting out punishment, criminal justice officials consider not only the desire to discourage crime, but also “the desire not to withdraw labor power from the employers.”

Scholars seeking to assess Rusche and Kirchheimer’s ([1939] 2003) claim face two challenges—one theoretical and the other empirical. To be theoretically compelling, studies of the political economy of punishment must document precisely how the capitalist class exerts influence over the criminal justice system (Wright et al. 1992, p. 107–127; Goodman et al. 2017, p. 6). “If it is to be argued that economic imperatives are conveyed into the penal realm,” writes David Garland (1990, p. 109), it is “necessary to describe the ways in which penal decision-makers—especially sentencers, prison authorities, and state officials—come to recognize labour-market ‘needs’ and ‘ruling class interests’ and then make decisions in accordance with them.” To be empirically convincing, meanwhile, studies of how the labor market affects crime and incarceration have to find a way around the methodological problem that crime and incarceration also affect the labor market (Pfaff 2008, p. 607; Western and Beckett 1999). Typically, this entails finding some event that transformed the labor market, but that could not itself have been affected by changes in incarceration.

In this paper, we address both challenges. We study a time and a place—the U.S. South in the early twentieth century—when powerful landowners exerted a clear
and well-documented influence over criminal justice officials. And we examine an event—the boll weevil infestation—that had a drastic effect on tenant farming, the primary form of work available to black southerners.

Boll weevils are small beetles that feed primarily on cotton. They entered the United States through Texas in 1892 and gradually migrated eastward across the South, reaching Georgia in 1915. As they passed through the South’s Black Belt, they dramatically reduced both cotton yields (Lange et al. 2009) and the share of farms worked by tenant farmers (Bloome et al. 2017; Ager et al. 2017).

Because a greater share of black than white southerners worked as tenant farmers and sharecroppers, the boll weevil infestation threw relatively more African Americans than whites out of work. With few other options for survival, displaced tenants may have turned to property crime as an alternative means of subsistence. But the infestation also increased the risk that African Americans would be incarcerated for property crimes irrespective of changes in crime itself. Before the infestation, elite landowners often secured workers by paying their bail or fines (Blackmon 2008; Daniel 1972, p. 24–25; Novak 1978, p. 24; Raper 1936, p. 293). Some dealt with property crimes informally or interfered with prosecutions to keep tenants and sharecroppers on their land (Alston and Ferrie 1999, p. 28–29; Davis et al. [1941] 2009; Smith 1982, p. 195; Du Bois 1904, p. 44–48; Raper and Reid 1941, p. 25). When the infestation reduced their need for agricultural workers, planters no longer had an interest in preventing actual or potential laborers from being incarcerated. Thus the boll weevil infestation might have increased incarceration even if it had no effect on crime.

In the following analysis, we combine sixteen years of archival records on incarceration in the state of Georgia with data on the timing of the boll weevil infestation drawn from a map published by the United States Department of Agriculture. These data enable us to study how the arrival of the boll weevil affected imprisonment within Georgia counties. We find that the infestation increased the black prison admission
rate for property crimes by more than a third in the following year. The boll weevil’s
effect on the white prison admission rate for property crimes, in contrast, was weaker
and not statistically significant. Its effect on the rate at which both African Americans
and whites were admitted to prison for homicide was close to zero and not statistically
significant.

We then use the boll weevil infestation as an instrumental variable for cotton
production. We find that the size of a county’s cotton yield was inversely related to
its black prison admission rate. The boll weevil’s effect on the black admission rate
was also largest in the counties that depended most on cotton cultivation before the
infestation.

These results add new causal evidence to the literature on the political economy
of punishment. They demonstrate that shocks to the labor market help to explain
increases in incarceration in the rural South in the early twentieth century. As we
discuss in the conclusion, they may also point to an underappreciated cause of the rise
in incarceration in the late twentieth century: the mechanization of cotton production
from 1950 to 1970.

The Political Economy of Punishment

Our work falls in a tradition of Marxist scholarship on the political economy of
punishment. This tradition has highlighted how the form and scale of punishment
over time varies with the demand for and supply of labor (Rusche [1933] 1978;
Rusche and Kirchheimer [1939] 2003). It has spawned an empirical literature on the
relationship between the labor market, crime, and incarceration, with a particular
focus on unemployment and labor force participation (Jankovic 1977; Greenberg 1977;
Myers and Sabol 1987; D’Alessio and Stolzenberg 1995, 2002; Darity and Myers 2000;
Melossi 2003; Sutton 2004; De Giorgi 2013). The results of this research have been
mixed and much debated (Sampson 2000; Chiricos 1987, Chiricos and Delone 1992, and Freeman 2000 survey the literature).

