Black Networks After Emancipation: Evidence from Reconstruction and the Great Migration *

Kenneth Chay[†] Kaivan Munshi[‡]

December 2015

Abstract

This study provides quantitative evidence that southern blacks were able to form networks soon after Emancipation – during Reconstruction and the Great Migration – but only in places where specific conditions prevailed. Our theory indicates that networks will only form when social connectedness in the population from which they are drawn is sufficiently large. This implies that there exists a threshold below which there is no relation between social connectedness and network-based outcomes - political participation, church membership, migration - and above which there is a positive association. Using county cropping patterns to measure social connectedness in the black farm population, we document the existence of thresholds at which the specific "slope change" predicted by our theory holds. This finding is robust to rigorous testing, and these tests do not detect the nonlinearity implied by our theory for blacks at other points in time; for whites; or for variables not associated with networks. Our results imply that black migration from southern counties above the connectedness threshold would have been significantly smaller in the absence of network externalities. Consistent with the presence of externalities, migrants from those counties were much more likely to move to the same destination cities than migrants from elsewhere.

Keywords. Networks. Social capital. Coalition formation. African-American history. Slavery. Reconstruction. Great Migration.
JEL. D85. J62. L14. L22.

*We are grateful to Jan Eeckhout, Seth Rockman, and Yuya Sasaki for many helpful discussions. Bob Margo, Gavin Wright and numerous seminar participants provided comments that substantially improved the paper. Jacob Goldston, Florencia Borrescio Higa, Shiva Koohi, Jason Lu and, especially, Bruno Gasperini provided outstanding research support over the course of this project. Dan Black, Seth Sanders, Evan Taylor, and Lowell Taylor provided us with the Mississippi migration data, Jeremy Atack and Bob Margo provided us with the railroads data, and the U.K. National Archives provided us with the South Asian immigrant data under a special data sharing agreement with the University of Cambridge. Financial support from the National Science Foundation through grant SES-0617847 is gratefully acknowledged. We are responsible for any errors that may remain.

[†]Brown University and NBER
[‡]University of Cambridge

1 Introduction

Were African-Americans able to overcome centuries of social dislocation and form viable communities once they were free? This question has long been debated by social historians, and is relevant both for contemporary social policy and for understanding the process of social capital formation. The traditional view was that slavery, through forced separation and by restricting social interaction, permanently undermined the black community (Du Bois 1908, Frazier 1939, Stampp 1956). This was replaced by a counter narrative that documented a stable, vibrant African-American family and community, both during and after slavery (Blassingame 1972, Genovese 1974, Gutman 1976). More recently, Fogel (1989) and Kolchin (1993) have taken a position between the traditional and the revisionist view; while other social scientists have brought the literature around full circle by asserting that "[s]lavery was, in fact, a social system *designed* to destroy social capital among slaves" (Putnam 2000: 294).

Despite the continuing interest in black social capital after slavery, there has been virtually no quantitative investigation in this area. While we cannot examine the impact of slavery on social capital – i.e. the social capital that would have prevailed in the absence of slavery – we can study the important question of whether (and where) blacks formed networks to achieve common objectives soon after slavery ended. In the decades after Emancipation, two significant opportunities arose for southern blacks to work together. First, blacks could vote and elect their own leaders during the Reconstruction era, 1870-1890. Second, blacks left the South in unprecedented numbers to find jobs in northern cities during the Great Migration, 1916-1930. We find that southern blacks collectively organized in both historical events, but only in places where specific preconditions prevailed. This finding is reinforced by the observation that black church congregations, which supported the formation of black networks, were significantly larger in precisely those places.

We provide evidence that black networks were active in some places but not others by exploiting variation in the characteristics of the population of farm workers and tenants from which these networks were drawn. Spatial proximity within this population varied considerably across southern counties, depending on the crops grown in the local area during and after slavery. Where labor-intensive crops such as cotton, tobacco, rice, and sugarcane were grown, blacks worked and lived in close proximity to each other. Where crops such as wheat and corn were grown, blacks were more dispersed. Spatial proximity would have resulted, everything else equal, in a more socially connected rural population. We show theoretically that more connected populations would have supported the formation of larger networks of black political activists during Reconstruction and larger groups of black workers moving together to northern cities during the Great Migration. This, in turn, would have led to greater overall political participation (migration):

Population connectedness $\rightarrow$ *Network size* $\rightarrow$ *Political participation (Migration).*

While a positive relationship between population connectedness and particular outcomes during Reconstruction and the Great Migration is consistent with the presence of black networks, other explanations exist. Greater racial conflict in counties dominated by labor-intensive plantation crops may have induced more black voters to turnout during Reconstruction and more blacks to move to northern cities during the Great Migration. Alternatively, adverse economic conditions in these counties could have encouraged greater migration, without requiring a role for black cooperation. Our theory, however, has an additional prediction (not implied by other theories of black political participation and migration) which is that networks will only form above a threshold level of connectedness. This implies the existence of a threshold below which there is no relation between connectedness and network-based outcomes (political participation, church membership, migration) and above which there is a positive association. Our strategy to identify the presence of networks is, therefore, to test for the existence of a threshold at which the relation between the connectedness measure and network-based outcomes changes from zero to systematically positive.

We rigorously test the theory relating population connectedness to each network-based outcome: (i) black voting and the election of black leaders, 1870-1890; (ii) the average congregation size of black Methodist and Baptist churches in 1890; and (iii) the movement of black workers to northern cities during the Great Migration, 1916-1930. First, we use nonparametric regression to visually examine whether the relations between the network-based outcomes and our connectedness measure exhibit the specific nonlinearity predicted by the theory. Second, we derive a statistic that, when applied to a sequence of linear spline regressions, tests for the existence of a threshold at which the joint implications of the theory hold - i.e., the slope of the relation changes from zero to systematically positive.

Our benchmark measure of population connectedness is the share of land allocated to labor-intensive plantation crops in 1890, midway between Reconstruction and the Great Migration. The advantage of this crop-based measure is that it is positively associated with spatial proximity in the relevant population, during and after slavery. Farm workers and tenants worked and lived in close proximity to each other in the postbellum period in counties where labor-intensive crops were grown. Plantation size, which determined the frequency of social interactions in the antebellum period, was larger in the same counties. Our measure thus incorporates various sources of social connectedness.

Despite its advantages, a potential endogeneity issue associated with the 1890 crop-based measure is that blacks could have systematically sorted into counties with well-functioning networks after Emancipation, with a resulting change in cropping patterns. In contrast, the location of blacks in the antebellum period was primarily the result of slave owners' cropping decisions. We therefore use slaveholdings and the production of crops in the antebellum period (1860) as instruments for postbellum cropping patterns in each county to examine the robustness of our findings, applying the nonparametric control function approach of Newey, Powell and Vella (1999).

Our tests detect the existence of thresholds at which the relationship between population connectedness and network-based outcomes (black voting, church size, migration) changes from zero to systematically positive. These results comport with those from a popular test in the structural change literature (Hansen 1999) and are strengthened when we instrument for postbellum cropping patterns and control for competing hypotheses. We do not detect threshold effects for blacks at other points in time; for whites; or for variables not associated with networks.

Our primary measure of out-migration is based on changes in the black population in southern counties during the Great Migration adjusted for changes due to births and deaths. We cross-validate this measure with one constructed from newly-available data, which contain the city-of-residence in the 1970s of people born in Mississippi between 1905 and 1925, along with each person's county of birth. While the precise migration year is unknown, these data provide a direct measure of migration at the county level. This measure is highly correlated with the population change measure, and both variables show the same nonlinear relation with our crop-based connectedness variable for Mississippi counties as is observed for all southern counties.

As the Mississippi data contain the (final) destination city of each migrant, we can test another prediction of the theory. Networked migrants will move to the same place, whereas independent migrants will be spread across the available destinations. If variation in migration levels across counties with different levels of population connectedness is driven by differences in the size of underlying networks, then the number of black migrants and their spatial concentration across destinations will move in tandem. As predicted, various measures of the destination city concentration of Mississippi migrants are unrelated to population connectedness up to the same threshold as for the migration level, and steeply increasing in connectedness thereafter. This contrasts with the migration and destination patterns for whites, where no relation with the running variable is observed. In an important test of external validity that provides support for the generality of our theory, we use newly collected data from the British National Archives and the 1931 Indian Population Census to show that precisely the same nonlinear relationship between population connectedness in origin counties and both the number and the concentration of migrants across destinations is observed for migrants from rural Punjab to the U.K. in the 1950s.

We consider a range of other explanations for the observed pattern of black migration that do not rely on a role for networks. One posits that an external agency, such as the Republican Party or a northern labor recruiter, organized black voters or migrants. A related alternative, which is most relevant during Reconstruction, is that blacks would turn out to vote only when they were sufficiently sure their preferred candidate could win. Another possibility is that individuals vote and migrate independently in response to external forces that vary across counties with different cropping patterns. If black wages were lower in counties where plantation crops were grown, or if blacks were oppressed by the white elite in these counties, then they would be more likely to vote during Reconstruction and to migrate to northern cities when job opportunities arose.

While each alternative is plausible, we argue that our theory of network formation provides a simpler and more cohesive explanation for the totality of the findings. For example, no single alternative can explain the specific slope change in the relations between the connectedness variable and the network-based outcomes, obtained only for blacks and only at particular points in time. The slope changes found for black church congregation size and the clustering of black migrants in northern destinations, in particular, provide direct support for the hypothesis that blacks were able to cooperate to achieve common objectives in counties where social connectedness in the farm population exceeded a threshold. If network externalities were absent, then the probability of moving to the same destination would not track migration levels so closely. Finally, using simulations to contrast our model with several alternative models, we find that only our model can generate patterns consistent with the empirical findings.

The magnitudes of the implied network effects are large. For example, over 40 percent of the migrants to the North came from the one-quarter of southern blacks who lived in the most connected counties, while under 5 percent came from the one-quarter in the least connected counties. While anecdotal evidence suggests that networks linking southern communities to northern cities did emerge (Gottlieb 1987, Grossman 1989, Carrington, Detragiache, and Vishwanath 1996), we are the first to quantify network effects in the Great Migration. We conclude by discussing the implications of this finding for the subsequent evolution of black communities in southern counties and northern cities.

2 Institutional Setting

This section describes the historical context for two major opportunities that arose for African-Americans to work together in the postbellum South: (i) the right to vote and elect their own leaders during the Reconstruction era, 1870-1890 and (ii) the opportunity to move to northern cities during the Great Migration, 1916-1930.

2.1 Reconstruction

Three Constitutional amendments, known collectively as the Reconstruction Amendments, gave political representation to African-American men. The 13^{th} Amendment, ratified in 1865, abolished slavery; the 14^{th} Amendment, adopted in 1868, granted full rights of citizenship to African-Americans; and the 15^{th} Amendment, passed in 1870, gave freedmen the right to vote. The Reconstruction Act of 1867 placed the Confederate states under Federal military rule for the next decade, with the primary purpose of protecting the right of freedmen to vote. Blacks voted in large numbers for the Republican party (the party of the Union) during this period and elected their own leaders.

While external organizations such as the Freedmen's Bureau and the Union League were active during Reconstruction, the major impetus for African-American political participation came from within (Stampp 1966, Foner 1988).[1] "In record time they organized, sponsored independent black leaders, and committed themselves to active participation ... It was now possible for blacks to not only field candidates for election but to influence the outcome of elections by voting" (Morrison 1987: 35). During Reconstruction, as many as 600 blacks sat in state legislatures throughout the South.[2] Black voters continued to vote Republican in large numbers and to elect their own leaders

[1] At its peak in 1866, the Freedmen's Bureau employed only 20 agents in Alabama and 12 in Mississippi. It ceased most of its activities by the end of 1868 and was officially abolished in 1872, before black political participation even began (Kolchin 1993).

[2] During Reconstruction, the lower houses of South Carolina, Louisiana, and Mississippi were 50, 42, and 29 percent black, respectively. The upper houses in Louisiana and Mississippi were 19 and 15 percent black. Reconstruction was more radical and persistent in the deep South (Kousser 1974, Kolchin 1993). In states that did not witness a "radical" phase during Reconstruction, such as Virginia, blacks still made up a sizeable share of legislators (Valelly

through the 1880s, and even into the 1890s, after Federal troops had left the South (Kolchin 1993).[3]

2.2 The Great Migration

The first major movement of blacks out of the South after the Civil War began in 1916. Over 400,000 blacks moved to the North between 1916 and 1918, exceeding the total number who moved in the preceding 40 years. During the first wave of the Great Migration, running from 1916 to 1930, over one million blacks (one-tenth the black population of the United States) moved to northern cities (Marks 1983).[4] This movement of mostly rural farm workers was driven by both pull and push factors. The increased demand for labor in the wartime economy coupled with the closing of European immigration, gave blacks new labor market opportunities (Mandle 1978, Gottlieb 1987). Around the same time, the boll weevil beetle infestation reduced the demand for labor in southern cotton-growing counties (Marks 1989). Adverse economic conditions in the South, together with segregation and racial violence, also encouraged blacks to leave (Tolnay and Beck 1990), and their movement was facilitated by the penetration of the railroad into the deep South (Black et al. 2012). This confluence of favorable and unfavorable circumstances set the stage for one of the largest internal migrations in history.

How did rural blacks hear about new opportunities in northern cities? The first links appear to have been established by recruiting agents acting on behalf of northern railroad and mining companies (Henri 1975, Grossman 1991). Independent recruiters, who charged migrants a fee for placing them in jobs, were soon operating throughout the South (Marks 1989). Apart from these direct connections, potential migrants also heard about jobs through ethnic newspapers. For example, the *Chicago Defender*, which has received much attention in the literature, increased its circulation from 33,000 in 1916 to 125,000 in 1918. Industries throughout the Midwest sought to attract black southerners through classified advertisements in that newspaper (Grossman 1991).

Although external sources of information such as newspapers and recruiting agents played an important role in jump-starting the migration process, and agencies such as the Urban League provided migrants with housing and job assistance at the destination, networks linking southern communities to specific Northern cities, and to neighborhoods within those cities, provided the multiplier effects (Gottlieb 1987, Marks 1991, Carrington, Detragiache, and Vishwanath 1996). "[These] networks stimulated, facilitated, and helped shape the migration process at all stages from the dissemination of information through the black South to the settlement of black southerners in

2004). Over the course of Reconstruction, more than 1,500 African-Americans held public office in the South.

[3]Black disfranchisement was a staggered process. Whites used violence and intimidation to discourage black voters during Reconstruction. After the Compromise of 1877, southern state legislatures enacted laws making voter registration and electoral rules increasingly restrictive. Blacks were still elected to local offices in the 1880s, but legislation passed between 1890 and 1910 effectively eliminated blacks from the electorate (Du Bois 1908, Morrison 1987, Valelly 2004).

[4]There were three phases in the Great Migration: an initial wave, 1916-1930; a slow down in the 1930s during the Great Depression; and a second wave initiated by the industrial buildup to World War II, 1940-1970 (Carrington, Detragiache, and Vishwanath 1996). We focus on the first wave, as do many historians (e.g. Mandle 1978, Gottlieb 1987, Marks 1989) since we are interested in the black cooperation that preceded the presence of significant black communities in the North. As we discuss in the conclusion, future work will trace the evolution of these networks in northern cities over the course of the twentieth century, linking our project to previous contributions in urban economics (e.g. Cutler, Glaeser, and Vigdor 1999, Boustan 2010).

northern cities" (Grossman 1991: 67).

During the Great Migration, the heaviest black out-migration occurred in areas that had been dominated by the plantation economy. "Some counties were characterized by extremely high out-migration, while others maintained relatively stable black populations ... Such intra-state variation raises interesting questions about the causes of the differential migration ... Was the cotton economy particularly depressed? Were blacks subjected to more brutal treatment by whites in those areas? Did economic competition between blacks and whites restrict economic opportunity, and thereby encourage out-migration?" (Tolnay and Beck 1990: 350). Our novel explanation for part of this variation across counties is based on internal rather than external forces. Blacks would have worked and lived close to each other in counties where a greater fraction of land was allocated to labor intensive plantation crops (not just cotton). The social interactions resulting from spatial proximity would have given rise to a more connected population of farm workers, to larger networks drawn from these workers and, by extension, to greater political participation during Reconstruction *and* larger population flows during the Great Migration.

2.3 Black Networks

Networks can only function effectively if their members interact with one another sufficiently frequently over long periods of time. Forced separation would have made it difficult to support networks in the slave population (Du Bois 1908, Frazier 1939).[5] Nevertheless, the slave quarter and the independent informal church that often formed within the quarter, have been identified as domains within which cooperation, mutual assistance, and black solidarity did emerge (Blassingame 1972, Genovese 1974). "[Large plantations] permitted slaves to live together in close-knit communities – the slave quarters – where they could develop a life of their own" (Fogel 1989: 170).

A distinctive feature of the antebellum South was the unequal size of slaveholdings and the uneven distribution of the slave population across counties (Stampp 1956). One-quarter of U.S. slaves resided in plantations with less than 10 slaves, one-half in plantations with 10-50 slaves, and the remaining in plantations with more than 50 slaves (Genovese 1974). This variation arose as a natural consequence of geographically determined cropping patterns and the organization of production under slavery (Wright 1986). Where labor intensive plantation crops such as cotton, tobacco, rice, and sugarcane could be grown, slaveholdings tended to be large, allowing black communities to form. However, a substantial fraction of slaves lived in counties with widely dispersed family farms growing wheat or corn, where both whites and blacks worked on the land (Genovese 1974).[6] These farms were too small, and interactions across farms too infrequent, to support the formation of black communities (Stampp 1956). Antebellum cropping patterns would thus have

[5] The inter-state slave trade frequently separated families and plantation communities. For example, close to one million slaves moved to southwestern cotton states between 1790 and 1860 as production of that crop boomed (Fogel 1989, Kolchin 1993). Although Fogel and Engerman (1974) estimate that 84 percent of the slaves that moved west migrated with their owners, most other historians assign much greater weight to slave sales (Tadman, 1989, for instance, estimates that sales accounted for 70-80 percent of the slave movement).

[6] While just one or two slaves worked on a family farm growing wheat or corn, approximately 100 slaves worked on a rice or sugarcane plantation, 35 on a cotton plantation, and a somewhat smaller number on tobacco plantations (Fogel 1989).

determined social connectedness in the slave population and, by extension, social connectedness in the postbellum black population because this population remained stable over time (the county-level population correlation between 1860 and 1890 is as high as 0.85). Although many blacks did move after the Civil War, most did not abandon their home plantations and those who did traveled only a few miles (Mandle 1978, Foner 1988, Steckel 2000).[7]

We will see that antebellum cropping patterns strongly predict postbellum patterns. This implies that black farm workers and tenants, the population from which postbellum networks were drawn, would have worked and lived in close proximity to each other in counties where labor-intensive plantation crops – cotton, tobacco, rice, and sugarcane – were grown historically and continued to be grown.[8] The alternative measures of population connectedness that we describe in Section 4 will thus be based on postbellum cropping patterns across southern counties. These measures will capture both plantation size in the antebellum period, as discussed above, as well as black spatial proximity in the postbellum period.

Our theory links connectedness in the farm population to black network size and, by extension, to political participation and migration. However, the networks themselves cannot be observed. Our best proxy of network size is the size of the local church congregation. Community life in the postbellum period centered on the church, and African-American churches played an important political role during Reconstruction (DuBois 1908, Frazier 1964, Dvorak 1988). African-American politicians were often drawn from the clergy and church congregations worked together to support local leaders (Woodson 1921, Foner 1988). African-American churches based in southern origin counties, and later in northern destination cities, similarly played a critical role in the Great Migration (Grossman 1991). The specific nonlinear relationship between population connectedness and both political participation and migration that is implied by our theory should thus also be obtained with black church congregation size. The size of non-black congregations will be useful for falsification tests, since we do not expect the predictions of the theory relating population connectedness to network size to apply to them.

3 Theory with a Test

The theory developed in this section derives a specific nonlinear relationship between social connectedness in a local population and outcomes associated with network formation. We will use the terms network, coalition, and group interchangeably in the discussion that follows. This section concludes by deriving a test of the theory.

[7]Federal assistance to former slaves who sought to acquire land was extremely limited (Kolchin 1993). 40,000 blacks in Georgia and South Carolina were granted land for homesteading by General Sherman in 1865, but the land was returned to their original owners by President Johnson. Similarly, only 4,000 blacks, most of whom resided in Florida, benefited from the Homestead Act of 1866. Apart from these limited opportunities, white landowners could also have actively discouraged black sharecroppers and laborers from moving (Naidu 2010).

[8]After Emancipation, a system of sharecropping was established in which landowners broke up large plantations and rented plots to freedmen and their families. These plots were smaller, and black tenants worked and lived closer to each other, in areas where labor intensive crops were grown.

3.1 Individual Payoffs

There are many economic environments in which socially connected individuals cooperate to achieve a common objective. In our research setting, a group of black activists in a southern county could have come together to provide a service to a local political leader during Reconstruction. Members of the group would have canvassed potential voters and turned out themselves in local, state, and federal elections. Once the leader was elected, the network of activists would have worked on his behalf, helping to provide goods and services to the electorate and increasing his chances of reelection. In return for these services, the network would have received a transfer to be shared by its members. Alternatively, a group of black migrants could have moved together to a northern city during the Great Migration, helping each other find jobs and working diligently as a team once they were employed. In a production environment where worker ability and effort were unobserved by employers, such mutual support and diligence would have resulted in improved employment prospects and favorable wages for the members of the destination network.

The payoff W received by each member of the network is increasing in its size, N. We assume that the size effects are declining at the margin, perhaps due to congestion. Social connectedness is introduced in the model by assuming that it makes the network function more efficiently. Members of a connected network will work better together. A connected network will also support stronger collective punishments and, hence, larger *ex post* transfers that encourage members to help each other and generate superior payoffs. We assume that connectedness in the population, λ, maps one-for-one into connectedness in the network, which is thus also denoted by λ. We could have allowed network connectedness to be an increasing function of population connectedness instead, without changing any of the results that follow.

For analytical convenience, let N and λ be real numbers. The payoff each individual receives from participation can then be expressed by the continuous function $W(N, \lambda)$. Based on the discussion above, the payoff function is increasing in N but at a decreasing rate; $W_N(N, \lambda) > 0$, $W_{NN}(N, \lambda) < 0$. The payoff is also increasing in connectedness, $W_\lambda(N, \lambda) > 0$. If collective punishments are increasing in the *number* of social links, for example, then the efficiency gain from belonging to a connected network will be increasing in N. This implies that the cross-partial with respect to λ will be positive, $W_{\lambda N}(N, \lambda) > 0$. These (reasonable) restrictions on the payoff function will be shown to give rise to an increasing and nonlinear relationship between population connectedness and equilibrium network size.

Let P be the population in the local area, which is defined to be small enough that only a single network can form. Individuals outside the network operate independently and we normalize so that their payoff is zero. Using the payoff in autarky as the benchmark, this implies the following limit condition:

$$\textbf{C1}.\ \lim_{\lambda \to 0} W(N, \lambda) = 0 \ \ \forall N$$

This is just saying that there is no additional payoff from belonging to the network, regardless of its size, when social connectedness becomes infinitesimally small ($\lambda \to 0$).

3.2 Maximum Stable Network Size

Given the payoffs described above, we now proceed to derive the largest stable network, N^*, that can be supported in a local area. Population connectedness, λ, varies exogenously across local areas, which are otherwise indistinguishable. Our objective is to derive the relationship between λ and N^*. During Reconstruction, N^* would refer to the number of activists who would have worked together to support the local political leader. During the Great Migration, N^* would refer to the number of individuals who moved as a group to the North. Although migration is a dynamic process, we can think of N^* as the stock of individuals who had moved and were providing mutual support to each other at a given point in time.

Since $W(N, \lambda)$ is increasing in N and we have normalized so that the payoff in autarky is zero, what prevents the entire population from joining the network? To place bounds on the size of the network, we assume that each member incurs a private effort cost c each period. Benefits are received up front by the network, with the expectation that each member will exert effort *ex post*. This could well describe the timing of wage setting and work effort in northern jobs, as well as the sequence of transfers (patronage) and community effort during Reconstruction. The commitment problem that arises here is that a self-interested individual will renege on his obligation in a one-shot game. This problem can be avoided if the network is active over multiple periods. Based on the standard solution to an infinitely repeated game, cooperation can be sustained if individuals are sufficiently patient, i.e. if the discount factor δ is large enough so that the following condition is satisfied:

$$\frac{W(N, \lambda) - c}{1 - \delta} \geq W(N, \lambda).$$

The term on the left hand side is the present discounted value of cooperation for each member of the network. The right hand side describes the payoff from deviating. In the first period, the deviator receives the usual per capita payoff without incurring the effort cost. Although effort is not observed immediately, shirking is ultimately revealed at the end of the period. Each local area supports a single network and the usual assumption is that deviators will be excluded from the group forever after. Since individuals operating independently receive a zero per-period payoff, the continuation payoff is set to zero.

Collecting terms, the preceding inequality can be written as,

$$W(N, \lambda) \geq \frac{c}{\delta}.$$

From condition C1, this inequality cannot be satisfied for $\lambda \to 0$ even if the entire population joins the network. This implies that all individuals must operate independently. As λ increases, there will be a threshold λ^* satisfying the condition,

$$W(P, \lambda^*) = \frac{c}{\delta}.$$

As λ increases above λ^*, this condition can be satisfied for smaller networks because $W_{\lambda N}(N, \lambda) > 0$. But we are interested in the *largest* stable network. It follows that the entire population will join the network for all $\lambda \geq \lambda^*$. This unrealistic result is obtained because the continuation payoff –

set to zero – is independent of N. If cooperation can be sustained for a given network size N, it follows that it can be sustained for any network size larger than N. Thus, if cooperation can be sustained at all, the entire population will join the network.

Genicot and Ray (2003) face the same problem in their analysis of mutual insurance. If individual income shocks are independent, then a larger network does a better job of smoothing consumption, and absent other constraints the entire population should join the insurance arrangement. Genicot and Ray consequently turn to an alternative solution concept, the coalition-proof Nash equilibrium of Bernheim, Peleg, and Whinston (1987), to place bounds on the size of the group and we will do the same. An appealing and more realistic feature of this Nash equilibrium refinement in the context of collective arrangements is that it allows sub-groups rather than individuals to deviate. The continuation payoff is no longer constant because deviating sub-groups can form arrangements of their own and we will see that this limits the maximum size that the network can attain.

The coalition-proof Nash equilibrium places two restrictions on deviating sub-groups: (i) only credible sub-groups, i.e. those that are stable in their own right, are permitted to pose a threat to the coalition. (ii) Only subsets of existing coalitions are permitted to deviate.[9] The condition for cooperation can now be described by the expression,

$$\frac{W(N,\lambda)-c}{1-\delta} \geq W(N,\lambda) + \frac{\delta}{1-\delta}\left[W(N',\lambda)-c\right],$$

where N' is the size of the deviating sub-group. Collecting terms, the preceding condition can be expressed as,

$$W(N,\lambda) - W(N',\lambda) \geq \frac{1-\delta}{\delta}c.$$

The greatest threat to a group will be from a sub-group that is almost as large, $N - N' \to 0$. For analytical convenience assume that c is an infinitesimal number. If c is of the same order as $N - N'$, the ratio $\tilde{c} \equiv c/(N - N')$ will be a finite number. Dividing both sides of the preceding inequality by $N - N'$, the condition for cooperation is now obtained as,

$$W_N(N,\lambda) \geq \frac{1-\delta}{\delta}\tilde{c}.$$

For a given λ, the left hand side of the inequality is *decreasing* in N since $W_{NN}(N,\lambda) < 0$.[10] This implies that there is a *maximum* network size above which cooperation cannot be sustained for each λ (if cooperation can be sustained at all as discussed below). This also ensures that the deviating sub-group of size N' will be stable, as required by our solution concept, if N is stable.

Genicot and Ray show that the set of stable insurance arrangements is bounded above once they allow for deviations by sub-groups. Our model generates predictions that place stronger restrictions on the data:

[9] Members of the deviating sub-group could, in principal, form a new coalition with individuals who were originally operating independently. Bernheim, Peleg, and Whinston justify the restriction they impose on the solution concept by arguing that asymmetric information about past deviations would prevent insiders and outsiders from joining together.

[10] If we assumed that N was an integer, we would no longer need to assume that c was an infinitesimal number and that c and $N - N'$ converged to zero at the same rate. We would now need to difference instead of differentiating, but it is straightforward to verify that the result derived below would be unchanged.

Proposition 1. *Networks will not form below a threshold level of connectedness, $\underline{\lambda}$. Above that threshold, the maximum stable network size, N^*, is increasing in connectedness, λ.*

To prove the first part of the proposition, we take advantage of condition C1, which implies that $\lim_{\lambda \to 0} W_N(N, \lambda) = 0$. Cooperation cannot be supported and networks will not form for small λ. As λ increases, $W_{\lambda N}(N, \lambda) > 0$ implies that there will be a threshold $\underline{\lambda}$ at which cooperation can be supported, but only for groups of infinitesimal size ($N \to 0$). Above that threshold, since N^* is the largest group that can be supported in equilibrium for a given λ,

$$W_N(N^*, \lambda) = \frac{1-\delta}{\delta}\tilde{c}.$$

Applying the Implicit Function theorem,

$$\frac{dN^*}{d\lambda} = \frac{-W_{\lambda N}(N, \lambda)}{W_{NN}(N, \lambda)} > 0$$

to complete the proof.[11]

Although Proposition 1 derives the relationship between λ and N^*, network size is not directly observed. We can, however, derive the relationship between λ and observed outcomes – political participation and migration – that are associated with underlying networks. Suppose that there are two types of individuals: type-1 individuals belong to, or are influenced by, the network, while type-2 individuals vote and migrate independently. The number of type-1 individuals is equal to, or weakly increasing in, $N^*(\lambda)$. If the number of type-2 individuals is independent of λ, then Proposition 1 can be restated as follows: political participation and migration will be *uncorrelated* with λ up to a threshold (not necessarily the same threshold) and *increasing* in λ thereafter.

We could assume, instead, that the number of type-2 individuals is increasing in population, P, which, in turn, is positively correlated with λ, since λ measures the proximity of individuals to each other. The number of voters and migrants would then be increasing in λ below the threshold, falsely rejecting the theory. To test Proposition 1, we would then need to condition for local population. To allow for this possibility, we will report both conditional and unconditional estimates of the relationship between population connectedness and the outcomes of interest in the empirical analysis.

Figure 1A provides preliminary evidence on the relationship between population connectedness and both political participation and migration. Connectedness in the farm population from which the postbellum black networks were drawn is specified to be increasing in the fraction of land allocated to labor intensive plantation crops. Political participation is measured by the number of Republican votes in the county in the 1872 presidential election, at which point in time blacks could freely vote and elect their own leaders.[12] Migration is measured by black population change

[11] Multiple equilibria evidently exist above the threshold once we characterize individual participation in the network as the solution to a noncooperative game. Apart from the equilibrium derived above, no one participates in another equilibrium. We implicitly assume that blacks were able to solve the coordination problem. Note that there are no other equilibria in this noncooperative game. In particular, a network smaller than the largest stable network is not an equilibrium because any individual operating independently would want to deviate and join it, making everyone better off without affecting its stability.

[12] Blacks would have voted almost exclusively for the Republican party – the party of the Union – at this time (Morrison 1987). The empirical analysis that follows will account for the presence of white Republican voters.

in the county from 1910 to 1930 minus the corresponding change from 1890 to 1910 (to control for natural changes in population across counties). The nonparametric regressions presented in Figure 1A reveal a highly nonlinear and precisely estimated relationship between our connectedness measure and both network-based outcomes that is broadly consistent with Proposition 1.[13] The statistical test that we derive below will allow us to formally assess whether these relationships, and the relationships obtained with other network-based outcomes, are consistent with the theory.

3.3 An Additional Implication of the Theory

Our theory generates predictions for variation in the *level* of political participation and migration across local areas. It can be extended to generate predictions for the *distribution* of migrants across destinations. Let the number of type-2 migrants who move independently from each county be n. Assume that these migrants are distributed evenly across $M \geq 2$ destinations. The number of type-1 migrants who belong to the network will be zero below the threshold, $\underline{\lambda}$, and $N^*(\lambda)$ above the threshold. When the network does form, these individuals will move as a group to a single destination.

The Herfindahl-Hirschman Index, which is defined as the sum of the squared share of migrants across all destinations, can then be used to measure the concentration of migrants across destinations. Below the threshold, the Herfindahl-Hirschman Index, $H(\lambda) = M\left[\frac{n/M}{n}\right]^2 = 1/M$, is uncorrelated with population connectedness, λ. Above the threshold,

$$H(\lambda) = \left[\frac{\frac{n}{M} + N^*(\lambda)}{n + N^*(\lambda)}\right]^2 + (M-1)\left[\frac{\frac{n}{M}}{n + N^*(\lambda)}\right]^2.$$

Differentiating this expression with respect to λ,

$$H_\lambda(\lambda) = \frac{2(M-1)\frac{n}{M}N^*(\lambda)N^*_\lambda(\lambda)}{[n + N^*(\lambda)]^3} > 0,$$

since $N^*(\lambda) > 0$ and $N^*_\lambda(\lambda) > 0$ for $\lambda > \underline{\lambda}$ from Proposition 1. The specific nonlinear relationship between the level of migration and population connectedness that we derived in Proposition 1 should apply to the distribution of migrants at the destination as well. This result will hold as long as networked migrants cluster more at the destination than individuals who move independently. It will also hold for alternative measures of concentration, such as the fraction of migrants at the most popular destination, and is robust (under reasonable conditions) to allowing the number of type-2 migrants who move independently, n, to be increasing in population connectedness.[14]

Figure 1B describes migration to northern cities from counties in the state of Mississippi as a function of our population connectedness measure. These data are constructed by merging Medicare records with social security records, as described below, allowing migrants from each Mississippi county during the Great Migration to be linked to northern destination cities. Providing independent support for the relationship we uncovered in Figure 1A across all southern counties,

[13] Following Robinson (1988), state fixed effects are partialled out nonparametrically using a two-step procedure in Figure 1A and all the regressions that follow.

[14] Below the threshold $\underline{\lambda}$, either measure of concentration will be uncorrelated with λ, whether or not n is correlated with λ. Above the threshold, concentration will be increasing in λ as long as $nN^*_\lambda - N^* n_\lambda > 0$.

there is no association between population connectedness and the level of migration up to the same threshold as in that figure, after which a monotonic relationship begins. More importantly, the level of migration and the concentration of migrants across northern cities, measured by the Herfindahl-Hirschman Index (HHI), track very closely together in Figure 1B.

3.4 Testing the Theory

The theory indicates that social connectedness in the population has no association with network size, and outcomes associated with networks, up to a threshold and a positive association thereafter. The location of the threshold is *a priori* unknown. To test these predictions we thus follow standard practice, e.g. Hansen (1999), to estimate a series of piecewise linear equations that allow for a slope change at different *assumed* thresholds. The pattern of coefficients that we estimate, with accompanying t-ratios, will locate our best estimate of the *true* threshold and formally test the specific nonlinearity implied by the theory.[15]

Ignoring state fixed effects, which are included in all regressions, to simplify the discussion that follows, the piecewise linear equation that we estimate for each assumed threshold, S, is specified as

$$y_i = \beta_0 + \beta_1 S_i + \beta_2 D_i(S_i - S) + \beta_3 D_i + \xi_i \tag{1}$$

where y_i is the outcome of interest in county i, S_i is our measure of population connectedness in that county, D_i is a binary variable that takes the value one if $S_i \geq S$, and ξ_i is a mean-zero disturbance term. β_1 is the baseline slope coefficient, β_2 is the slope change coefficient, and β_3 is the mean shift coefficient (measuring the level discontinuity at the threshold). We will estimate this equation for a large number of assumed thresholds, in increments of 0.0001, over the range $[0, 0.25]$.

The slope coefficients, β_1 and β_2, can be directly linked to the predictions of the theory: $\beta_1 = 0$ and $\beta_2 > 0$ at the true threshold. To derive the pattern of t-ratios on β_1 and β_2 that we expect to obtain across the range of assumed thresholds when the data generating process is consistent with the theory, we constructed a data set that consists of two variables: the measure of population connectedness in our southern counties that we will use in the empirical analysis that follows, S_i, and a hypothetical outcome, $\tilde{y}_i$, that is constructed to be consistent with the theory, with the true threshold set at 0.08. To verify that the data we have generated match the theory, we nonparametrically regress $\tilde{y}_i$ on S_i in Figure 2A. Despite the noise that we have added to the outcome, a slope change near the "true" threshold, 0.08, is clearly visible in the figure.

Having generated data that match the theory, we next proceed to estimate equation (1) sequentially over a large number of assumed thresholds. The t-ratios for the two slope coefficients, β_1 and β_2, are reported in Figure 2B for each of these assumed thresholds. The t-ratio for the baseline slope coefficient remains close to zero for all assumed thresholds below the true threshold and starts to increase thereafter. The t-ratio for the slope change coefficient starts close to zero,

[15]The theory specifies that network size, and the level of associated outcomes, will be increasing in population connectedness above the threshold. We place the additional restriction that this relationship is linear, which is broadly consistent with the patterns reported in Figures 1A and 1B, when testing the theory.

then increases steadily reaching a maximum well above two where the assumed threshold coincides with the true threshold, and then declines thereafter.

To understand why the t-ratios follow this pattern, return to Figure 2A and consider the piecewise linear regression line that would be drawn for an assumed threshold to the left of the true threshold. The best fit to the data at that assumed threshold sets $\hat{\beta}_1 = 0$ and $\hat{\beta}_2 > 0$. This implies that the t-ratio on the baseline slope coefficient will be zero and the t-ratio on the slope change coefficient will be positive. Now suppose we shifted the assumed threshold slightly to the right. It is evident that we would continue to have $\hat{\beta}_1 = 0$ since there is no change in the slope to the left of the assumed threshold, but $\hat{\beta}_2$ would increase and the regression line would do a better job of fitting the data to the right of the threshold. The t-ratio on the baseline slope coefficient would remain at zero, while the t-ratio on the slope change coefficient would increase. This would continue as the assumed threshold shifted gradually to the right until it reached the true threshold.

Once the assumed threshold crosses to the right of the true threshold, the piecewise linear regression line that best fits the data will set $\hat{\beta}_1 > 0$. Although the magnitude of the baseline slope coefficient will increase as the assumed threshold shifts further to the right, the regression line will do an increasingly poor job of fitting the data to the left of the threshold. This implies that the t-ratio on the baseline slope coefficient is not necessarily monotonically increasing to the right of the true threshold, although it must be positive. In practice, this t-ratio increases monotonically with all the network-based outcomes that we consider.