One major impediment to estimating the effect of unemployment on crime and incarceration is that crime and incarceration clearly affect unemployment (Pfaff 2008, p. 595; Western and Beckett 1999). This has led scholars to search for sources of variation in unemployment that are not affected by crime or incarceration (Pfaff 2008, p. 607). For instance, Raphael and Winter-Ebmer (2001) use Department of Defense annual prime contract awards and state-specific oil price shocks as instrumental variables for state unemployment rates from 1971 to 1997. They find that increases in unemployment due to these awards and shocks increased the rate of property crime but had weaker and less consistent effects on violent crime. Lin (2007) reports similar results for 1974 to 2000 using state-level changes in the exchange rate, union membership, and manufacturing as instrumental variables. Gould et al. (2002) predict state-level non-college unemployment and wage rates from 1979 to 1997 using the industrial composition in each state, national employment trends in each industry, and changes in the demographic composition of each industry. They find that falling wages and employment increased the rate of both property and violent crime.

Most of the research on unemployment, crime, and incarceration has focused on urban and industrial labor markets. Scholars have traced both the rise in crime in the 1960s and 1970s and the origins of mass incarceration to the collapse of manufacturing in the Northeast, Midwest, and West (Wilson 1987; Western 2006; Gilmore 2007, p. 70–78; Wacquant 2009). These arguments are supported by evidence that class inequality more than racial inequality in incarceration increased during the prison boom (Western 2006; Wacquant 2010; Forman 2012; Muller 2012), that growing unemployment increased young black men’s likelihood of being imprisoned, and that declining earnings increased the risk of imprisonment for both young black and young white men (Western et al. 2006).
But the mechanization of agriculture in the South may have been equally con-
sequential (Gottschalk 2015, p. 85). Between 1950 and 1970, the percentage of U.S.
cotton harvested by machine increased from five percent to nearly 100 percent (Wright
1986, p. 243). In 1940, 31.7% of young black men were employed in agriculture; by
1960, that figure had fallen to 6.5% (Fitch and Ruggles 2000, p. 75, 79; see also Mare
and Winship 1979 and Cogan 1982). Katz et al. (2005, p. 86) argue that the collapse
of agricultural employment “was a more important source of joblessness among black
men than the decline in manufacturing opportunities.” In this paper, we study an
exogenous change to the southern agricultural labor market that can be conceived as
a rehearsal for the larger changes induced by the mechanization of cotton production
from 1950 to 1970: the boll weevil infestation of 1892–1922.

The Boll Weevil Infestation

In 1910, African Americans in the state of Georgia worked predominantly as share-
croppers and tenant farmers. More than 45 percent of African Americans, compared
to 26 percent of whites, lived on farms they rented (Ruggles et al. 2019). Eighty-seven
percent of farms worked by black Georgians were run by tenants rather than owners
(United States Department of Commerce and Labor 1913, p. 344). The comparable
figure for white Georgians was 50 percent. Black tenants grew an especially large share
of the cotton crop. In 1910, they worked 45 percent of Georgia’s acres devoted to
cotton, compared to 32 percent of its acres devoted to corn (United States Department
of Commerce 1918b, p. 623–624). White tenants, in contrast, grew 25 percent of both
corn and cotton acres in Georgia.

Historical scholarship has documented that when the boll weevil entered a county,
planters “reduced their cotton acreage and chose to give up cotton altogether in favor
of livestock or food crops. That in turn reduced the demand for black labor, and many
field hands, sharecroppers, and tenants found themselves forced off the plantations to seek work elsewhere” (Litwack 1998, p. 177). Subsequent research in economics and sociology has supported these conclusions. Lange et al. (2009) find that cotton yields declined by 50 percent within five years of the weevil’s arrival. Bloome et al. (2017) show that the infestation reduced the share of farms worked by black and white tenants. Ager et al. (2017) report that the weevil caused both tenancy and farm wages to decline.

Previous studies have examined the boll weevil’s effects on education, migration, health, and marriage (Baker 2015; Baker et al. 2018; Fligstein 1981; Clay et al. 2019; Bloome et al. 2017). Baker (2015) finds that the infestation, by reducing the demand for child labor, increased black children’s rate of school enrollment in Georgia. Baker et al. (2018) link the 1940 census records of men from cotton-belt counties to their corresponding records in 1900, 1910, and 1920. They find that both black and white children who lived in a county that was hit by the boll weevil completed more schooling by the time they were adults. Fligstein (1981) shows that counties infested by the weevil had higher rates of black outmigration from 1900 to 1920 and higher rates of white outmigration from 1900 to 1930. Clay et al. (2019) document that the boll weevil prompted farmers to switch from cotton to food crops that were rich in niacin, causing rates of death from pellagra to fall.

Finally, Bloome et al. (2017) argue that the extent to which black southerners married at young ages depended on the political and economic constraints that they faced. African Americans in the rural South had few employment prospects outside of sharecropping and tenant farming—systems of work that used the patriarchal family to coordinate production (Bloome and Muller 2015; Hill 2006; Mann 1989). Landlords’ preference for contracting with married men put pressure on African Americans to marry at young ages so that they could acquire agricultural work. Although the infestation reduced rates of tenancy and sharecropping among both
black and white southerners, because relatively more black southerners worked as tenants and sharecroppers, the infestation had a larger effect on their early marriage rates.

**From Tenancy and Sharecropping to Incarceration**

By reducing the extent of tenant farming, the boll weevil infestation caused a temporary decline in the demand for black labor. Theorists writing as early as Marx ([1867] 1990, p. 896) and Engels ([1845] 2005, p. 143) have proposed that people who lose their jobs may turn to crimes of survival to make up for their lost incomes (see also Rusche [1933] 1978, p. 4; Rusche and Kirchheimer [1939] 2003, p. 12, 14, 95–96; Thompson 1963, p. 61; Chiricos and Delone 1992; Davis 2003; De Giorgi 2013). If so, to the extent that crime and incarceration are correlated, the boll weevil should have increased the rate at which black southerners were incarcerated for property crimes.\(^1\)

But the infestation should have affected not only the rate at which black southerners committed property crimes: it also should have affected the extent to which those crimes were prosecuted (Rusche and Kirchheimer [1939] 2003, p. 67, 140). Because of their need for agricultural workers, elite landowners often used their influence over local judges and officials to offer sharecroppers and tenants “protection from the law” (Alston and Ferrie 1999, p. 28–29; Davis et al. [1941] 2009, p. 403, 521; Muller 2018). Some landowners punished property crimes themselves—often using violence—without appealing to the formal criminal justice system (Davis et al. [1941] 2009, p. 46, 404, 512; Smith 1982, p. 195). Others intervened in prosecutions to prevent accused workers from being sent away to prisons and chain gangs (Du Bois 1904, p. 44–48; Raper and Reid 1941, p. 25). In a survey W. E. B. Du Bois (1904, p. 47) distributed to African Americans in Georgia, one respondent attributed low rates of black incarceration for

\(^1\)In a study with a similar design to ours, Bignon et al. (2017) show that the spread of phylloxera, an aphid that destroyed French vineyards in the nineteenth century, increased the rate of property crime in affected départements.
petty crime to “the demand of labor in this county and the means employed by the large land owners to secure it.”

Landowners also paid tenants’, sharecroppers’, and potential agricultural laborers’ bail or fines, then had them work off the debt (Blackmon 2008; Daniel 1972, p. 24–25; Novak 1978, p. 24). Raper (1936, p. 293), who studied two counties in Georgia’s Black Belt, reported that this practice persisted until the boll weevil infestation:

At times when laborers have been in greatest demand in Green and Macon counties, certain landlords have made it a practice to pay fines and get out on bail, when possible, any defendants who seemed to be desirable workmen. This practice has been virtually abandoned in Greene since 1923, in Macon since 1925. Prior to the weevil depression, in a county adjoining Greene an understanding existed between certain court officials and two or three big planters whereby Negroes lodged in the county jail were bonded out to them; other laborers were obtained by them through the payment of court fines.

When the boll weevil interfered with cotton production, elite landowners no longer needed to keep actual or potential agricultural laborers—now a surplus population—out of prison. Irrespective of changes in crime, the infestation consequently should have caused the black prison admission rate for property crime to increase.