To derive the corresponding change in the t-ratio for the slope change coefficient, note that the regression line to the right of the assumed threshold will now perfectly fit the data, except for the noise we have added to the outcome, since we allow for a mean shift at the threshold. This line maintains the same slope, and continues to precisely match the data, as the assumed threshold shifts further to the right. However, since the regression line to the left of the assumed threshold is growing steeper and is less precisely estimated as the assumed threshold shifts to the right, the slope *change* coefficient and the t-ratio on that coefficient will unambiguously decline.

The preceding discussion and Figure 2B tell us what to expect when the data are consistent with the theory. They also locate our best estimate of the true threshold. This will be the assumed threshold at which the t-ratio on the baseline slope coefficient starts to systematically increase *and* the t-ratio on the slope change coefficient reaches its maximum value.[16] Given the noise in the outcome measures, however, it is sometimes difficult to assess whether or not the t-ratios match the predictions of the theory. This motivates a joint test of the theoretical predictions, based on the two slope coefficients, which also provides us with a single best estimate of the true threshold's location.[17]

[16]We could alternatively have plotted the baseline and slope change coefficients instead, over the range of assumed thresholds. The advantage of the t-ratios is that they provide us with a test of the theory that is comparable across outcomes with different means (and standard deviations).

[17]We are grateful to Yuya Sasaki for his help in deriving the test.

The statistic that we use for the joint test of the theory is derived in the Appendix as,

$$n\frac{\left[\phi\left(\frac{\hat{\beta}_1}{h}\right)\right]^2}{\left[\phi(\epsilon)\right]^2}\frac{\hat{\beta}_2^2}{\hat{V}_{\beta_2}},$$

where n is the number of observations, ϕ is a symmetric and continuous function that reaches its maximum value at zero, h is a scale parameter, and ϵ is the value below which the normalized baseline slope coefficient, $\frac{\hat{\beta}_1}{h}$, is treated as "zero." The normalization is required because $\hat{\beta}_1$ will be mechanically further away from zero when the outcome variable has a larger mean or variance. To make the joint-test comparable across outcomes, we thus set h to be the standard deviation of the outcome under consideration multiplied by a constant. The joint-test statistic is constructed by estimating equation (1) at each assumed threshold.

If the data generating process is consistent with the theory, $\hat{\beta}_1 = 0$ for all assumed thresholds to the left of the true threshold. However, $\hat{\beta}_2$ is increasing as we shift closer to the true threshold *and* is more precisely estimated. This implies that our joint-test statistic will be increasing in magnitude as the assumed threshold moves closer to the true threshold. After reaching its maximum value at the true threshold, the statistic will drop rapidly to zero if the ϕ function places sufficient penalty on deviations in $\frac{\hat{\beta}_1}{h}$ away from zero. Recall that $\hat{\beta}_2$ is declining and less precisely estimated as the assumed threshold shifts further to the right of the true threshold, reinforcing this effect.

The null hypothesis when deriving the joint-test statistic is specified to be inconsistent with the theory; $\beta_1 > 0$, $\beta_2 = 0$. We show in the Appendix that the joint-test statistic is distributed as chi-squared with one degree of freedom under the null. This implies that the null hypothesis will be rejected, in favor of our theory, if the test statistic exceeds the critical value for that distribution. Based on the discussion above, this is most likely to be the case when the assumed threshold coincides with the true threshold (conditional on the data generating process being consistent with the theory). However, the implicit assumption underlying this test is that the joint-test statistic is computed at a single assumed threshold. When implementing the test, we are essentially assessing whether the maximum value of the statistic, computed for a large number of assumed thresholds, exceeds the critical value. To account for this, we will compute an outcome-specific critical value by simulating the distribution of the *maximum* value of the joint test-statistic, under the null with no slope discontinuity.[18] The critical value we have derived analytically, nevertheless, serves as a useful benchmark when testing the theory and reporting the results.

Figure 2C reports the joint-test statistic across the entire range of assumed thresholds, in increments of 0.0001, with our constructed data. We use the density of the standard normal distribution to characterize the ϕ function and set h equal to the standard deviation of the outcome under consideration and ϵ to be zero (to be conservative), in the current exercise and in the analysis

[18] We first estimate the relationship between the outcome under consideration and population connectedness, setting $\beta_2 = 0$ and $\beta_3 = 0$ in equation (1). This allows us to predict the outcome in each county under the null. We next draw repeated samples of counties with replacement, add noise to the predicted outcome in each county in each draw using the wild bootstrap procedure, and then estimate equation (1) across the full range of assumed thresholds with each sample. The maximum value of the joint-test statistic is computed for each sample and the 95^{th} percentile of this value across all samples provides us with the 5 percent critical value under the null with no discontinuity.

that follows.[19] The joint-test statistic is increasing in the assumed threshold in Figure 2C until it reaches its maximum value near the true threshold (0.08), and declining steeply thereafter. The analytical and simulated 5 percent critical values are also reported in Figure 2C. We can evidently reject the null hypothesis for a range of assumed thresholds around the true threshold. We are nevertheless most likely to reject the null hypothesis where the joint-test statistic reaches its maximum value, and this will be our best estimate of the true threshold.

An alternative criterion to locate the true threshold, as suggested by Hansen (1999) is the assumed threshold at which the sum of squared residuals in the piecewise linear regression is minimized. Based on our description of Figure 2B, this is precisely the point at which the t-ratio on the baseline slope coefficient starts to increase (from zero) and the t-ratio on the slope change coefficient starts to decline. With no additional controls in the regression, Hansen's threshold and the threshold obtained from our joint test will also coincide. This is evident in Figure 2D, where Hansen's Likelihood Ratio (LR) statistic, which is simply a normalization of the sum of squared residuals, declines as the assumed threshold shifts to the right until it reaches its minimum value at the true threshold, as in Figure 2C, before starting to increase once again.[20]

The advantage of the joint test is that it is tied directly to the theory, locating the threshold at which the estimated slope coefficients – $\hat{\beta}_1$ and $\hat{\beta}_2$ – match most closely with the predictions of the model, i.e. $\beta_1 = 0$ and $\beta_2 > 0$. In contrast, Hansen's test searches for a slope change ($\beta_2 > 0$) without placing the additional restriction that the slope to the left of the threshold should be zero ($\beta_1 = 0$). His test has less power and, moreover, cannot distinguish between our model and a data generating process in which the outcome is a monotonically increasing nonlinear function of population connectedness. It does, however, independently locate the threshold at the same place as the joint test when the data generating process is consistent with our theory.

If the joint-test statistic exceeds the critical value, providing statistical support for our theory, then the final step is to estimate equation (1) at our best estimate of the true threshold, which is the assumed threshold at which the joint-test statistic reaches its maximum value or, equivalently, at which the Hansen statistic reaches its minimum value. Based on the theory, we do not expect to reject the hypotheses that $\beta_1 = 0$ and $\beta_3 = 0$, but we do expect to reject that $\beta_2 = 0$. The point estimate $\hat{\beta}_2$ will measure the magnitude of the network effect.

Our benchmark measure of population connectedness in the empirical analysis is the fraction of land allocated to labor intensive plantation crops in each county in 1890, adjusting for differences in intensity across crops. This measure captures spatial proximity in the postbellum period as well as plantation size in the antebellum period. Cropping patterns in the South were initially put in

[19]The results are robust to different values of h. For example, we experimented with half and three-quarters of the standard deviation without substantively changing the results. In practice, we set h to be slightly smaller for outcomes associated with black networks. This makes $\phi(\hat{\beta}_1/h)$ smaller, making it is more difficult to reject the null hypothesis with those outcomes.

[20]Hansen's LR statistic is $n\frac{SSR_S - SSR_{MIN}}{SSR_{MIN}}$, where SSR_S is the sum of squared residuals at assumed threshold S, SSR_{MIN} is the minimum value of this statistic across all thresholds, and n is the number of observations. The advantage of the LR statistic over the SSR is that its asymptotic distribution (critical value) is known. Hansen derives his test without a mean shift variable (by setting β_3 to zero). Although the results with the mean shift variable are noisier in Figure 2D and with all the outcomes that follow, the relationship between the sum of squared residuals or, equivalently, the LR statistic and the assumed threshold is qualitatively the same.

place by white landowners. Variation in plantation size and, hence, black social connectedness in the antebellum period was an unintended consequence of those decisions. Once blacks were free, however, they could have moved to counties where networks were stronger, systematically changing existing cropping patterns. To account for such endogenous sorting, we will report robustness tests that use only that part of the variation in our crop-based measure of population connectedness in 1890 that can be explained by (predetermined) 1860 cropping patterns.

The two-step estimation procedure that we implement for the robustness tests is based on the nonparametric instrumental variable procedure suggested by Newey, Powell, and Vella (1999), except that we do not claim that 1860 cropping patterns satisfy the exclusion restriction. Our identification comes from the nonlinear relationship between population connectedness and network-based outcomes. In the first step, we regress the 1890 population connectedness measure on a full set of state dummies, a quartic function of the median slaveholding in 1860, and a cubic function of 1860 production for each plantation crop, additively and without interaction terms.[21] The goodness of fit (R-squared) in the first-stage regressions exceeds 0.5, consistent with the view that postbellum cropping patterns, upon which the 1890 population connectedness measure is based, could be traced back to antebellum decisions. In the second step, we nonparametrically regress each outcome on the 1890 connectedness measure, partialling out state fixed effects (as usual) as well as a flexible (fifth-order polynomial) function of the first-stage residuals. By including the first-stage residuals in the second step, we effectively regress the outcome on predicted population connectedness in 1890 (based on 1860 cropping patterns). We will see that the two-step estimation procedure accentuates the nonlinear pattern observed in Figure 2A; i.e. the slope change coefficient increases, with all network-based outcomes. The same effect will be observed when we estimate equation (1) at our best estimate of the true threshold. This could be because the two-step procedure corrects for postbellum sorting across counties or because it purges measurement error.

4 Empirical Analysis

This section begins by describing the alternative measures of social connectedness in southern counties that we use in the empirical analysis. We then proceed to estimate the relationship between these measures and a variety of outcomes at different points in time, separately for blacks and whites. The statistical test derived above is used to formally assess whether the relationship is consistent with the theory in each case.

4.1 Measures of Social Connectedness

Social connectedness in a rural population is determined by spatial proximity. The relevant population when constructing the connectedness measure in our southern counties would be black

[21] The 1860 population census provides the number of slaveholdings by size-category in each county. These categories are all integers up to 9, 10-14, 15-19, 20-29, 30-39, 40-49, 50-69, 70-99, 100-200, 200-300, 300-500, and greater than 500. A hypothetical ranking of all slaves in a county can be constructed based on the size of the plantation to which they were assigned, which allows us, in turn, to compute the size of the slaveholding associated with the median slave. We use crop production, which is available from 1840, to predict the plantation share in 1890 because acreage data are only available from 1880 onwards.

agricultural workers and tenants, since this is the population from which networks during Reconstruction and the Great Migration were drawn. Spatial proximity in this population would have been determined by the crops that were grown in the local area. In particular, black men engaged in agriculture would have worked (and lived) close to each other in those counties where labor intensive plantation crops were grown.

Our first connectedness measure is the fraction of land allocated to the plantation crops: cotton, tobacco, rice, and sugarcane, adjusting for differences in labor intensity across those crops.

$$\textbf{M1}.\ \ S_i = \sum_j \beta_j \frac{A_{ij}}{A_i},$$

where A_{ij} is the acreage allocated to plantation crop j, A_i is total acreage, and β_j is the labor intensity (workers per acre) for plantation crop j obtained from farm studies in the postbellum period (reported in Column 1 of Appendix Table A1). Although crop acreage at the county level is available from the 1880 census onward, our benchmark connectedness measure is constructed in 1890, midway between Reconstruction and the Great Migration. We will verify that the results are robust to using the average of this measure over the 1880-1900 period.

Black farm workers and tenants would have worked close to each other in counties where labor intensive crops were grown, resulting in a higher level of social connectedness in that population. Social connectedness would have been additionally greater in those counties because larger plantations would have supported stronger social ties during slavery, with these ties persisting over time in a stable population. Appendix Figure A1 reports the relationship between plantation size in 1860 and the M1 measure of social connectedness. Plantation size is increasing smoothly in this measure, highlighting this additional channel through which our crop-based measure could determine social connectedness.

The M1 measure can be interpreted as the acreage weighted average of the labor intensity across all crops, with the implicit assumption that the black labor intensity on non-plantation crops is small enough to be ignored. To validate this assumption and to obtain independent estimates of the labor intensities, we estimate the following equation over the 1880-1900 period:

$$P_{it} = \sum_j \beta_j A_{ijt} + \alpha(A_{it} - \sum_j A_{ijt}) + f_i + \zeta_{it}, \tag{2}$$

where P_{it} is total black population in county i in year t, f_i is a county fixed effect (to account for the population that is not connected to agriculture), and ζ_{it} is a mean-zero disturbance term. The coefficient estimates from the equation above are reported in Appendix Table A1, Column 2. The α coefficient, which measures black labor intensity on non-plantation crops, is an order of magnitude smaller than the β coefficients. As assumed, blacks were largely engaged in the cultivation of plantation crops. Our second connectedness measure is the same as M1 except that we use the estimated β coefficients from equation (2),

$$\textbf{M2}.\ \ S_i = \sum_j \hat{\beta}_j \frac{A_{ij}}{A_i}.$$

This measure is effectively the predicted number of black agricultural workers and tenants, and their dependents, divided by total acreage. To measure the average proximity of black men engaged in agriculture, we would want to parse out the dependents. Our third connectedness measure uses the complete count from the 1880 census, available from IPUMS-USA (Ruggles et al. 2010), which allows us to compute the number of black men, by age and occupation, residing in each southern county. Three occupations: (i) farm laborers and wage workers, (ii) farm owners and tenants, and (iii) unspecified laborers, account for 82 percent of black men aged 18-50. Individuals in the first two occupations will certainly belong to the population of agricultural workers and tenants from which black networks were drawn. Given the importance of agriculture in the postbellum southern economy, a large fraction of individuals in the third occupation, which accounts for 30 percent of the workforce, would also have been directly or indirectly engaged in agriculture. We thus replace total black population 1880-1900, P_{it}, with the number of working-age black men in these occupations as the dependent variable in equation (2). Since we now have a single time period, the t subscripts and the fixed effects, f_i, are dropped when estimating the equation. To be consistent with the previous connectedness measures, we continue to use 1890 acreage to measure A_{ij} and A_i.

The coefficients estimated with this equation are reported in Appendix Table A1, Column 3. The β coefficients continue to be large and precisely estimated, while the α coefficient is once again an order of magnitude smaller than the β coefficients. Our final **M3** connectedness measure is constructed using the same specification as M2 above, with the estimated β coefficients from 1880 rather than over the 1880-1900 period.[22] This is simply the predicted number of agricultural workers and tenants divided by total acreage, providing us with a direct measure of their proximity at work.

As noted, the advantage of the crop-based measure is that it is correlated with multiple sources of social connectedness: (i) plantation size during slavery, (ii) proximity at work after slavery, and (iii) residential proximity. To measure residential proximity, we simply divide the number of black men aged 18-50 in farm occupations, by total county area. We see in Appendix Figure A1 that this population density measure, and the density of the total black population, are also increasing smoothly in the M1 measure of social connectedness.

The acreage allocated to different crops must satisfy the orthogonality condition for consistent estimates of the labor intensities to be obtained. Since this assumption cannot be validated, we use the M1 measure, where the labor intensities are based on farm studies, as the baseline measure in all the analysis that follows. We will, however, verify that the results are stable across all three measures. To facilitate this comparison, M1, M2, and M3 are normalized to have the same mean and standard deviation as the fraction of land allocated to plantation crops, a statistic that is easy to interpret. This normalization, which simply involves multiplying each measure by a constant and then adding another constant term, has no effect on the shape of the relationship between each

[22] To verify that individuals working in other occupations do not contribute to the population of agricultural workers and tenants, we replaced the number of working-age black men in the three occupations listed above with the number in all other occupations in 1880 as the dependent variable. The estimated coefficients are statistically and economically insignificant.

connectedness measure and the outcomes of interest.

Figure 3 describes the benchmark connectedness measure (M1), which we will refer to interchangeably as the *plantation share*, in the 15 southern states in which slavery existed prior to Emancipation.[23] The message to take away from the figure is that there is substantial variation in this statistic across states and, more importantly, across counties within states. We will take advantage of this variation to include state fixed effects in all the regressions that we report, although the results are very similar with and without fixed effects.

4.2 Reconstruction

A larger network of black activists in a county during Reconstruction would have generated greater political participation in the population. Although political participation by race is not available, voter turnout by party is available from U.S. Historical Election Returns (ICPSR). Because blacks would have voted Republican at this time, our primary measure of political participation is the number of Republican votes in the county. This statistic is reported at three points in time in Figure 4A, for the 1872, 1880, and 1900 presidential elections. The pattern of votes in 1872, which is at the height of black political power, was reported earlier in Figure 1A. Although southern Democrats started to take control and blacks were gradually disfranchised once Reconstruction ended in 1877, blacks continued to vote and to elect their own leaders, with less and less success, into the 1890s. As expected, the increase in Republican votes past the plantation share threshold is weaker in 1880 than in 1872. However, the specific nonlinearity implied by the theory continues to be obtained. This contrasts with the pattern in 1900, by which point in time blacks would have been completely disfranchised and where we see no relationship between the number of Republican votes and plantation share.

Figure 4B tests whether the nonlinear relationship that we uncovered in 1872 in Figure 4A matches the theory. The t-ratio on the baseline slope coefficient is close to zero up to a threshold and increasing thereafter. The t-ratio on the slope change coefficient increases steadily up to the same threshold, reaching a maximum value of four, and then declines thereafter. Figure 4C reports the joint-test statistic across the range of assumed thresholds in 1872 and 1900. The 1872 statistic reaches its maximum value, well above the simulated 5 percent critical value, close to the threshold in Figure 4B. It declines steeply, on both sides, away from our best estimate of the true threshold (around 0.08). The 1900 statistic, in contrast, is close to zero across the entire range of assumed thresholds. Figure 4D reports the nonparametric instrumental variable estimates for 1872 Republican votes. The results are even stronger (and the relationship between voting and plantation share is more nonlinear) than what we obtained in Figure 4A. The results with political participation match the model's predictions, and the simulations in Figures 2B and 2C (where the data were constructed to be consistent with the theory).

We next proceed to establish the robustness of these results to alternative measures of social

[23] The slave states are Alabama, Arkansas, Delaware, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, Missouri, North Carolina, South Carolina, Tennessee, Texas, and Virginia. Among these states, Kentucky, Missouri, Delaware, and Maryland did not join the Confederacy.

connectedness and black voting. Appendix Figure A2(A) reports nonparametric estimates where the M1 measure is replaced by (i) the average of that measure over the 1880-1900 period, and (ii) the M2 and M3 measures. The estimated relationship is robust to the social connectedness measure and the same robust result is obtained with other outcomes discussed below. Federal, state, and local elections are synchronized in the American political system and so the voter turnout across counties that we observe for presidential elections should also apply to local elections occurring at the same time, where the implications of the theory may be more relevant. Appendix Figure A2(B) regresses Republican votes in gubernatorial and congressional elections (separately) on plantation share, uncovering the same pattern that we obtained with 1872 presidential elections.[24] The relationship between plantation share and Republican votes is robust to the type of election and we expect that the same relationship would be obtained with state and local elections, although those data are unavailable.

While the robust nonlinear relationship between Republican votes and social connectedness we have uncovered is consistent with the theory, we do not have direct evidence that the increase in Republican votes above the threshold was driven by black voters. White "carpetbaggers" from the North and white "scalawags" from the South also voted Republican in southern counties at this time. If the number of white Republican votes was correlated with plantation share, this could confound our interpretation of the results in Figure 4A. One observation from that figure that goes against this alternative explanation is that the number of Republican votes and plantation share are unrelated in 1900, by which time blacks were effectively disfranchised. To provide further support for our hypothesis, we take advantage of the fact that an increase in black votes would have generated an increase in black leaders, to the extent that blacks wanted to elect members of their own race.

Foner (1993) provides a complete list of black officeholders during Reconstruction. Almost all of these officeholders were elected to positions in state government. We therefore construct two measures of leadership based on his data: whether a black state representative and whether a black state senator was elected from each county in this period. These measures are regressed nonparametrically on plantation share in Figure 5A. The probability that a black leader, especially a state representative, was elected from a county tracks closely with the pattern of Republican votes in 1872 and 1880, indicating that voting patterns in those years were indeed being driven by black voters. Figure 5B reports the joint test statistic for state representatives (who accounted for most black leaders) and for Republican votes in gubernatorial elections (as a benchmark). Matching Figure 4C, which reports the corresponding statistic for the 1872 Presidential election, the test statistic reaches its maximum value (well above the simulated critical value needed to reject the null with 95 percent confidence) at the same assumed threshold, just to the left of 0.1, for both outcomes.[25] The same results are obtained for state senators (not reported).

[24]Republican votes in gubernatorial and congressional elections are available, by county, from ICPSR. Gubernatorial elections were held at four-year intervals but were not synchronized across states. Appendix Figure A2(B) is thus based on all gubernatorial elections held between 1871 and 1873. Data on congressional elections are obtained for 1872.

[25]Results from the Hansen test, reported in Appendix Figure A3(A) match closely with the results from the joint

The unconditional relationship between plantation share and political outcomes can only be used to test the theory, based on unobserved network size, if the number of individuals voting independently is uncorrelated with plantation share. This will not be the case if this number is increasing in the black population and black population is, in turn, increasing in plantation share. We would expect the black population to be increasing in plantation share, since we saw in Appendix Figure A1 that black population density was increasing in population share. However, the black population is increasing smoothly in plantation share in Appendix Figure A4 and so it is unlikely that variation in the black population across counties is driving the specific nonlinear pattern that we observe in Figure 4. We nevertheless estimate the *conditional* relationship between plantation share and the probability that a black state representative is elected in the county in Figure 5C. The black population in the county, together with the state fixed effects, are partialled out nonparametrically, generating results that match closely with the unconditional estimates.

Our explanation for the variation in voting across counties is based on internal forces that generate differences in the size of the largest network that can form (and encourage voter turnout). Another explanation is based on competition between blacks and whites. Consider a model of political competition in which blacks only turn out when they expect to win and elect their own leader with sufficiently high probability. Because black population and the share of blacks in the population (not reported) are both increasing in plantation share, blacks will not turn out to vote until a threshold share, which is consistent with the voting patterns that we observe. This model implies that there will be a discrete jump in voter turnout (sufficient to win the election) at the threshold. Formal tests reported below reject a mean shift at the threshold. Nevertheless, as a final robustness test, we condition nonparametrically for the black population share when estimating the relationship between plantation share and black leadership in Figure 5C. Once again, the conditional results match closely with the unconditional estimates, indicating that our results are not being driven by strategic voting considerations.[26]

4.3 The Black Church

While slaves worshipped in biracial churches for the most part, they did appear to have some autonomy in the choice of denomination and most were formally affiliated with either the Baptist or Methodist church (Woodson 1921, Genovese 1974). Once free, they quickly formed independent congregations within those denominations (Boles 1988, Kolchin 1993). Southern blacks could remain part of the mainstream Baptist and Methodist denominations they belonged to as slaves, or they could affiliate with the exclusively black sub-denominations that spread throughout the South after the Civil War. Some of these sub-denominations, such as the African Methodist Episcopalian

test. In particular, a threshold is located with 95 percent confidence at the same place as the joint test for voting in the 1872 Presidential election, the 1871-1873 Gubernatorial election, and the election of black state representatives. In contrast, a threshold cannot be located for the 1900 Presidential election.

[26]Black population and black population share are included (separately) as linear terms, and then partialled out nonparametrically, in Figure 5C. Similar results are obtained when we include a flexible polynomial function of the black population share to allow for the possibility that the turnout of individual black voters is a nonlinear function of the population share.

(AME) Church and the African Methodist Episcopalian Zion (AMEZ) Church, were established by freed blacks in northern cities at the beginning of the nineteenth century (Du Bois 1908). Black Baptist sub-denominations coalesced much later (Frazier 1964).

Church congregation size is our most direct measure of network size. The Census of Religious Bodies (CRB) provides information on the number of churches in each county, by sub-denomination, at ten-year intervals from 1860 to 1890. The CRB collected information on the number of church members, by sub-denomination within the Baptist and Methodist church, from 1890 onwards.[27] We thus measure average congregation size in each sub-denomination by the ratio of church members to the number of churches in 1890. The advantage of having information on the African-American sub-denominations is that the average congregation-size we compute for them will be based entirely on black congregations. Southern whites, like southern blacks, were most often Baptist or Methodist (Kolchin 1993). The average congregation-size that we compute for the Baptists and the Methodists as a whole will thus be based on black as well as white congregations. For this reason, the analysis of congregation-size that follows will separately consider Baptists and Methodists, black sub-denominations among the Baptists and Methodists, and other (white) denominations such as the Presbyterians, Episcopalians, and Catholics.[28]

Figure 6A nonparameterically regresses average congregation size in each set of denominations described above on the plantation share. The pattern for the Baptists and Methodists and for the black sub-denominations matches the corresponding pattern for black political participation and leadership that we obtained earlier: there is no association between average congregation size and plantation share up to a threshold and a positive association thereafter. Notice that the increase in congregation size past the threshold is greater for the black sub-denominations than for Baptists and Methodists as a whole. This implies that the results are not being driven by variation in the size of white congregations across counties. Consistent with this interpretation, no particular relationship between congregation size and plantation share is observed for other (white) denominations.

Figure 6B formally tests whether the nonlinear pattern observed in Figure 6A for the black sub-denominations is consistent with the theory. The joint-test statistic increases steeply in the assumed threshold until it reaches its maximum value and declines steeply thereafter for both the black sub-denominations and for Baptists and Methodists. The maximum value of the joint-test statistic for black sub-denominations and for Baptists and Methodists overall is above the simulated critical value needed to reject the null with 95 percent confidence, whereas it is close to zero over the entire range of assumed thresholds for the other denominations.[29] Our best estimate of the location of the threshold for the black sub-denominations is close to what we obtained earlier for

[27]The CRB was conducted as part of the population census from 1860 to 1890, with census enumerators collecting information from individual churches in each county. Subsequently, the U.S. Bureau of the Census conducted the CRB separately from the population census in ten-year intervals from 1906 to 1936.

[28]The black sub-denominations included in the 1890 CRB are Regular Baptist (colored), African Methodist Episcopal, African Methodist Episcopalian Zion, Colored Methodist Episcopalian, and Colored Cumberland Presbyterian. Among these sub-denominations, only the Cumberland Presbyterians, who had a small following, fell outside the umbrella of the Baptists and the Methodists.

[29]Results from the Hansen test, reported in Appendix Figure A3(B) match the results from the joint test. We locate a threshold with 95 percent confidence, at the same place as in Figure 6B, for the Baptists and Methodists, whereas a threshold cannot be located for the other denominations.

voting and black leadership. As with political participation, the results are stronger (and the relationship between black church congregation size and plantation share is more nonlinear) when we instrument for 1890 plantation share with 1860 median slaveholding and 1860 plantation-crop production in Figure 6C.

4.4 The Great Migration

We next proceed to examine the relationship between the plantation share and the level of migration across southern counties. Since the population census does not provide the county of birth, the birth-location of blacks residing in northern cities in 1920 and 1930 cannot be used to measure the level of migration from each southern county. The census survivor ratio method has been proposed in the historical demography literature to deal with this problem (e.g. Lee et al. 1957, Collins 1997). In our application, this method would predict what a southern county's population would have been at the end of a given decade in the absence of migration – based on the age and sex distribution, each cohort's survival rate (determined by mortality at the national or regional level) and fertility (for the youngest cohort). The difference between this predicted population and the actual population would provide an estimate of intercensal migration. We do not use this procedure for two reasons. First, the age distribution is not available at the county-level for census rounds between 1870 and 1930 (except for the full count in 1880). Second, even if these data were available, a single survival rate and fertility rate could not be applied since it is evident from Appendix Figure A4(A) that the black population was growing more rapidly in high plantation share counties in the postbellum period (prior to the Great Migration).

Our approach – which we will validate with an independent migration measure discussed below – uses county-level population changes just prior to the Great Migration to "nonparametrically" predict the changes that would have occurred in the absence of northern migration during that period. The first major movement to the North commenced in 1916. The population change in the preceding decade, $P_{1900} - P_{1910}$, predicts the change that would have occurred in the next decade in the absence of migration. The "short" double-difference, $(P_{1910} - P_{1920}) - (P_{1900} - P_{1910})$, is thus our best estimate of northern migration in each county between 1916 and 1920. The "long" double-difference, $(P_{1910} - P_{1930}) - (P_{1890} - P_{1910})$ provides an analogous measure over the course of the first wave of the Great Migration.

Figure 7A nonparametrically regresses the change in population, $P_{1910} - P_{1920}$ and $P_{1900} - P_{1910}$, separately for black and whites, on plantation share. $P_{1900} - P_{1910}$ for blacks is negative everywhere and mildly declining in plantation share. This implies that the black population was increasing on net throughout the South prior to the Great Migration, particularly in counties with large plantation shares, which is consistent with the changes over time observed in Appendix Figure A4(A). This relationship is reversed in the subsequent decade. There is no population change up to a threshold plantation share and a large *decline* in the population thereafter, which we attribute to migration. In contrast, population change for the whites is stable over the two decades, providing a useful benchmark for the results we obtain for the blacks.

Figure 7B adjusts for natural population change by nonparametrically regressing the short double-difference, $(P_{1910} - P_{1920}) - (P_{1900} - P_{1910})$ on plantation share. Figure 7C repeats the exercise with the long double-difference, $(P_{1910} - P_{1930}) - (P_{1890} - P_{1910})$, as the dependent variable. The regression with the long double-difference was reported earlier in Figure 1A and we see that the same pattern is obtained with the short double-difference. There is no association between plantation share and our measure of black migration up to a threshold and a positive association thereafter. As before, conditioning for the black population (in 1910) makes this relationship even stronger. This contrasts with white migration, where a monotonic and mildly declining relationship with plantation share is observed. Figures 7D and 7E formally test the predictions of the theory. The joint test-statistic with the short-double difference measure of black migration reaches its maximum value to the right of 0.1 in Figure 7D, although a second peak to the left of 0.1 is also visible. The corresponding statistic for the long double-difference measure reaches its maximum value to the left of 0.1 in Figure 7E, at a point that coincides with our best estimate of the threshold for voting and black church congregation size. The maximum value of the joint-test statistic is well above the simulated critical value at which we can reject the null with 95 percent confidence in both figures. This contrasts with the test statistics for black population-change prior to the Great Migration as well as for white migration, which are close to zero across the range of assumed thresholds in both figures.[30] As with voting and black church congregation size, the results are even stronger (and the relationship between black migration and plantation share more nonlinear) when we instrument nonparametrically for 1890 plantation share with 1860 slaveholding and crop production in Figures 7F and 7G.

4.5 Migration from Mississippi

Although it does account for natural population change, the double-differenced statistic is still an indirect measure of migration. To verify the robustness of the results in Figure 7 we consequently utilize newly available data from the state of Mississippi that link southern counties to northern destinations. These data include the zip code of residence of all recipients of Medicare Part B between 1976 and 2001. The Medicare records, which are reliably available from the 1905 birth-cohort onward, were merged with social security records (the Numident file), which include the town of birth. Under the assumption that individuals remained in the city (MSA) to which they moved, we can compute the number of migrants and the distribution of migrants across northern cities, by race, for each Mississippi county. These statistics are computed for individuals born between 1905 and 1925 because these are the individuals most likely to have migrated between 1916 and 1930, either as young adults or as children with their parents. While the large number of cohorts

[30] The nonparametric relationship between plantation share and black migration (short and long double-difference) at other points in time, as well as the relationship between plantation share and white migration during the period of the Great Migration are reported in Appendix Figure A5. Consistent with the results from the joint test reported in Figures 7D and 7E, no slope discontinuity is discernable for any of these migration measures. Results from the Hansen test, reported for the short double-difference migration measure in Appendix Figure A3(C), also match the results from the joint test in Figure 7D. We locate a threshold with 95 percent confidence, at the same place to the right of 0.1, for black migration, 1900-1920. However, we do not locate a threshold for black migration, 1880-1900, or for white migration, 1900-1920.

allows us to measure migration from each southern county with precision, this also implies that some individuals who moved after the Great Migration will be included in these cohorts. This will not qualitatively change the analysis that follows, because Southern counties that channeled their members to particular Northern destinations during the Great Migration would have continued to do so thereafter once networks were established.

Figure 8A nonparametrically regresses the short and long double-difference statistics that we use to indirectly measure migration, and a direct measure based on the 1905-1925 birth cohorts, on plantation share across Mississippi counties.[31] Reassuringly, these measures of migration track closely together and, moreover, match the pattern that was obtained across all southern counties. Although not reported, this pattern is obtained across Mississippi counties for Republican votes in 1872, the probability that a state representative was elected, and black church congregation size. Figure 8B reports nonparametric regressions with the number of migrants and the distribution of migrants, measured by the Herfindahl-Hirschman Index. As observed in Figure 1B, both statistics for blacks are uncorrelated with plantation share up to the same threshold and increasing in plantation share thereafter. In contrast, the number and the distribution of white migrants is uncorrelated with plantation share.

Figure 8C reports nonparametric regressions with alternative measures of the distribution of black migrants across destinations: (i) the fraction of migrants at the most popular destination MSA, and (ii) the fraction of the remaining migrants who moved to the next most popular destination. Both measures indicate that there is a high degree of clustering at the destination. Moreover, the relationship between plantation share and these measures matches what we obtained with the Herfindahl-Hirschman Index in Figure 8B – there is no association up to a threshold and a positive association thereafter.

Our theory is silent about which of the available destinations will be selected by the network; in general, while networks will form at more than one destination, there is a random (accidental) aspect to network formation. Previous studies; e.g. Carrington, Detragiache, and Vishwanath (1996) and Munshi (2003) have exploited this fact to provide indirect support for the presence of underlying networks by showing that migrants from proximate origin locations (with similar characteristics) end up clustering at very different destinations. Appendix Figure A6(A) indicates that although Mississippi counties were well connected by rail to multiple northern cities, Chicago was the first choice of black migrants, almost without exception. However, their destination choices diverge substantially when we turn to the next most popular destination in Appendix Figure A6(B). Migrants from geographically contiguous counties cluster in diverse destination MSAs. Once again, this contrasts with the corresponding pattern for whites in Appendix Figure A6(C). The white migrants end up almost without exception in the closest MSA.

[31] All the nonparametric regressions up to this point in the analysis have included state fixed effects. Since we are now focussing on a single state, the two-step procedure used to partial out the state fixed effects is no longer required.

4.6 Summary of Results and Alternative Explanations

Tables 1 summarizes the results we have obtained for outcomes associated with black networks by estimating equation (1) at our best estimate of the threshold location, based on the joint test. Appendix Tables A2 and A3 report corresponding estimates with threshold locations obtained from the Hansen test, with and without a mean-shift variable, respectively. The threshold locations from the joint test and the Hansen test match closely for each outcome. The baseline slope and the mean-shift coefficients, estimated at the threshold, are statistically indistinguishable from zero in all three tables and with all outcomes. In contrast, the slope change coefficient is positive and significant, almost without exception.

Instrumental variable estimates, at the threshold derived from the joint test, are reported in Table 2. Recall that the nonparametric instrumental variable regression is implemented by including a polynomial function of the first-stage residuals in the second-stage. The first-stage residuals are jointly significant for most outcomes in Table 2. This indicates that the instrumental variable estimates are correcting for measurement error in the plantation share variable or for internal black migration across southern counties after Emancipation that was correlated with the outcomes of interest. Once we have made this correction, the slope change coefficients in Table 2 are even larger than the corresponding coefficients in Table 1, consistent with the nonparametric plots.

The specific nonlinearity we have uncovered appears consistently across multiple outcomes associated with black networks at particular points in time. It is not obtained at other points in time or for whites. We complete the analysis by considering alternative explanations for these results.

1. External Mobilization. Suppose that an external agency organizes political participation during Reconstruction and the movement north during the Great Migration. Depending on the context, this agency could be the Republican party or a northern labor recruiter. The value to the agency $V(N)$ is an increasing function of the number of individuals, N, that it can mobilize. It is reasonable to assume that N is an increasing function of the black population of the county, which we saw in Appendix Figure A4 was increasing in the plantation share, S. This can explain the increase in Republican votes and migration to the right of a plantation share threshold, simply because there is a larger black population to draw from. To explain the absence of such a relationship to the left of the threshold, introduce a fixed cost k. The external agency will only enter counties where it expects to mobilize a sufficiently large number of individuals. Because V is increasing in N, and N is increasing in S, there exists a threshold $\underline{S}$ below which there is no entry. N is constant (zero) to the left of $\underline{S}$ and increasing in S to the right of $\underline{S}$.

This alternative *centralized* explanation has many features in common with our theory of *decentralized* network formation. What distinguishes it from our theory is a level discontinuity at the threshold (a discrete jump to $N(\underline{S})$) which is needed to just offset the fixed cost and which is not implied by our theory. We do not observe a discrete jump at the threshold in any of the figures presented in this paper. What we observe instead is a change in the slope at the threshold. Formal tests of the theory at our best estimate of the true threshold, reported in Tables 1-2, are also consistent with this observation.[32]

2. Individual Response to External Forces. Suppose that individuals vote and migrate independently in response to external forces that vary across counties. When networks are absent, individuals will have the same response to these forces in each county, in contrast with our model in which the response to the same external force varies with social connectedness. If the relationship between plantation share and the external forces is characterized by the specific nonlinearity that is implied by the theory; i.e. no association up to a threshold and a positive association thereafter, then the results obtained for black political participation and migration could spuriously be attributed to network effects.

In the absence of network effects, black voting could have varied nonlinearly across southern counties because black literacy rates or the black population (share) varied in the same way across those counties. We have already examined the latter possibility, establishing in Appendix Figure A4 that the black population over the 1860-1910 period does not exhibit the specific nonlinear relationship with plantation share that is implied by the theory. We subject these results to further scrutiny in Figure 9A, establishing that this nonlinearity is not obtained in 1880 for working-age black men engaged in farm occupations, the white population-share or, equivalently, the black population-share, the white population, the number of literate black men in 1870, and the literacy rates for blacks and whites in that year.