Because we cannot observe property crime directly, we cannot distinguish between the boll weevil’s effects on crime and its effects on enforcement. Our estimates almost certainly reflect a combination of these two ways the infestation could have increased incarceration. However, because we have data on prison admissions for all offense types, we can examine whether the weevil affected admissions for homicide—an offense type more likely to reflect changes in crime than changes in enforcement and less likely to be affected by changes in the labor market. Finally, because black tenants and sharecroppers grew a comparatively large share of Georgia’s cotton, the decline in cotton production should have had a larger effect on the demand for black than white workers. With data on both black and white prisoners, we can test whether it also increased the black more than the white prison admission rate.
Data and Methods

To study the effect of the boll weevil infestation on the black prison admission rate for property crime, we gather data from several historical sources. Data on incarceration come from the *Central Register of Convicts, 1817–1976*, housed at the Georgia Archives in Morrow, Georgia. These data consist of a series of handwritten ledgers listing every person convicted of a felony in the state, along with their offense, their county of conviction, their racial classification, and the date they were received. Data on prisoners’ county of conviction are especially important because they enable us to study the effect of changes in the labor market in the counties where prisoners were convicted rather than the counties where they were incarcerated. Most data on incarceration, including census data, count prisoners where they are confined rather than where they were convicted (Lotke and Wagner 2004). We focus on the years 1910–1925 so that we can study incarceration several years before the weevil infested the first county in Georgia and several years after it infested the last county.

The ten volumes of the *Central Register of Convicts* that we use often cover the same months and years. To ensure that the same person is not counted in separate volumes for a single admission, we match admission records based on prisoners’ name, offense, county of conviction, and admission date to identify duplicate records. We split prisoners’ names into first, middle, and last, then discard middle names and any prefixes or suffixes. We sort crime descriptions into 40 distinct crimes, and we correct misspelled county names. We then use approximate string matching to match admission records by first name, last name, crime, and county. We consider admission

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3 We manually examined the quality of our matches using different thresholds to classify a Jaro-Winkler distance score as a match. A threshold of 0.44 provided the best balance between false positives and false negatives, but any threshold between 0.3 and 0.5 produced results that differed by
dates to match if they are within 30 days of one another. Matching records in this way enables us to identify and discard 682 duplicate admission records.

In the remaining sample, 13 prisoners have a racial classification other than black or white. Because our analyses focus on black and white admissions, we drop these prisoners. We also exclude 83 prisoners (0.6%) with missing racial classification data, 16 prisoners (0.1%) with missing offense data, and 64 prisoners (0.4%) with missing county of conviction data. This leaves 13,776 unique records of prison admissions.

We divide crimes into three categories: property crimes, homicide, and other crimes. Property crimes (54% of the sample) include all forms of burglary, larceny, robbery, and other forms of theft, such as forgery and embezzlement. Homicides (36% of the sample) include murder, attempted murder, assault to murder, and manslaughter. Other crimes include all offenses that do not fit into the first two categories, the most common being rape, shooting, arson, and bigamy. Other crimes make up only about 10% of the sample.

Data on the boll weevil infestation come from a map published by the U.S. Department of Agriculture (Hunter and Coad 1923, p. 3). The map charts the boll weevil’s path as it migrated northward and eastward across the South, using lines to indicate its farthest extent in a given year. This enables us to assign a year of infestation to each county. With information on the year each county was infested, we can examine the black and white prison admission rate in the following year.

We adopt the same coding scheme as Baker (2015), who uses annual data to study the boll weevil’s effect on children’s school enrollment in Georgia. In a small number of counties, the boll weevil entered, retreated, then reentered. We follow Baker in assigning these counties the final rather than the first year of infestation. The boll weevil migrated across Georgia from 1915 to 1920. Figure 1 depicts the year each county was infested, using 1920 county borders from Manson et al. (2018).

only a small number of matches. For a formal definition of the Jaro-Winkler distance score, see van der Loo (2014).
Figure 1: The boll weevil infestation in Georgia, 1915–1920. The map depicts Georgia counties, using 1920 borders from Manson et al. (2018). Darker shades indicate later infestation years. Data on the timing of the infestation come from Hunter and Coad (1923, p. 3).
Like Baker, we study the boll weevil’s effect in the year after its arrival because the weevil migrated late in the growing season and thus primarily affected the following season’s harvest. The boll weevil indicator we create thus equals 1 in the year after the infestation and every year thereafter. In some regressions, we treat counties as if they had been infested one to four years before they actually were infested to check that we do not observe a treatment effect in these pre-treatment years (Heckman and Hotz 1989). We do the same for four additional post-treatment years.

Because the boll weevil was attracted primarily to rural counties, which typically had lower incarceration rates than urban counties (Muller 2018), we adjust all of our estimates for the population density of each county. Data on the area and population of Georgia counties in the 1910, 1920, and 1930 censuses are available in Haines and the Inter-university Consortium for Political and Social Research (2010). We divide the total population of each county by its land area and linearly interpolate population density in the intercensal years.

Between 1910 and 1925, 15 new counties were created in Georgia. To ensure that we study units that are consistent over time, we create “super-counties” that include the new counties and the counties out of which they were carved. This reduces our sample from 161 counties to a combination of 131 counties and super-counties. For simplicity, in what follows we refer to both counties and super-counties as counties. We assign the 13,776 unique prison admissions from the *Central Register of Convicts* to county-years. After excluding seven county-years with zero black residents, our primary sample includes \( N = 2089 \) county-year observations.

Our primary outcome \( y_{it} \) measures the number of annual prison admissions in each Georgia county, where \( i \) indexes counties and \( t \) indexes years. This is a count

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4 Specifically, we created eight super-counties out of the following 38 counties: (1) Bleckley and Pulaski; (2) Bulloch, Candler, Emanuel, Evans, Montgomery, Tattnall, Treutlen, and Wheeler; (3) Appling, Atkinson, Bacon, Berrien, Brantley, Charlton, Clinch, Coffee, Cook, Lanier, Lowndes, Pierce, Ware, and Wayne; (4) Barrow, Gwinnett, Jackson, and Walton; (5) Lamar, Monroe, and Pike; (6) Liberty and Long; (7) Decatur and Seminole; and (8) Houston, Macon, and Peach.
variable, and it is overdispersed with a large number of zeros, so our main analyses fit negative-binomial regressions of the form

\[ y_{it} \sim \text{Negative binomial}(\mu_{it}, \theta) \]  

(1)

\[ \mu_{it} = N_{it} \times \exp(\beta_t BW_{i,t+1} + \beta_x PD_{it} + \gamma_i + \delta_t), \]  

(2)

where \( BW_{i,t+1} \) represents the lagged presence of the boll weevil in a county and \( PD_{it} \) represents population density. \(^5\) \( \theta \) is an overdispersion parameter. \( \gamma_i \) and \( \delta_t \) are county and year fixed effects. \( N_{it} \), the county population, acts as an “exposure” term that accounts for the fact that larger counties will typically have higher counts of prison admissions. Dividing both sides of (2) by \( N_{it} \) shows that this is equivalent to modeling the prison admission rate in a given county–year.

Our key parameter of interest is \( \beta_t \), the regression coefficient on the arrival of the boll weevil. Because there was little farmers could do to prevent the boll weevil from overtaking their land, \( \beta_t \) should represent the causal effect of the infestation on the prison admission rate (Lange et al. 2009, p. 689). Because the conditional mean \( \mu_{it} \) is exponentiated in (2), we can interpret \( \beta_t \) and the other regression coefficients in the same way as we would in a linear model with a logged outcome. County fixed effects control for all stable characteristics of counties. \( \beta_t \) thus captures the within-county effects of the boll weevil: each county, in the years before the boll weevil arrived, acts as its own control case to compare with the years after the boll weevil arrived. Including county and year fixed effects makes the interpretation of \( \beta_t \) equivalent to a differences-in-differences estimate of the causal effect of the boll weevil infestation.

In some generalized linear models such as logistic regression, fixed effects can be biased because of the incidental-parameters problem, but this is not true of Poisson

\(^5\) Below we introduce data on cotton production in each county. We do not control for cotton production in this model because it is a post-treatment mediator of the effect of the boll weevil on prison admissions.
or negative-binomial regression models (Allison and Waterman 2002). However, the standard confidence intervals in fixed-effects negative-binomial regressions can be too small. To correct this, we use the nonparametric bootstrap to compute our confidence intervals, clustering on counties. Allison and Waterman (2002) offer a corrected version of standard errors for fixed-effects negative-binomial regressions, and in practice their correction produces smaller confidence intervals than the bootstrap. Our results are substantively identical if we use their corrected standard errors, but because our bootstrapped confidence intervals are wider, they provide a more conservative test of our claims. In some cases, particularly for the instrumental-variables estimates discussed below, the sampling distributions of our estimated coefficients are skewed, so we use Efron’s (1987) bias-corrected and accelerated (BC$_a$) bootstrap confidence intervals, which produce confidence intervals with correct coverage for skewed and other non-normal sampling distributions.