Turning to the Great Migration, three push factors that have featured prominently in the literature are the the arrival of the railroad, racial intimidation and violence, and the boll weevil beetle infestation, which reduced the demand for labor in cotton-growing counties.[33] A well documented feature of the Great Migration is positive selection on education (eg. Lieberson 1978, Margo 1990, Tolnay 1998). We see in Figure 9B that the nonlinear relationship with plantation share implied by the theory is not obtained for any of the push factors, with black literacy (rates and numbers) in 1910, or with white literacy in that year.[34]

To provide further support for the hypothesis that our network-based interpretation of the core

[32] Could a model with a mean-shift at the threshold generate the slope discontinuity (without an apparent mean-shift) that we observe in the data if we added noise to the plantation share variable or the threshold location? To answer this question, we generated data corresponding to different hypothetical models, (separately) varying the amount of measurement error in the plantation share variable and adding heterogeneity to the threshold location (correlated or uncorrelated with plantation share). The results of this simulation exercise are reported in Appendix Table A4: (i) A model that matches our theory, with a slope change at a threshold, will continue to generate the observed patterns in the data with a small or moderate amount of noise (measurement error in the plantation share variable or heterogeneity in the threshold location). (ii) A model with just a mean-shift at a threshold or both a mean-shift and a slope change (with the same level of significance in the baseline specification) never matches the data even when noise is added.

[33] Railroad access is measured by the number of miles of railroad in 1911 divided by the area of the county (available in 1880). The boll weevil beetle infestation commenced in the cotton south around 1890, so we measure the boll weevil effect by the percentage change in cotton acreage from 1890 to 1920, at the onset of the Great Migration. Alternative measures, based on the percentage change from 1910 to 1920, as well as the percentage change in cotton production, generate similar results. Data on the number of black lynchings in each southern county between 1882 and 1915 (just before the onset of the Great Migration) are obtained from the Historical American Lynching (HAL) Data Collection Project. They do not include data from Delaware, Maryland, Missouri, Texas, and Virginia.

[34] Nonparametric estimates of the relationship between plantation share and each independent determinant of voting and migration that we have discussed are reported in Appendix Figure A7. Matching the results of the joint tests in Figures 9A and 9B, the nonlinear relationship that is implied by the theory is not detectable, without exception.

empirical results is not confounded by these independent determinants of voting and migration, we include them as additional regressors in equation (1). The estimated slope change coefficients in Appendix Tables A5-A7 match closely with what we obtained in Table 1.

3. White Networks. Wealthy white landowners in counties where labor intensive plantation crops were grown would have benefited disproportionately by suppressing wages and restricting labor mobility (Engerman and Sokoloff 1997, Alston and Ferrie 1999, Acemoglu and Robinson 2008). One way to achieve this objective would have been through intimidation and racial violence (Tolnay and Beck 1990). A second strategy would have been to reduce public expenditures on black education in those counties (Margo 1990). As in our theory of black network formation, suppose that white networks only form above a threshold plantation share, with their size (and, hence, their ability to exploit the black population) increasing in plantation share above the threshold. Then this would explain the results that we obtain, as the individual black response to white oppression and low wages when the opportunities for such a response became available during Reconstruction and the Great Migration.

We do not find evidence directly supporting this alternative explanation. Threshold tests in Figure 9B and the corresponding nonparametric estimates in Appendix Figure A7 do not detect an increase in black lynchings or a decline in black literacy below a threshold plantation share. Moreover, there is no evidence that economic conditions for blacks were unchanged up to a threshold plantation share and declining steeply thereafter.[35] Even if that were the case, external forces that increased the propensity of blacks to migrate (independently) in some counties would not necessarily channel them to a restricted number of northern destinations. The observation that the level of migration and the concentration of migrants across destinations track closely together is difficult to explain without a theory of underlying *black* cooperation. Variation in the size of the black church congregation is also difficult to explain without local coordination in that population above a threshold.

4.7 External Validity: South Asian Migration to the U.K.

Although our theory is designed to explain black political participation and migration in the decades after Emancipation, it should apply to other contexts. Consider, for example, the migration of South Asians to the U.K. after the Second World War, which has many features in common with the Great Migration. There were just 7,000 South Asians settled in the U.K. in 1932, but this number expanded rapidly in the post-war period, 1948-1962, when restrictions on immigration were temporarily lifted (Visram 1986). Any citizen of a former British colony was entitled to enter

[35] It has been argued that the loss of economies of scale in agricultural production after slavery resulted in a dramatic decline in productivity (Fogel and Engerman 1974, Goldin and Lewis 1975, Moen 1992, Irwin 1994). This decline may have been particularly severe in the high plantation share counties with large plantations. But this would not explain the high migration from those counties if productivity was equalized across counties in the postbellum period with the loss in scale efficiencies. A contrasting view is that the organization of production in the plantation counties was retained after Emancipation, with black laborers and tenants managed by white landowners in large units (Brannen 1924). Even if this were true, there is no obvious reason why wages would have been systematically suppressed above a plantation share threshold. Recall that plantation size was increasing smoothly in plantation share prior to Emancipation, as documented in Appendix Figure A1.

at will during this period and by 1961 the (largely male) South Asian population settled in the U.K. had grown to about 100,000.

The vast majority of South Asian immigrants to the U.K. are drawn from three regions: Gujarat in India, Sylhet in Bangladesh, and the Punjab, which straddles India and Pakistan (Ballard 2003). The analysis that follows focuses on the Punjabis, estimating the relationship between social connectedness in their origin location, which is appropriately measured at the county (*tehsil*) level, and migration to the U.K. between 1948 and 1962.[36] Naturalization Certificates for all migrants in this period are housed in the National Archives and a random sample of these certificates were computerized under a special data sharing arrangement with the University of Cambridge in 2014. The place of birth is recorded in the certificate, although information down to the county level is not always available. Restricting attention to migrants from Punjab for whom the county of birth is available, we are left with a sample of 1324 individuals drawn from 90 out of 200 rural counties.

Historical cropping patterns at the county level are unavailable and so we measure social connectedness by the population density (people per square mile) in the migrant's birth county, obtained from the 1931 Indian Population Census.[37] The number of migrants from a county, N, ranges from 0 to 353 in our data set. There is thus sufficient variation to test the relationship between social connectedness and the level of migration. However, estimation of the relationship between social connectedness and the HHI across U.K. destinations, which we define by the postal code of the migrant's initial address, poses a problem when the number of migrants is small. The HHI is mechanically decreasing in N for two reasons; (i) the HHI is bounded below at $1/N$, and (ii) random clustering at particular locations is more likely to occur when N is small. We account for this in the analysis by constructing a normalized HHI statistic that divides the unadjusted HHI, based on the observed concentration of migrants across destinations, by the expected HHI if the migrants were to move independently, with the same probability, to each of the M available destinations.[38]

Figure 10 reports nonparametric estimates of the relationships between population density in the Punjabi origin county and the level of migration to the U.K. and the normalized HHI across destinations.[39] Closely matching the pattern we observed earlier for the Mississippi migrants, both the number of migrants and the normalized HHI are unchanged up to a threshold population density and steeply increasing thereafter. The normalized HHI takes the value one when migrants are moving independently. Notice in Figure 10 that this appears to be the case below the threshold,

[36]Many Gujaratis moved first to East Africa and then later to the U.K. in the early 1970s, while the bulk of the Bangladeshis used the family reunification channel to migrate in the 1980s.

[37]Total population density is increasing smoothly in our crop-based measure of social connectedness in Appendix Figure A1, and we would also expect this relationship to be obtained in the Punjab. Past research has documented the important role of caste networks in supporting internal migration in India. It is likely that caste networks were similarly active in the migration to the U.K. This will have no bearing on our analysis as long as higher population density in a county increased social connectedness in all the castes that were present in the area.

[38]The expected HHI statistic is derived in the Appendix as a function of N and M. In the limit, when N is very large, it has a value $1/M$, as derived earlier in the theoretical section. As N declines, this statistic grows in size.

[39]The relationship between population density and HHI is estimated using the 90 origin counties with positive migration. The corresponding relationship with the level of migration is estimated using all 200 counties, although the pattern is the same when the sample is restricted to the 90 counties.

whereas the normalized HHI exceeds three at its highest point above the threshold. These results provide empirical support for the generalizability of our theory and for our network-based view of the Great Migration. Many of the alternative explanations we considered in the context of the Great Migration, such as white network formation, are irrelevant for South Asian migration and yet the same empirical pattern, characterized by a slope discontinuity at a threshold, is obtained.

5 Conclusion

The development process has historically been characterized, and continues to be characterized, by the movement of groups across space and occupations. The analysis in this paper highlights the interaction between historical preconditions and new opportunities in shaping such group mobility. Despite the adverse circumstances that they faced under slavery, blacks were able to respond as a group to new political and economic opportunities in the postbellum period. It is worth emphasizing, however, that the collective response we uncover is restricted to southern counties where specific preconditions, based on historical cropping patterns, were satisfied. As shown in Figure 11, less than 10 percent of the migrants to the North were drawn from the third of the black population living in counties below the plantation share threshold, whereas over 50 percent were drawn from the third of the population residing in the highest plantation share counties.

Black migrants from counties below the threshold would have moved with relatively little social support. Blacks from counties above the threshold would have moved in large groups to a small number of northern destinations. This variation in the pattern of out-migration would have had consequences for the formation and evolution of black communities in northern cities. Relatively weak communities would have formed in destinations that received migrants who moved independently from diverse origin locations. In contrast, the small number of northern destinations that received the bulk of their migrants from southern counties above the threshold would have formed more cohesive communities. This variation in initial conditions would, in turn, have shaped the evolution of African-American communities over the course of the twentieth century.

Differential out-migration could also have had consequences for the evolution of black communities in southern counties. Given the well documented positive selection on education among northern migrants, counties above the threshold would have lost the bulk of their most able residents over the first half of the twentieth century. The resulting social dislocation could then explain Putnam's observation that those counties have relatively low social capital today. Wilson (1987) famously argued that the exit of educated black professionals from northern neighborhoods after Civil Rights and desegregation resulted in social dislocation and the concentration of poverty in inner-cities. A similar dynamic process may well have occurred in certain southern counties at the beginning of the twentieth century, paradoxically because they were better positioned to support collective migration. Slavery did have long-term effects on individual and institutional outcomes, but this worked through channels that have previously been unexplored and which we will examine in future research.

6 Appendix

6.1 Derivation of the Joint-Test Statistic

Following standard practice, the composite null, which we test by estimating equation (1) at each assumed threshold, is set up to be inconsistent with the theory:

$$H_0 : \beta_1 \geq |\epsilon h| \;\; and \;\; \beta_2 = 0,$$

where h is a scale parameter set to be the standard deviation of the outcome under consideration multiplied by a constant and ϵh is the value below which β_1 is treated as "zero."

Given the outcomes that we consider in this paper, the following data generating processes are feasible when the null is rejected:

$$H_1 : (i)\beta_1 = 0 \;\; and \;\; \beta_2 > 0$$

$$(ii)\beta_1 = 0 \;\; and \;\; \beta_2 = 0$$

$$(iii)\beta_1 \geq |\epsilon h| \;\; and \;\; \beta_2 > 0.$$

The first data generating process is consistent with our model. With the second data generating process, there is no relationship between the outcome under consideration and population connectedness. With the third data generating process, the outcome is increasing monotonically in population connectedness (with a slope change at a threshold).

If we replaced the *and* statement under the null with an *or* statement, the parameter space would expand and only our model would be feasible if the null were rejected. However, this would introduce a new problem because any statistic constructed to test the composite hypothesis would have different values under the null, depending on which component was relevant. We consequently retain the *and* statement, but we will see that our joint-test statistic nevertheless has the power to distinguish between the alternative data generating processes when the null is rejected.

The joint-test statistic is constructed as follows:

$$T(\beta) = \phi\left(\frac{\beta_1}{h}\right)\beta_2,$$

where ϕ is a symmetric and continuous function that reaches its maximum value at zero and the h parameter once again ensures that deviations in $\hat{\beta}_1$ away from zero are penalized consistently across outcomes. By the delta method,

$$\sqrt{n}\left(T(\hat{\beta}) - T(\beta)\right) \xrightarrow{d} N\left(0, DT(\beta)VDT(\beta)'\right)$$

where $V = \begin{bmatrix} V_{\beta_1} & V_{\beta_1\beta_2} \\ V_{\beta_1\beta_2} & V_{\beta_2} \end{bmatrix}$ and $DT(\beta) = \left[\frac{1}{h}\phi'\left(\frac{\beta_1}{h}\right)\beta_2 \quad \phi\left(\frac{\beta_1}{h}\right)\right]$.

$T(\beta) = 0$, under the null H_0 because $\beta_2 = 0$. Substituting the expressions for V and $DT(\beta)$, under the null

$$\sqrt{n}T(\hat{\beta}) \xrightarrow{d} N\left(0, \left[\phi\left(\frac{\beta_1}{h}\right)\right]^2 V_{\beta_2}\right).$$

Dividing by the standard deviation and then squaring,

$$\frac{n\left[T(\hat{\beta})\right]^2}{\left[\phi\left(\frac{\beta_1}{h}\right)\right]^2 V_{\beta_2}} \xrightarrow{d} \chi_1^2.$$

Under the null, β_1 has a range of values. We select the "least favorable" null, $\beta_1 = |\epsilon h|$, which minimizes the value of the preceding statistic. If we do reject the null, this implies that we would reject the null for any $\beta_1 \geq |\epsilon h|$. Following standard practice when implementing the Wald test, we replace V_{β_2} with $\hat{V}_{\beta_2}$. Substituting the expression for $T(\hat{\beta})$, we arrive at the statistic that is used for the joint test of the theory,

$$n\frac{\left[\phi\left(\frac{\hat{\beta}_1}{h}\right)\right]^2}{[\phi(\epsilon)]^2}\frac{\hat{\beta}_2^2}{\hat{V}_{\beta_2}} \xrightarrow{d} \chi_1^2.$$

We will reject the null hypothesis if this test statistic exceeds the critical value for the chi-squared distribution with one degree of freedom. This statistic will be zero when the data generating process is consistent with model (ii), and we will not reject the null hypothesis, since $\beta_2 = 0$. We will not reject the null under model (iii) either, if β_1 is sufficiently large and the ϕ function places sufficient penalty on deviations from zero. In the empirical analysis, we will consistently reject the null hypothesis for outcomes associated with black networks, where the data generating process based on the t-ratio test is consistent with model (i). In contrast, we will not reject the null for other outcomes where the t-ratio test indicates that the data generating process is consistent with model (ii) or model (iii). The joint-test statistic thus distinguishes our model from other data generating processes when the null is rejected.

6.2 Derivation of the Normalized HHI

Suppose that there are n trials, that each outcome j from the set of k possible outcomes has an independent probability of occurring p_j, and that the random variable X_j is the number of occurrences of outcome j. Then the multivariate random variable $\mathbf{X} = (X_1, \cdots, X_k)$ has a multinomial distribution with parameters $(n, k, p_1, \cdots, p_k)$. Applied to our context, (i) n is the total number of migrants, N (ii) k is the total number of destinations, M, and (iii) $p_1, \cdots, p_k$ are the probabilities that a migrant moving independently would settle at each of those destinations. We assume that there is an equal probability of settling at any destination; $p_j = \frac{1}{M}, \forall j$.

The expected HHI when migrants move independently can be expressed as,

$$E(HHI) = E\left(\frac{1}{N^2}\sum_{i=1}^{M} X_i^2\right) = E\left(\frac{1}{N^2}\mathbf{X}^T\mathbf{X}\right).$$

Based on the general properties of the multinomial distribution,

$$E(HHI) = \frac{1}{N^2}\left([E(\mathbf{X})]^T E(\mathbf{X}) + tr[cov(\mathbf{X})]\right).$$

It follows that,

$$E(HHI) = \frac{1}{N^2}\left(M\left(\frac{N}{M}\right)^2 + M\left[N\frac{1}{M}\left(1 - \frac{1}{M}\right)\right]\right) = \frac{1}{M} + \frac{1}{N}\frac{M-1}{M}.$$

For large M, the fraction $\frac{M-1}{M}$ is close to one, and

$$E(HHI) \approx \frac{1}{M} + \frac{1}{N}. \tag{3}$$

For large N, $E(HHI) \approx \frac{1}{M}$. This is what we assumed implicitly when deriving the HHI in the theoretical section. For small N, $E(HHI)$ is decreasing in N. We account for this by constructing a normalized HHI statistic, which is simply the unadjusted HHI, based on the observed distribution of migrants across destinations, divided by $E(HHI)$. If migrants move independently, then the normalized HHI will be close to one, providing us with a useful benchmark for this statistic.

References

[1] Acemoglu, Daron and James A. Robinson. 2008. Persistence of Power, Elites, and Institutions, *American Economic Review* 98(1):267-293.

[2] Alston, Lee J. and Joseph P. Ferrie. 1999. *Southern Paternalism and the American Welfare State: Economics, Politics, and Institutions in the South, 1865-1965*, Cambridge, MA: Cambridge University Press.

[3] Ballard, Roger. 2003. The South Asian Presence in Britain and its Transnational Connections, in *Culture and Economy in the Indian Diaspora*, eds. B. Parekh, H. Singh, and S. Vertovec, London: Routledge.

[4] Bernheim, Douglas B., Bezalel Peleg, and Michael D. Whinston. 1987. Coalition-Proof Nash Equilibria. I. Concepts, *Journal of Economic Theory* 42: 1-12.

[5] Black, Dan A., Seth G. Sanders, Evan J. Taylor, and Lowell J. Taylor. 2015. The Impact of the Great Migration on Mortality of African Americans: Evidence from the Deep South, *American Economic Review* 105(2): 477-503.

[6] Blassingame, John W. 1972. *The Slave Community: Plantation Life in the Antebellum South.* New York and Oxford: Oxford University Press.

[7] Boles, John B. 1988. Introduction, in *Masters and Slaves in the House of the Lord: Race and Religion in the American South, 1740-1870*, ed. John B. Boles, Lexington: The University Press of Kentucky.

[8] Boustan, Leah Platt. 2010. Was Postwar Suburbanization “White Flight”? Evidence from the Black Migration, *Quarterly Journal of Economics* 125(1): 417-443.

[9] Brannen, C.O. 1924. Relation of Land Tenure to Plantation Organization, U.S. Department of Agriculture, Bulletin No. 1269.

[10] Carrington, William J., Enrica Detragiache, and Tara Vishwanath. 1996. Migration with Endogenous Moving Costs, *American Economic Review* 86(4): 909-930.

[11] Collins, William J. 1997. When the Tide Turned: Immigration and the Delay of the Great Black Migration, *Journal of Economic History* 57(3): 607-632.

[12] Cutler, David M., Edward L. Glaeser, and Jacob L. Vigdor. 1999. The Rise and Decline of the American Ghetto, *Journal of Political Economy* 107(3): 455-506.

[13] Du Bois, W.E.B. 1908. *The Negro American Family.* New York: Negro Universities Press.

[14] Dvorak, Katherine L. 1988. After Apocalypse, Moses, in *Masters and Slaves in the House of the Lord: Race and Religion in the American South, 1740-1870*, ed. John B. Boles, Lexington: The University Press of Kentucky.

[15] Engerman, Stanley L. and Kenneth L. Sokoloff. 1997. Factor Endowments, Institutions, and Differential Growth Paths Among New World Economies, in *How Latin America Fell Behind*, ed. Stephen Haber, Stanford, CA: Stanford University Press.

[16] Fogel, Robert W. 1989. *Without Consent or Contract: The Rise and Fall of American Slavery.* New York : W.W. Norton and Company.

[17] Fogel, Robert W. and Stanley L. Engerman. 1974. *Time on the Cross: The Economics of American Negro Slavery.* Boston: Little, Brown.

[18] Foner, Eric. 1988. *Reconstruction, America's Unfinished Revolution, 1863-1877.* New York: Harper and Row.

[19] Foner, Eric. 1993. *Freedom's lawmakers: a directory of Black officeholders during Reconstruction.* New York: Oxford University Press, 1993.

[20] Frazier, Franklin E. 1939. *The Negro Family in the United States.* Chicago: University of Chicago Press.

[21] Frazier, Franklin E. 1964. *The Negro Church in America.* Liverpool: Liverpool University Press.

[22] Genicot, Garance and Debraj Ray. 2003. Group Formation in Risk-Sharing Arrangements, *Review of Economic Studies* 70(1): 87-113.

[23] Genovese, Eugene D. 1974. *Roll, Jordan, Roll: The World the Slaves Made.* New York: Pantheon Books.

[24] Goldin, Claudia D. and Frank D. Lewis. 1975. The Economic Cost of the American Civil War: Estimates and Implications, *Journal of Economic History* 35(2): 299-326

[25] Gottlieb, Peter. 1987. *Making Their Own Way: Southern Blacks' Migration to Pittsburgh, 1916-30.* Urbana and Chicago: University of Illinois Press.

[26] Grossman, James R. 1989. *Land of Hope: Chicago, Black Southerners, and the Great Migration.* Chicago: University of Chicago Press.

[27] Gutman, Herbert G. 1976. *The Black Family in Slavery and Freedom, 1750-1925.* New York: Vintage Books.

[28] Hansen, Bruce E. 1999. Threshold Effects in Non-Dynamic Panels: Estimation, Testing and Inference, *Journal of Econometrics* 93: 345-368.

[29] Henri, Florette. 1975. *Black Migration: Movement North 1900-1920.* Garden City, New York : Anchor Press/Doubleday.

[30] Irwin, James R. 1994. Explaining the Decline in Southern per Capita Output after Emancipation, *Explorations in Economic History* 31: 336-356.

[31] Kolchin, Peter. 1993. *American Slavery, 1619-1877.* New York: Hill and Wang.

[32] Kousser, J. Morgan. 1974. *The Shaping of Southern Politics: Suffrage Restrictions and the Establishment of the One-Party South, 1880-1910*, New Haven and London: Yale University Press.

[33] Lee, Everett S., Ann Ratner Miller, Carol P. Brainerd, and Richard Easterlin. 1957. *Population Redistribution and Economic Growth, United States 1870-1950, Vol. 1: Methodological Considerations and Reference Tables*, Philadelphia: American Philosophical Society.

[34] Lieberson, Stanley. 1978. Selective Migration from the South: A Historical View, in *The Demography of Racial and Ethnic Groups*, eds. Frank D. Bean and W. Parker Frisbie, Academic Press.

[35] Mandle, Jay R. 1978. *The Roots of Black Poverty: The Southern Plantation Economy After the Civil War.* Durham, North Carolina: Duke University Press.

[36] Margo, Robert. 1990. *Race and Schooling in the South, 1880-1950.* Chicago: University of Chicago Press.

[37] Marks, Carole. 1983. Lines of Communication, Recruitment Mechanisms, and the Great Migration of 1916-1918, *Social Problems* 31(1): 73-83.

[38] Marks, Carol. 1989. *Farewell – We're Good and Gone: The Great Black Migration.* Bloomington and Indianapolis: Indiana University Press.

[39] Marks, Carol. 1991. The Social and Economic Life of Southern Blacks During the Migration, in *Black Exodus: The Great Migration from the American South*, ed. Alferdteen Harrison, Jackson and London: University Press of Mississippi.

[40] Moen, Jon R. 1992. Changes in the Productivity of Southern Agriculture between 1860 and 1880, in *Without Consent or Contract: The Rise and Fall of American Slavery; Markets and Production Technical Papers, Volume 1*, eds. Robert William Fogel and Stanley L. Engerman, New York : W.W. Norton and Company.

[41] Morrison, Minion K.C. 1987. *Black Political Mobilization: Leadership, Power, and Mass Behavior.* Albany: State University of New York Press.

[42] Munshi, Kaivan. 2003. Networks in the Modern Economy: Mexican Migrants in the U.S. Labor Market, *Quarterly Journal of Economics* 118(2): 549-597.

[43] Naidu, Suresh. 2010. Recruitment Restrictions and Labor Markets: Evidence from the Postbellum U.S. South, *Journal of Labor Economics* 28(2): 413-445.

[44] Newey, Whitney K., James L. Powell and Francis Vella. 1999. Nonparametric Estimation of Triangular Simultaneous Equations Models, *Econometrica* 67(3): 565-603.

[45] Putnam, Robert D. 2000. *Bowling Alone: The Collapse and Revival of American Community.* New York: Simon and Schuster.

[46] Robinson, Peter. 1988. "Root-N-Consistent Semiparametric Regression," *Econometrica* 56: 931-954.

[47] Ruggles, Steven, J. Trent Alexander, Katie Genadek, Ronald Goeken, Matthew B. Schroeder, and Matthew Sobek. 2010. Integrated Public Use Microdata Series (IPUMS): Version 5.0. Minneapolis: University of Minnesota.

[48] Stampp, Kenneth M. 1956. *The Peculiar Institution: Slavery in the Ante-Bellum South.* New York: Alfred A. Knopf.

[49] Stampp, Kenneth M. 1966. *The Era of Reconstruction, 1865-1877.* New York: Alfred A. Knopf.

[50] Steckel, Richard H. 2000. The African American Population of the United States, 1790-1920, in *A Population History of North America*, eds. Michael Haines and Richard H. Steckel, New York: Cambridge University Press.

[51] Tadman, Michael. 1989. *Speculators and Slaves: Masters, Traders, and Slaves in the Old South.* Madison: University of Wisconsin Press.

[52] Tolnay, Stewart E. and E.M. Beck. 1990. Lethal Violence and the Great Migration, 1900-1930, *Social Science History* 14(3): 347-370.

[53] Tolnay, Stuart E. 1998. Educational Selection in the Migration of Southern Blacks, 1880-1990, *Social Forces* 77(3): 487-514.

[54] Valelly, Richard M. 2004. *The Two Reconstructions.* Chicago and London: University of Chicago Press.

[55] Visram, Rozina. 1986. *Ayahs, Lascars and Princes: Indians in Britain 1700-1947* London: Pluto Press.

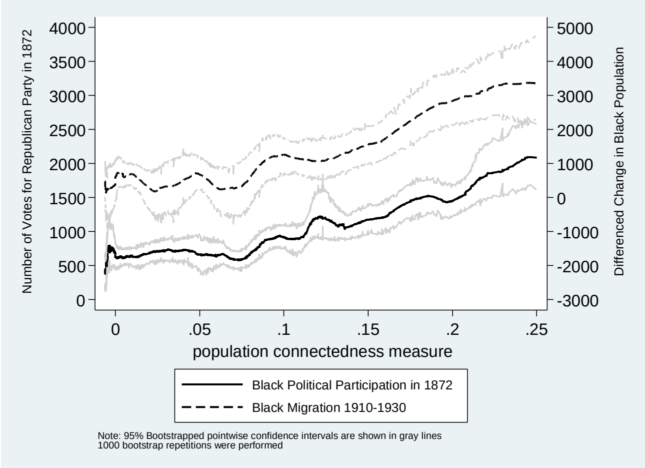
[56] Wilson, William Julius. 1987. *The Truly Disadvantaged: The Inner City, the Underclass, and Public Policy.* Chicago: University of Chicago Press.

[57] Woodson, Carter G. 1921. *The History of the Negro Church.* Washington, D.C.: The Associated Publishers.

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

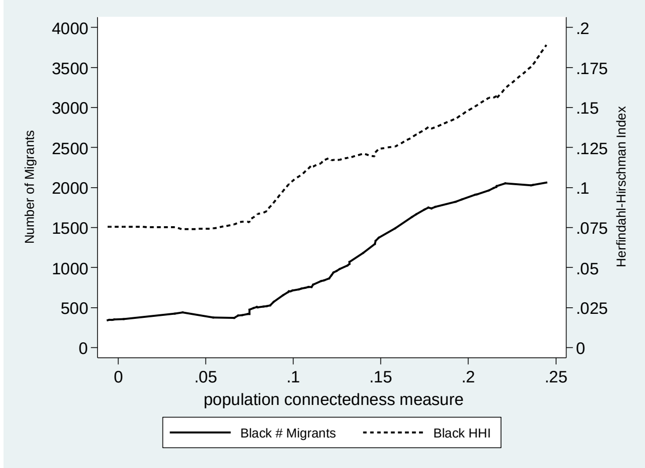
Figure 1: Response to Political and Economic Opportunities

A. Black Political Participation in 1872 and Black Migration 1910-1930



Notes: Bandwidths for "Black Political Participation in 1872" and "Black Migration 1910-1930" are 0.075 and 0.15.

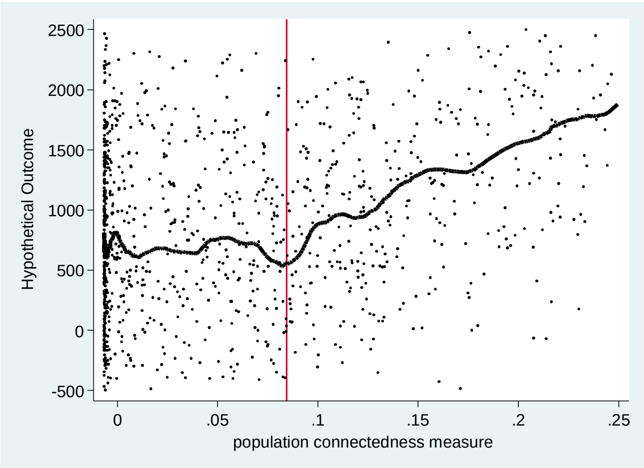
B. Black Migration from Mississippi and Destination Concentration



Notes: Bandwidths for "Black # Migrants" and "Black HHI" are 0.35

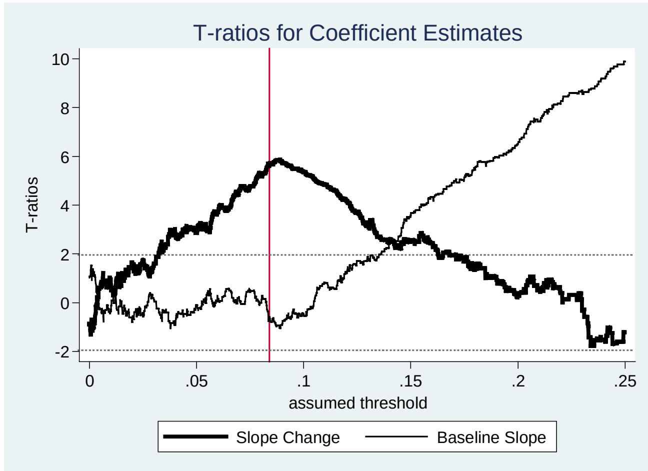
Figure 2: Simulation of Hypothetical Outcome based on Theoretical Model

A. Relationship between hypothetical outcome and population connectedness measure



Notes: Bandwidth is 0.075.

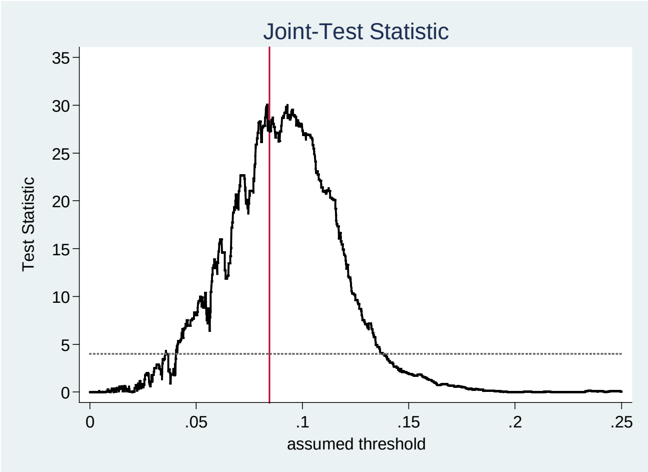
B. T-ratios for baseline slope and slope change



Notes: True threshold location is 0.0844 (vertical line). At true location, absolute values of t-ratios of baseline slope, mean shift at threshold, and slope change are 0.71, 1.05 and 5.68, respectively.

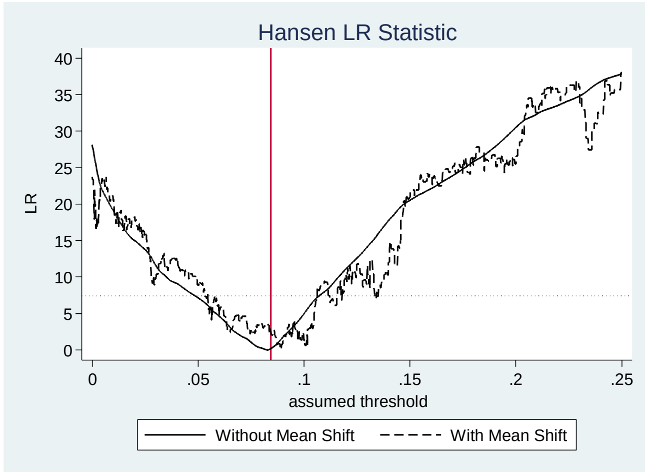
Figure 2: Simulation of Hypothetical Outcome based on Theoretical Model (continued)

C. Joint-Test statistic for theoretical model



Notes: Maximum of joint test statistic at threshold location of 0.0829 to 0.0834. The 5% critical value of the maximum of the test statistic (based on simulations using the wild bootstrap) is 3.98. The 5% critical value for a single chi-square test with one degree of freedom is 3.84.

D. Hansen Test statistic for change in slopes



Notes: Minimum of Hansen test statistic (without mean shift at threshold) at 0.0829. At threshold of 0.0829, absolute values of t-ratios of baseline slope, mean shift at threshold, and slope change are 0.12, 0.03 and 5.46, respectively. The 5% critical value of the likelihood ratio statistic is 7.35.

Figure 3: Weighted fraction of land allocated to plantation crops in 1890 (former slave states)

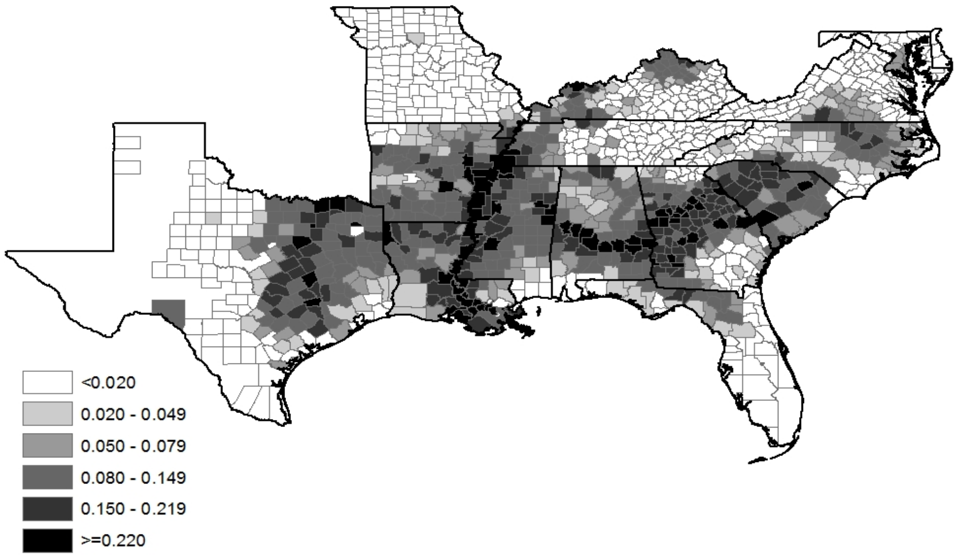
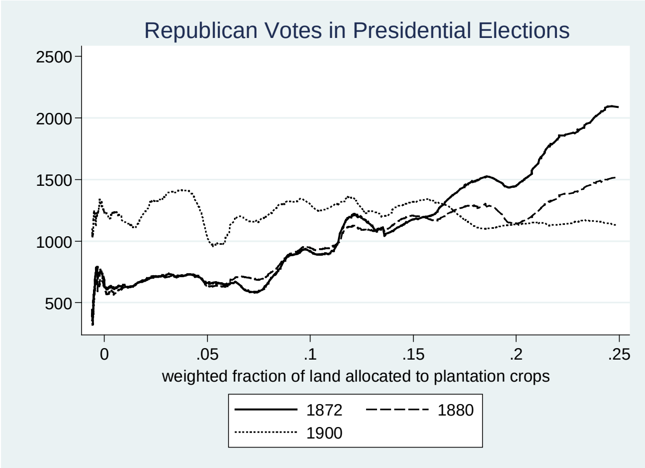


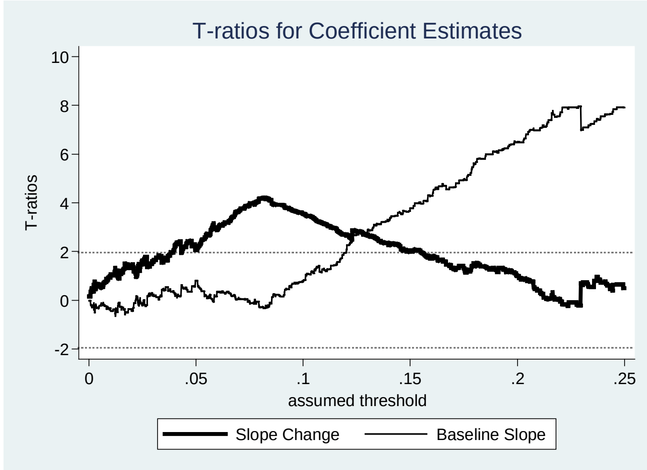
Figure 4: Political Participation in relation to plantation share

A. Republican Votes in Presidential Elections

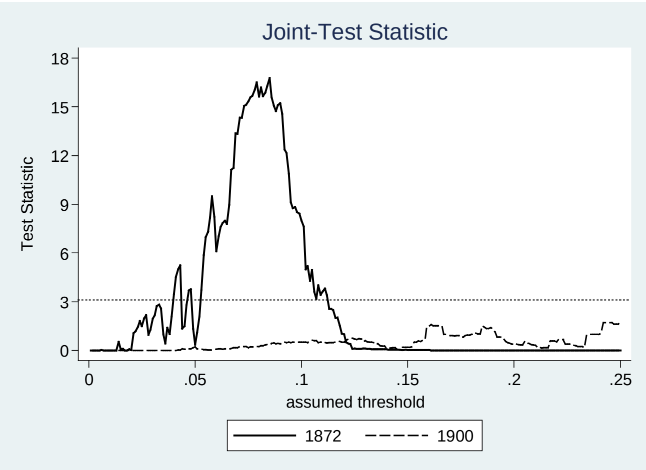


Notes: Bandwidth is 0.075 for all three series.

B. T-ratios for Republican Votes in 1872



C. Joint-Test Statistic for Republican Votes in 1872 and 1900



Notes: The 5% critical values of the maximum of the test statistics (based on simulations using the wild bootstrap) are, respectively, 3.11 and 7.75 for 1872 and 1900 Republican votes. The scale parameter for the joint test was set to the standard deviation of 1872 Republican votes and 1.25 times the standard deviation of 1900 Republican votes.