Next, we use the timing of the boll weevil infestation as an instrumental variable for changes in the agricultural labor market. Unlike Bloome et al. (2017) and Ager et al. (2017), we cannot study the effect of tenancy directly because agricultural census data on tenancy are available only in ten-year intervals. However, we can estimate the effect of cotton production on incarceration. Like Lange et al. (2009) and Baker (2015), who show that the infestation markedly reduced cotton production, we use data on the number of bales of cotton ginned, available in annual United States Department of Commerce (1911, 1916, 1917, 1918a, 1919, 1920, 1921, 1923, 1924, 1927) Reports. Using state-level time-series data on incarceration in Georgia from 1868 to 1936, Myers (1991) shows that the incarceration rate of both black and white men increased when the price of cotton fell.

Because we use negative-binomial regression to model our outcome, standard two-stage least-squares approaches are not appropriate for estimating instrumental-variables models. Instead, we use a control-function approach (Cameron and Trivedi
2013, p. 401), which has two stages. The first stage is a linear regression of the treatment, the log of the number of cotton bales ginned, on the instrument, the arrival of the boll weevil, controlling for population density and county and year fixed effects. We then use the residuals from this first-stage regression as controls in the second-stage regression, which takes a form identical to (1)–(2), with the cotton-production treatment taking the place of the boll-weevil treatment. The first-stage residuals represent the variation in cotton production that is not explained by the arrival of the boll weevil and controls—in other words, the remaining endogeneity in cotton production. Including these residuals in the second stage controls for this endogeneity. In this application, the estimated residuals are referred to as the control function.

Because our estimation procedure has two stages, the standard errors reported for the second-stage negative-binomial regression do not account for the estimation uncertainty in the first-stage regression. To properly estimate this uncertainty, we use the BC$_a$ bootstrap to produce appropriate confidence intervals, as described above.\footnote{Because the nonparametric bootstrap resamples counties from the observed data, a handful of bootstrap samples exhibit no correlation between the instrument and the treatment, which produces extreme values in the second-stage regressions because of the weak-instrument problem. This creates a heavy-tailed sampling distribution, which is why we report BC$_a$ bootstrap confidence intervals, which are robust to non-normality. As shown in column (2) of Table 1, in the observed data, the arrival of the boll weevil is a strong instrument for cotton production; it is only in a small number of bootstrapped samples where this issue appears.}

The boll weevil infestation should have had a limited effect on counties where there was little cotton cultivation. To account for this, in some regressions we interact the boll weevil indicator with each county’s share of improved acres devoted to growing cotton in 1909. We choose 1909 because it is the year before our other time series begin, and we want to ensure that our measure of cotton cultivation is unaffected by the boll weevil or by later prison admission rates. Data on cotton cultivation come from the 1910 census of agriculture (United States Department of Commerce and Labor 1913), the last agricultural census before the infestation began in Georgia. Haines and the Inter-university Consortium for Political and Social Research (2010) have digitized
these data and made them available for public use. In this model, we are interested in the marginal effect of the boll weevil on prison admissions at different levels of cotton cultivation (Brambor et al. 2006). We expect the effect of the infestation to be larger in counties that relied more heavily on cotton cultivation. We test the linearity of the interaction using the binned estimator of Hainmueller et al. (2019).

**Results**

The boll weevil infestation sharply increased the rate at which African Americans were admitted to prison for property crimes. We report our estimate of the infestation’s effect in Figure 2. The leftmost point estimate (0.31) suggests that the boll weevil increased the black prison admission rate for property crime by 36 percent \((100 \times [\exp(\beta_t) - 1])\) a year after its arrival.

The boll weevil’s effect on the black admission rate for homicide, in contrast, was nearly zero \((-0.02\) and its confidence interval is compatible with a range of positive and negative values. Although some research has shown that contractions in the labor market are related to increases in violence, violence is less likely to be economically motivated than property crime. More importantly, because elite landowners and criminal justice officials had less discretion over whether to prosecute homicide, incarceration for homicide is more likely than incarceration for property crime to reflect the underlying rate of crime. The weak effect of the boll weevil infestation on prison admissions for homicide thus provides suggestive evidence that some portion of its effect on imprisonment for property crime was due to changes in enforcement.

Figure 2 also shows that the infestation’s effect on the white prison admission rate

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Footnote: Data on cotton production are missing in 182 county–years. In addition, cotton production is zero in 14 county–years. Because our models focus on the natural logarithm of cotton production, we drop these observations, although all results are robust to alternative log transformations. The resulting sample size for models including data on cotton production is \(N = 1893\).
Figure 2: The effect of the boll weevil infestation on prison admissions in Georgia. Dots represent point estimates from negative-binomial regressions, controlling for population density and county and year fixed effects. Bars represent 95% confidence intervals. The boll weevil infestation increased the black prison admission rate for property crime by more than a third. Its effect on the white prison admission rate was smaller and less precisely estimated. The infestation’s effect on both the black and the white prison admission rate for homicide was nearly zero and not statistically significant.

for property crime was much smaller and less precisely estimated than its effect on the black prison admission rate for property crime. Like its effect on the black prison admission rate for homicide, its effect on the white prison admission rate for homicide was nearly zero and not statistically significant. Using decennial data covering most of the U.S. South, Bloome et al. (2017) show that the boll weevil reduced both the share of farms worked by black tenants and the share of farms worked by white tenants. However, because relatively fewer white than black southerners were employed as tenants and sharecroppers, the infestation had a much smaller effect on their rate of marriage at young ages. The same appears to be true of incarceration.

In column 1 of Table 1 we show that the number of cotton bales ginned—our measure of cotton production—was inversely related to the black prison admission rate for property crimes. The smaller the cotton harvest, the higher was the black admission rate. A 10% decrease in cotton production increased the rate at which
Table 1: Negative-binomial and control-function IV negative-binomial regression of black prison admissions for property crimes, Georgia counties, 1910–1925.

African Americans were admitted to prison for property crimes by 1.4%.

In columns 2 and 3, we report the effect of cotton production instrumented by the boll weevil. Both the coefficient and the first-stage F-statistic in column 2 show that the infestation drastically reduced cotton yields. The instrumental variable estimate shown in column 3 remains positive and statistically significant and is much larger than the baseline negative-binomial estimate shown in column 1. This could be because the number of cotton bales ginned is an imperfect measure of changes in the agricultural labor market. It is also possible that counties with high crime or incarceration rates produced less cotton (Bignon et al. 2017).

To examine whether the model defined in (1)–(2) properly specifies the timing of the boll-weevil treatment, we assign infestation dates to counties from one to four years before and after their actual date of infestation. If we find evidence of a treatment effect in time periods before the treatment actually occurred, this would suggest that we have failed to properly control for pre-treatment differences in counties infested.

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### Table 1

<table>
<thead>
<tr>
<th></th>
<th>Negative Binomial (1)</th>
<th>OLS First Stage (2)</th>
<th>IV Negative Binomial (3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boll Weevil</td>
<td></td>
<td>−0.14**</td>
<td>−2.33*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[−0.25, −0.04]</td>
<td>[−8.23, −0.46]</td>
</tr>
<tr>
<td>Cotton Bales Ginned (log)</td>
<td>−0.14*</td>
<td>−2.33*</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>[−0.27, −0.02]</td>
<td>[−8.23, −0.46]</td>
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<tr>
<td>AIC</td>
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<td>5267.61</td>
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<tr>
<td>BIC</td>
<td>6047.90</td>
<td>6049.58</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>1893</td>
<td>1893</td>
<td></td>
</tr>
<tr>
<td>First-stage F-statistic</td>
<td>84.14</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

***p < 0.001, **p < 0.01, *p < 0.05

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8Because cotton production is logged, and because the conditional mean of a negative-binomial regression is exponentiated, the coefficient (−0.14) is an elasticity as in a log-log regression: $-10\% \times -0.14 = 1.4\%$. 
Figure 3: The boll weevil treatment effect one-to-four years before and one-to-four years after the year of infestation. The boll weevil had a positive and significant effect on black incarceration rates for property crime beginning one year after its arrival. Assigning a placebo treatment year closer and closer to the actual treatment year gradually decreases the noise in the estimated treatment effect until it converges to the true timing of the treatment.