D. Instrumental Variable Estimates for Republican Votes in 1872

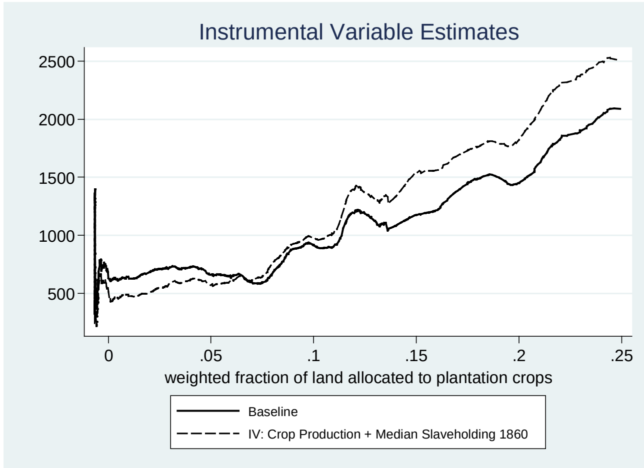
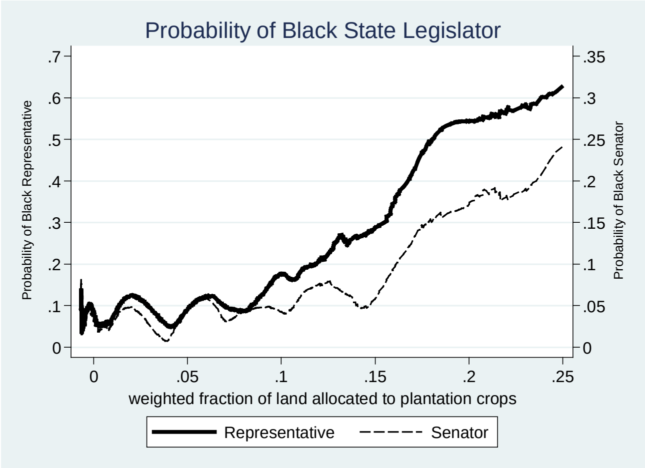


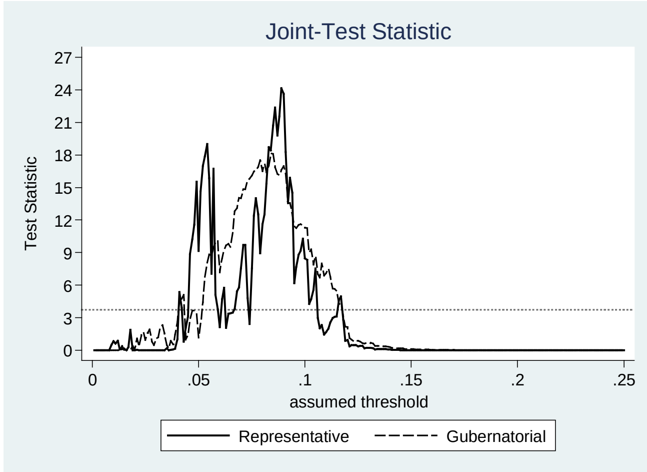
Figure 5: Elected Black Leaders in relation to plantation share

A. Black State Representative and Senator



Notes: Bandwidth is 0.1 for "Representative" and 0.125 for "Senator".

B. Joint-Test for Republican Votes in Gubernatorial Elections and Probability of Black State Representative



Notes: The 5% critical values of the maximum of the test statistics (based on simulations using the wild bootstrap) are 3.73 and 3.01 for "Representative" and "Gubernatorial" elections. The scale parameter for the joint test was set to 1.2 times the standard deviation of "Representative" and the standard deviation of "Gubernatorial".

C. Probability of Black State Representative, Conditional on Black population level or share

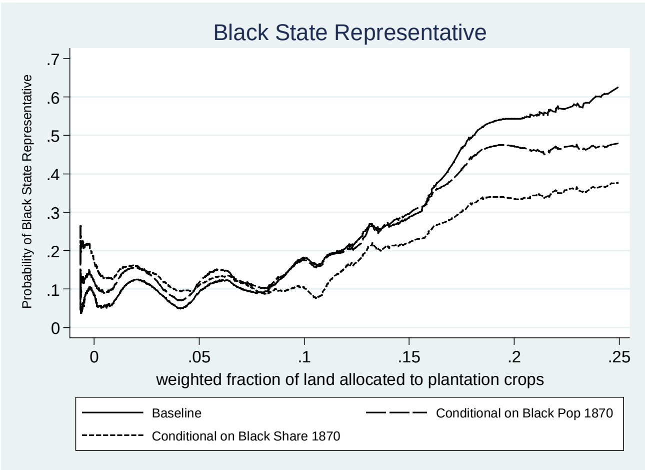
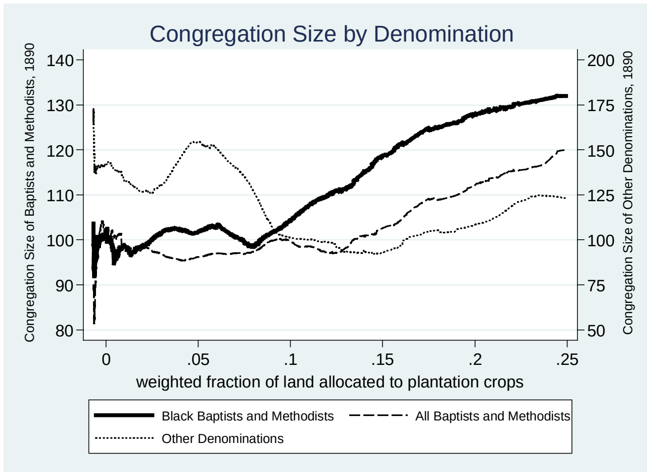


Figure 6: Church Congregation Size in 1890 in relation to plantation share

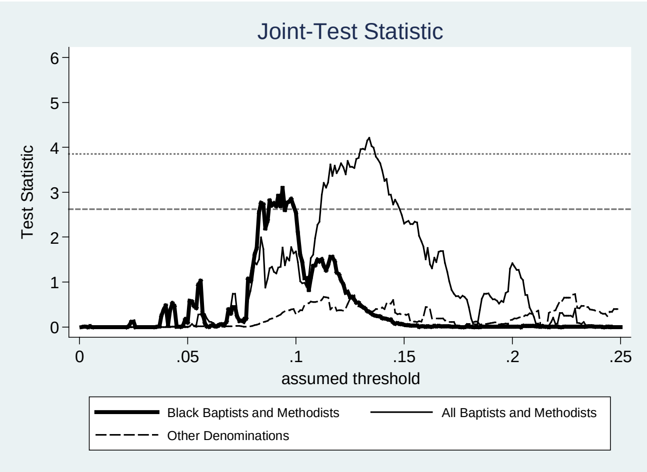
A. Congregation Size by Denomination



Notes: Bandwidth is 0.20 for "Black Baptists and Methodists", 0.15 for "All Baptists and Methodists" and 0.25 for "Other Denominations"

Figure 6: Church Congregation Size in 1890 in relation to plantation share (continued)

B. Joint-Test for Congregation Size by Denomination



Notes: The 5% critical values of the maximum of the test statistics (based on simulations using the wild bootstrap) are 3.86, 2.62 and 4.74 for "All Baptists and Methodists", "Black Baptists and Methodists", and "Other Denominations". The p-values for the maximum value of the statistic are 0.008 and 0.012 for "All Baptists and Methodists" and "Black Baptists and Methodists". The scale parameter for the joint test was set to 1.2 times the standard deviation of "All Baptists and Methodists", the standard deviation of "Black Baptists and Methodists", and 1.25 times the standard deviation of "Other Denominations".

C. Instrumental Variable Estimates for Black Baptist and Methodist Church Size

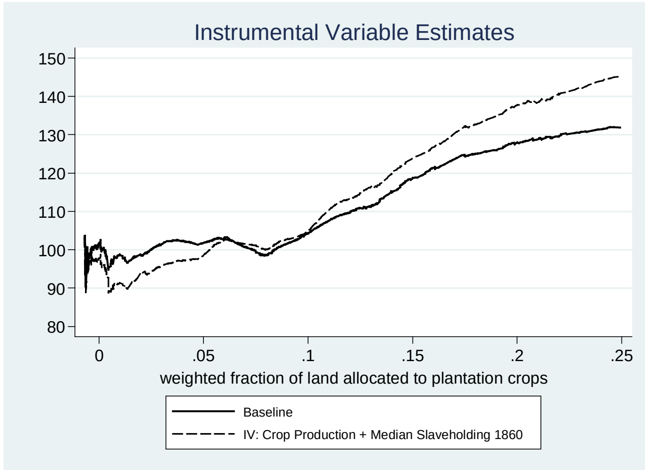
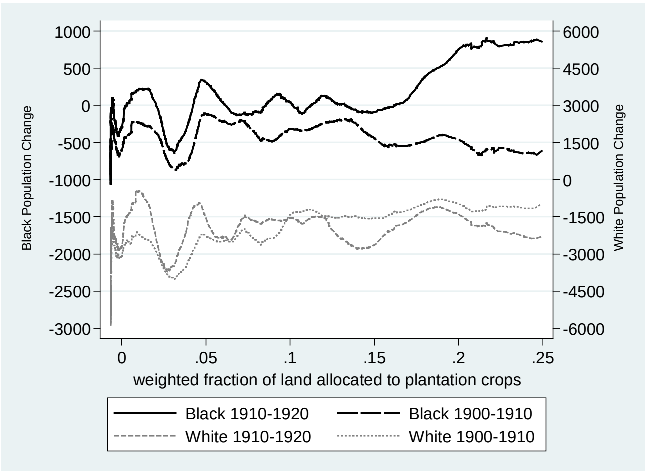


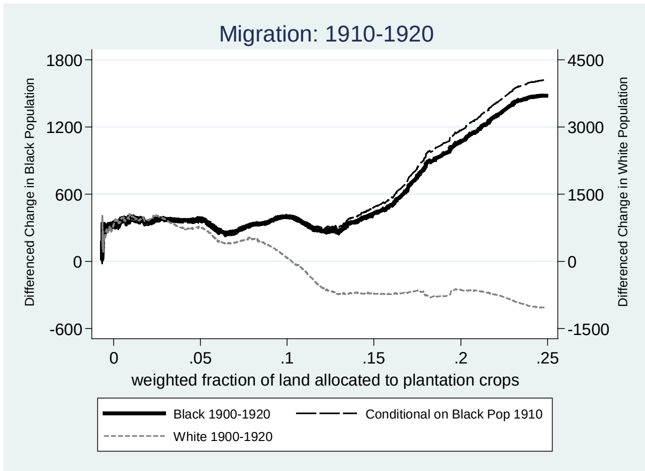
Figure 7: Black Migration in relation to plantation share

A. Black and White Population Change



Notes: Bandwidth is 0.1 for all four series.

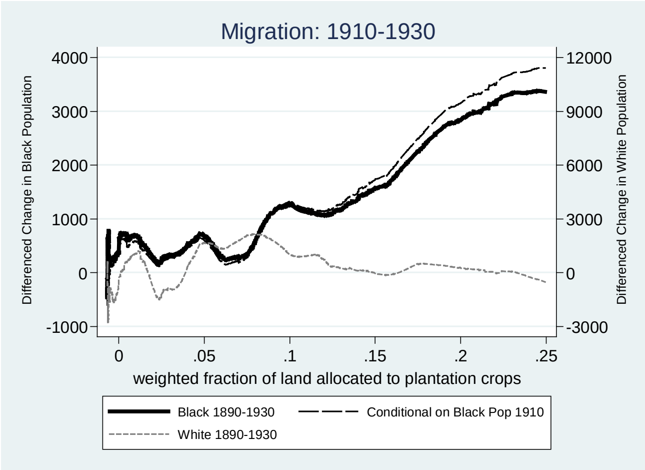
B. Short Double-Difference in Black and White Population



Notes: Bandwidth is 0.2 for all three series.

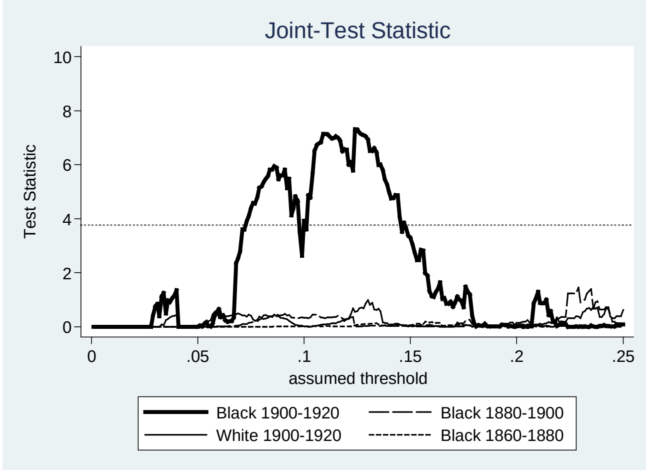
Figure 7: Black Migration in relation to plantation share (continued)

C. Long Double-Difference in Black and White Population



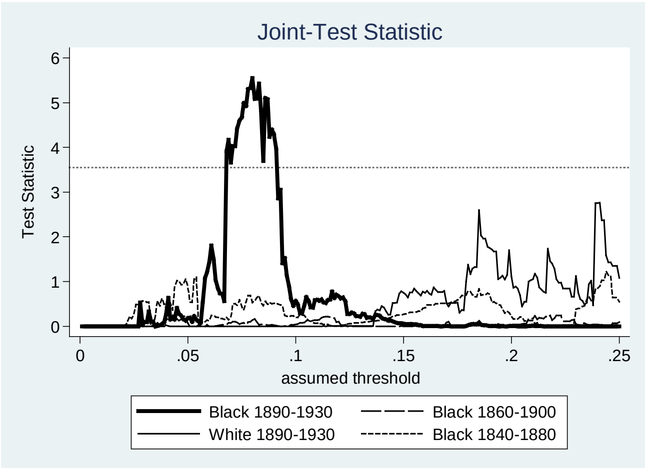
Notes: Bandwidth is 0.15 for all three series.

D. Joint-Test for Short Double-Difference in Black and White Population



Notes: The 5% critical values of the maximum of the test statistics (based on simulations using the wild bootstrap) are, respectively, 3.76, 5.23, 4.12 and 4.09 for “Black 1900-1920”, “Black 1880-1900”, “Black 1860-1880”and “White 1900-1920”. The p-value for the maximum value of the statistic is 0.002 for the “Black 1900-1920” migration measure. The scale parameter for the joint test was set to the standard deviation of “Black 1900-1920” and 1.25 times the standard deviation for the other three outcomes.

E. Joint-Test for Long Double-Difference in Black and White Population



Notes: The 5% critical values of the maximum of the test statistics (based on simulations using the wild bootstrap) are, respectively, 3.55, 3.71, 6.97, and 5.23 for “Black 1890-1930”, “Black 1860-1900”, “Black 1840-1880”and “White 1890-1930”. The p-value for the maximum value of the statistic is 0.006 for the “Black 1890-1930” migration measure. The scale parameter for the joint test was set to the standard deviation of “Black 1890-1930”, 0.75 times the standard deviation of “White 1890-1930”, and 1.25 times the standard deviation of “Black 1860-1900” and “Black 1840-1880”

F. Instrumental Variables for Short Double-Difference in Black Population

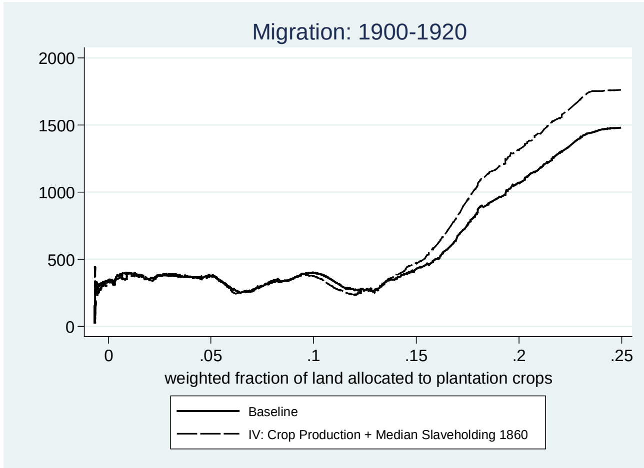
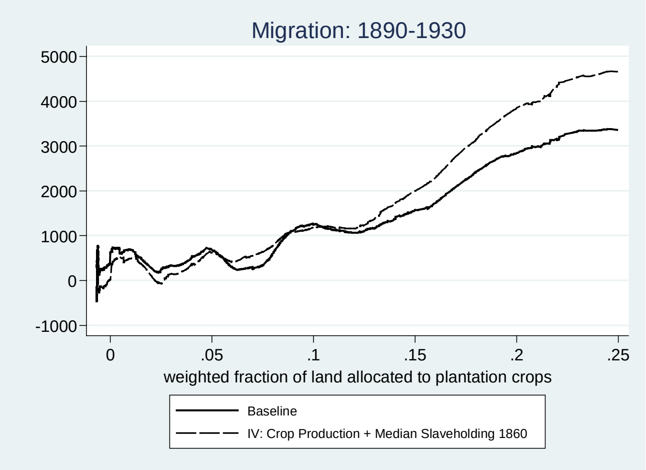
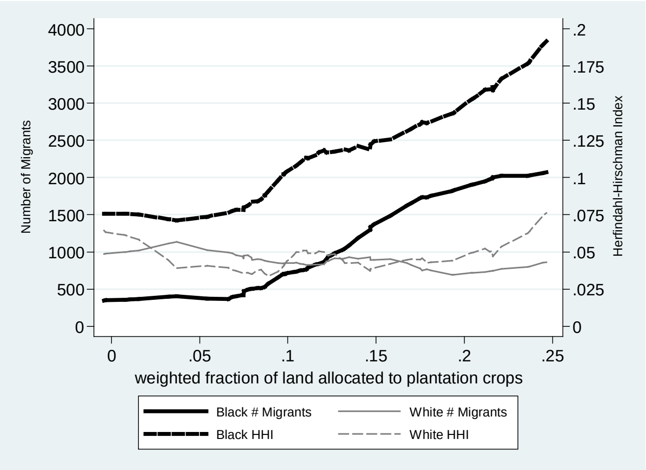


Figure 7: Black Migration in relation to plantation share (continued)

G. Instrumental Variables for Long Double-Difference in Black Population



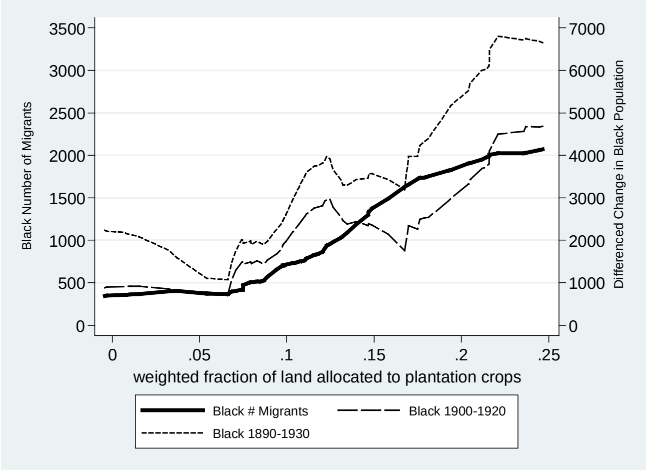
B. Black and White Migrant Levels and Destination Concentrations



Notes: Bandwidth is 0.35 for all four series.