by the boll weevil or that the timing of boll weevil does not correspond to a change in prison admission rates (Heckman and Hotz 1989). Figure 3 shows the results. We observe that the boll weevil had a positive and significant effect on black incarceration rates for property crime beginning one year after its arrival. This is consistent with historical evidence that the boll weevil primarily affected the following year’s harvest because it migrated late in the growing season (Baker 2015). Once a county is infested by the boll weevil, it remains in a treated state for all future time periods, which means that the treatment effect is the within-county average admissions rate in the treated years minus the average rate in the pre-treatment years. This is why we see a gradual increase in the point estimates in the years leading up to infestation: assigning a placebo treatment year closer and closer to the actual treatment year gradually decreases the noise in the estimated treatment effect until it converges to the true timing of the treatment.
Finally, the infestation’s effect should have been larger in counties that relied more heavily on cotton cultivation before the infestation began. In Figure 4, we plot the marginal effect of the boll weevil infestation on the black prison admission rate for property crime as a function of the share of counties’ improved acres devoted to cotton cultivation in 1909. We observe that the infestation had a larger effect in counties that grew a relatively large share of cotton in 1909, whereas its effect on counties that grew little cotton was close to zero. Figure 4 also shows the conditional marginal effects for each tercile of cotton production—low, medium, and high. This provides a test of whether the interaction effect is linear, as our model assumes (Hainmueller et al. 2019). All three conditional marginal effects lie close to the line representing the linear marginal-effect estimate, indicating that the linearity assumption is reasonable. If anything, our interaction model underestimates the effect of the boll weevil in counties in the medium and high terciles of cotton production.

**Conclusion**

In the U.S. South in the early twentieth century, elite landowners depended on the labor of tenants and sharecroppers to produce cotton. When the boll weevil disrupted cotton cultivation, their demand for these workers markedly declined. Tenants and sharecroppers rendered economically superfluous may have resorted to theft to survive. Planters who had previously paid actual or potential workers’ bail or fines no longer needed to do so. The boll weevil infestation was most consequential for black southerners because they were more likely than white southerners to work as tenants and sharecroppers.

We find that the boll weevil infestation increased the rate at which black Georgians were admitted to prison for property crime by more than a third. The infestation’s effect on African Americans’ rate of admission to prison for homicide was near zero.
Figure 4: The marginal effect of the boll weevil infestation on black property-crime admissions in Georgia. The thick line plots the linear marginal effect of the boll weevil at different levels of cotton cultivation in 1909. The gray band depicts the 95% confidence interval around the marginal effect. Along the x-axis, the rug plot shows the distribution of counties’ share of improved acres devoted to cotton cultivation in 1909. The three points labelled “low,” “medium,” and “high” show point estimates for conditional marginal effects evaluated at the median of the three terciles of the distribution of cotton production. Lines around each dot represent 95% confidence intervals for each conditional marginal effect. The fact that all three conditional marginal effects lie close to the line representing the linear marginal-effect estimate indicates that the linearity assumption is reasonable.
and not statistically significant. Its effect on whites’ prison admission rate, both for property crimes and for homicide, was smaller and less precise than its effect on African Americans’ prison admission rate for property crimes.

Previous research has shown that the boll weevil destroyed a large portion of the cotton crop (Lange et al. 2009; Baker 2015). We find that this decline in cotton yields was inversely related to the black prison admission rate for property crimes: when the number of cotton bales ginned in a county fell, the black admission rate increased. Moreover, the infestation had the largest effect on black prison admissions in the counties that grew the most cotton before it began.

These results demonstrate the relevance of transformations in the economy to changes in incarceration in the U.S. South in the early twentieth century. How well they generalize to other regions and periods is another matter. In the time and place we studied, the connection between class interests and incarceration was unusually direct. In more recent years, it may be subtler (Greenberg 1977, p. 650). Ash et al. (2019), for instance, find that attending a Law and Economics training program funded by business and conservative foundations led federal judges to sentence defendants to prison more often and for longer terms. The work of Raphael and Winter-Ebmer (2001), Lin (2007), and Gould et al. (2002) suggests that some of the effect of unemployment on imprisonment in the last three decades of the twentieth century may be due to its effect on crime. The relationship between incarceration, crime, and the labor market, moreover, should be weaker in times when economic elites have less influence over the criminal justice system (Muller 2012) and in places with stronger unions and welfare states (Platt 1982; Sutton 2004, p. 171; Lacey 2008, p. 50; Fishback et al. 2010).

The boll weevil infestation prefigured a much larger collapse in tenancy and sharecropping induced by the mechanization of cotton cultivation from 1950 to 1970. Katz et al. (2005, p. 82) note that the decline in black men’s labor force participation, which originated in their shift out of agriculture, “coincided with a stunning rise
in their rates of incarceration” (see also Myers and Sabol 1987 and Harding and Winship 2016). Consistent with this observation, the uptick in incarceration in the late twentieth century began earlier in cotton-producing states than elsewhere, as shown in Figure 5. Future research should study the relationship between agricultural mechanization and mass incarceration in closer detail.
References