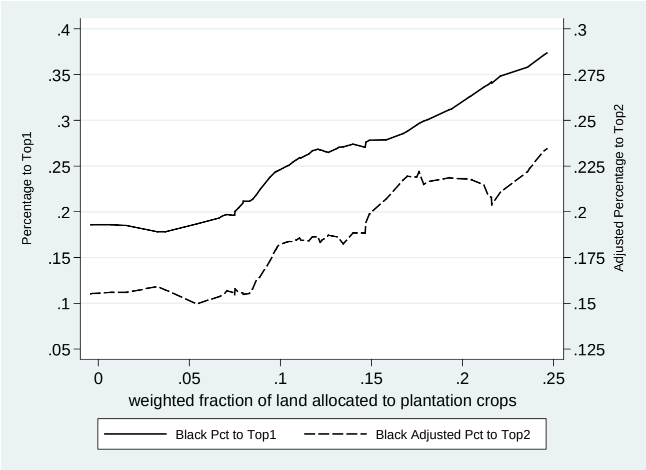
Figure 8: Black Migration from Mississippi in relation to plantation share

A. Alternative Measures of Black Migration



Notes: Bandwidth is 0.35 for all three series.

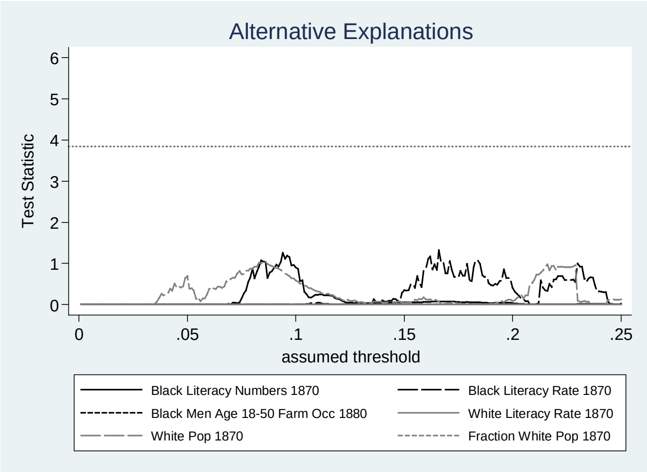
C. Percentage of Black Migrants to Top 1 and Top 2 MSA



Notes: Bandwidth is 0.35 for both series.

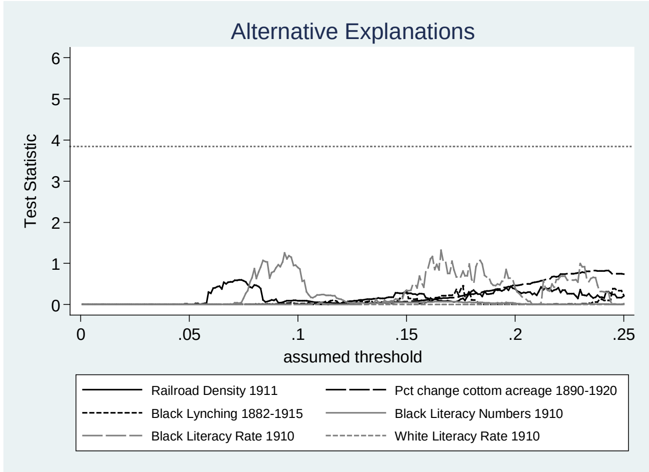
Figure 9: Alternative Explanations

A. Joint-Test Statistics, Competing Explanations for Voting Patterns in 1870's



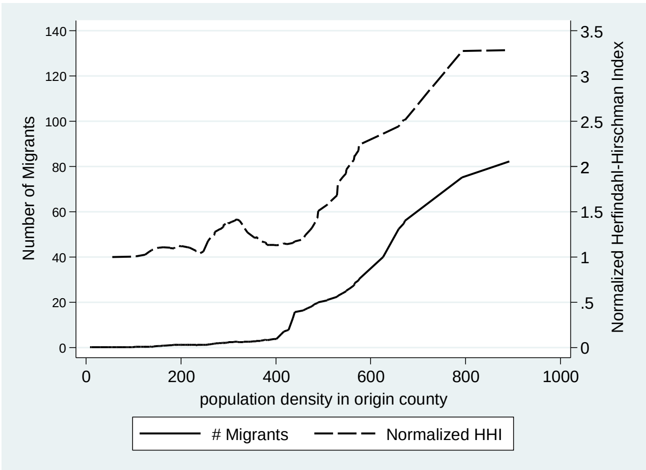
Notes: The 5% critical values of the maximum of the test statistics are 3.57 for "Black Literacy Numbers 1870", 5.17 for "Black Literacy Rate 1870", 3.19 for "Black Men Age 18-50 Farm Occ 1880", 3.39 for "White Literacy Rate 1870", 7.84 for "White Pop 1870", and 3.92 for "Fraction White Pop 1870". The scale parameter for the joint test was set to 1.25 times the standard deviation of the outcomes.

B. Joint-Test Statistics, Competing Explanations for Black Migration



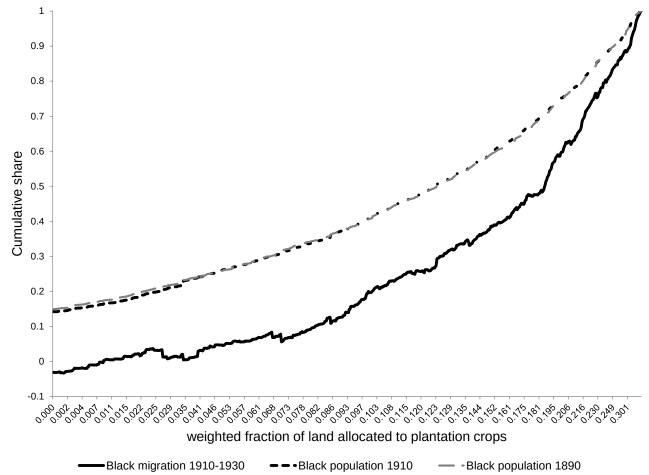
Notes: The 5% critical values of the maximum of the test statistics are 4.09 for "Railroad Density 1911", 4.19 for "Pct change cotton acreage 1890-1920", 6.65 for "Black Lynching 1882-1915", 3.00 for "Black Literacy Number 1910", 5.57 for "Black Literacy Rate 1910", and 2.75 for "White Literacy Rate 1910". The scale parameter for the joint test was set to 1.25 times the standard deviation of the outcomes.

Figure 10: South Asian Migration to the U.K. in relation to population density



Notes: Bandwidth is 0.3 for both series.

Figure 11: Cumulative share of Black Migration (1910-1930) and Black Population



Notes: One-third of the 1910 black population was in counties with an 1890 plantation share less than or equal to 0.078; these counties account for 8.5 percent of the black migrants. One-third of the black population was in counties with a plantation share greater than 0.175; these counties account for 53 percent of the black migrants.

One-quarter of the black population was in counties with a plantation share less than 0.044; these counties account for 4.4 percent of the black migrants. One-quarter of the black population was in counties with a plantation share greater than 0.200; these counties account for 41 percent of the black migrants

Table 1: Regression results for network-based outcomes, threshold locations from joint test statistic
[absolute value of t-ratios]

	Republican votes for President in 1872	Republican votes for Governor in 1871-1873	Black State Represent	Baptist & Methodist church size in 1890	Black Bapt. & Methodist church size in 1890	Diff-in-diffs in Black population, 1900-1920	Diff-in-diffs in Black population, 1890-1930
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Slope change	7695.3***	7655.8***	3.040***	159.43**	193.75*	11134.4***	15571.7**
	[4.10]	[4.25]	[5.53]	[2.37]	[1.76]	[2.73]	[2.34]
Baseline slope	-141.6	-60.9	0.227	31.35	9.61	365.9	-54.5
	[0.10]	[0.05]	[0.61]	[0.70]	[0.10]	[0.25]	[0.01]
Threshold mean shift	117.8	32.4	0.034	0.580	6.80	-197.8	337.4
	[1.06]	[0.33]	[0.80]	[0.13]	[1.06]	[0.72]	[0.72]
Avg. state fixed effect	667.61	637.04	0.076	94.57	99.02	298.43	382.85
Threshold location	0.0844	0.0843	0.0890	0.1339	0.0942	0.1231	0.0797
Bootstrapped p-value of max. of joint test statistic	<0.001	<0.001	<0.001	0.008	0.012	0.002	0.006
R-squared	0.2095	0.1854	0.3384	0.1414	0.2215	0.1299	0.1434
Sample size	1040	1005	1135	1104	939	1126	1125

Notes: Threshold locations based on the maximum of the joint test statistic. Models include state fixed effects, and estimated standard errors are corrected for heteroskedasticity.
***, **, and * indicate statistical significance at the 1, 5, and 10 percent level, respectively.

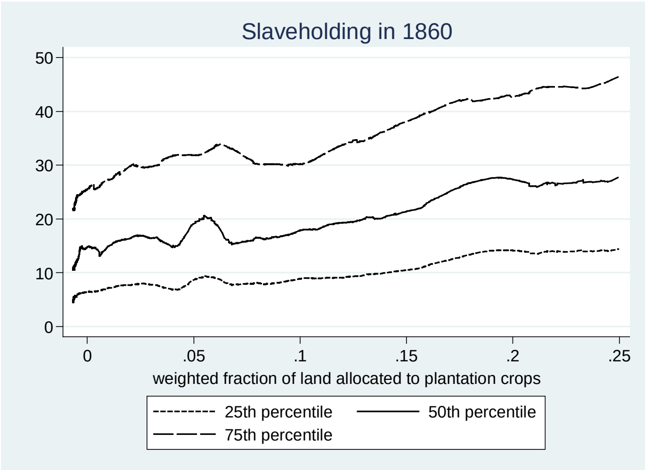
Table 2: Instrumental variables results, threshold locations from Table 1
[absolute value of t-ratios]

	Republican votes for President 1872	Republican votes for Governor 1871-1873	Black State Representative	Black Baptist & Methodist church size in 1890	Diff-in-diffs in Black population 1900-1920	Diff-in-diffs in Black population 1890-1930
	(1)	(2)	(3)	(4)	(5)	(6)
Slope change	8810.76***	8588.82***	3.77***	218.42*	15187.46***	21590.40***
	[4.12]	[4.66]	[5.89]	[1.74]	[2.57]	[3.48]
Baseline slope	1656.75	1859.61	1.32***	71.91	-640.48	3470.11
	[0.87]	[1.04]	[2.60]	[0.63]	[0.28]	[0.70]
Threshold mean shift	161.49	100.64	0.04	6.27	-120.76	-52.48
	[1.36]	[1.01]	[0.90]	[0.90]	[0.38]	[0.12]
1st-stage residuals						
Linear term	-6851.66***	-7532.43***	-2.67***	-234.17*	151.55	-1465.30
	[3.79]	[4.20]	[4.80]	[1.69]	[0.04]	[0.26]
Square term	-110793.77**	-110632.00**	-17.54**	-2596.31	-18052.97	23684.00
	[2.32]	[2.13]	[1.97]	[1.37]	[0.40]	[0.32]
Cubic term	171667.19	236652.17	36.60	23443.49	39949.73	-545856.49
	[.82]	[1.06]	[0.79]	[0.72]	[0.12]	[0.99]
Quartic term	5836325.70*	5927889.84*	211.83	179403.58	-2024551.02	-7198175.96
	[1.82]	[1.68]	[0.43]	[0.94]	[0.81]	[1.22]
Quintic term				-1080474.29		
				[0.68]		
F-stat for control function	4.934	5.421	11.807	1.745	1.867	3.486
p-value	0.0006	0.0002	2.31e-09	0.122	0.114	0.007
R-squared	0.250	0.249	0.397	0.239	0.151	0.210
Sample size	955	923	969	837	964	963

Notes: See notes to Table 1 and text for more details on the estimation and instruments. All regressions include state fixed effects. The standard errors and F-statistic for the significance of the control function (and its p-value) calculated based on the bootstrap with 1,000 repetitions.
***, **, and * indicate statistical significance at the 1, 5, and 10 percent level, respectively.

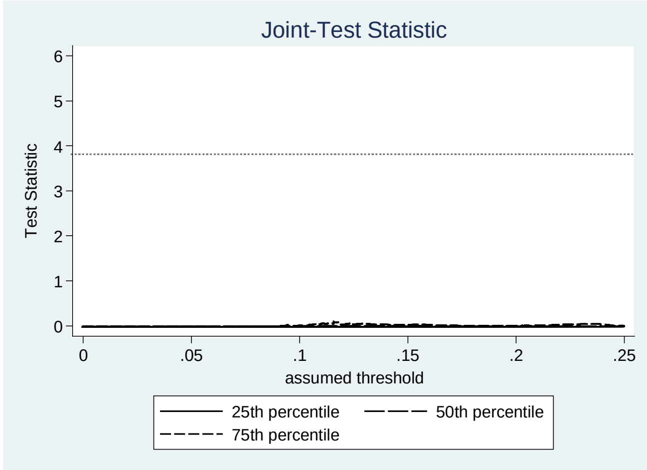
Appendix Figure A1: Slaveholding in 1860 and Black Population Density in 1880 in relation to plantation share

A. Slaveholding 1860



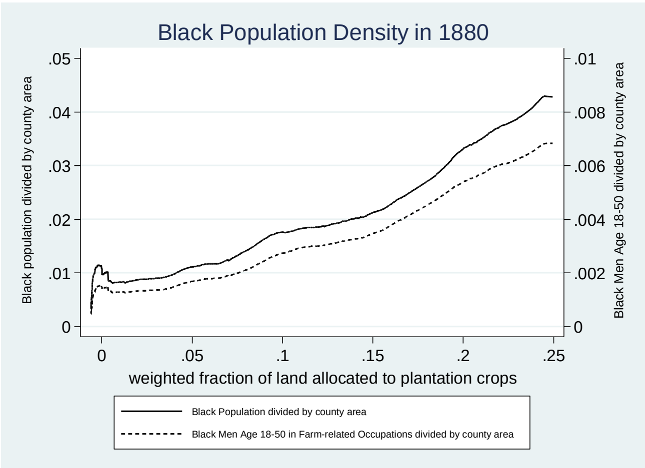
<u>Notes</u>: Bandwidth is 0.1 for "25th percentile" and "50th percentile" and 0.2 for "75th percentile".

B. Joint-Test statistics



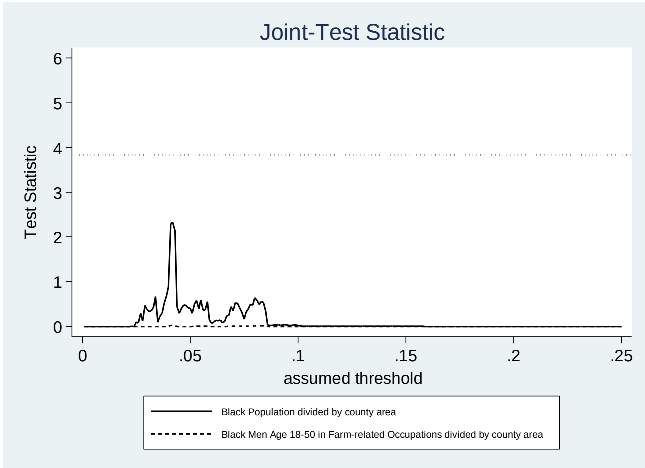
<u>Notes:</u> The 5% critical value of the maximum of the test statistics (based on simulations using the wild bootstrap) are, respectively, 4.39, 3.91, and 3.50 for the 25th percentile, 50th and 75th percentile slaveholdings. The scale parameter for the joint test was set to 1.25 times the standard deviation of the outcomes.

C. Black Population Density



<u>Notes</u>: Bandwidth is 0.1 for all three series.

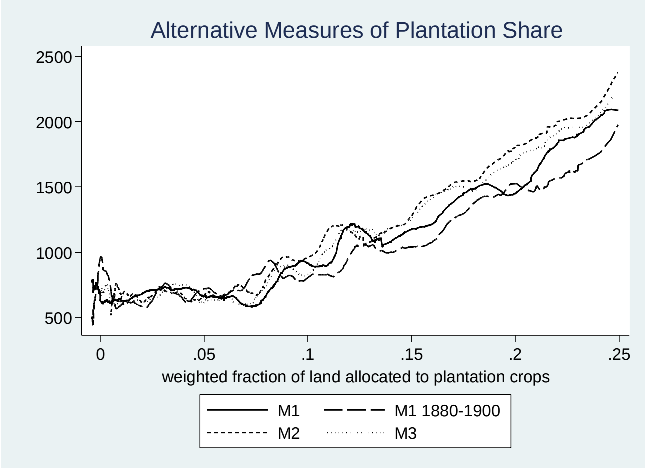
D. Joint-Test statistics



<u>Notes:</u> The 5% critical value of the maximum of the test statistics (based on simulations using the wild bootstrap) are 3.24 for "Black Population divided by county area" and 3.35 for "Black Men Age 18-50 in Farm-related Occupations divided by county area". The scale parameter for the joint test was set to 1.25 times the standard deviation of the outcomes.

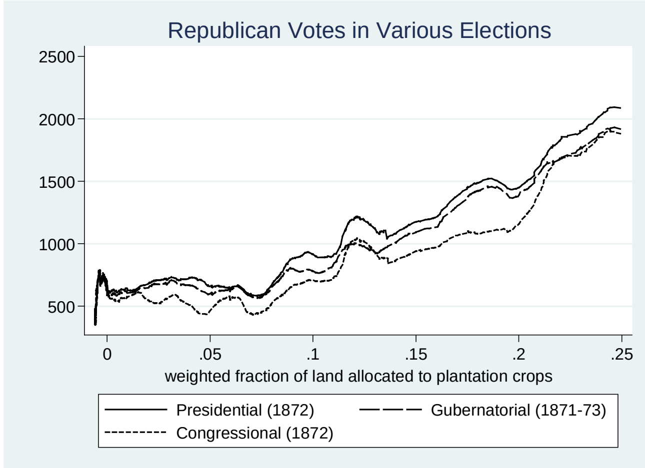
Appendix Figure A2: Alternative Measures of Plantation Share and Political Participation

A. 1872 Republican Votes and Alternative Plantation Share Measures



Notes: Bandwidth is 0.075 for all four series.

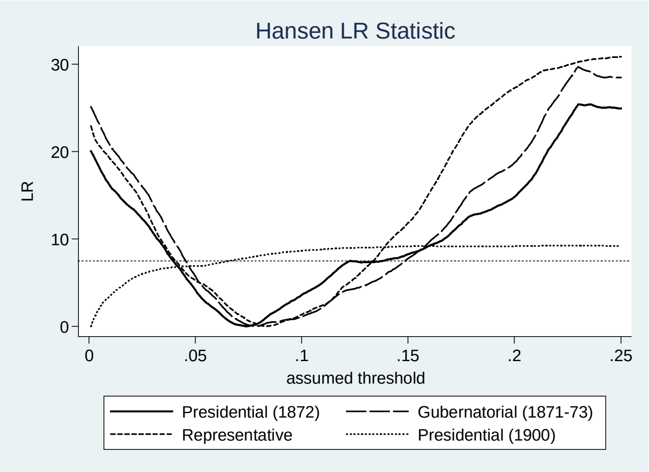
B. Republican Votes in Congressional and Gubernatorial Elections



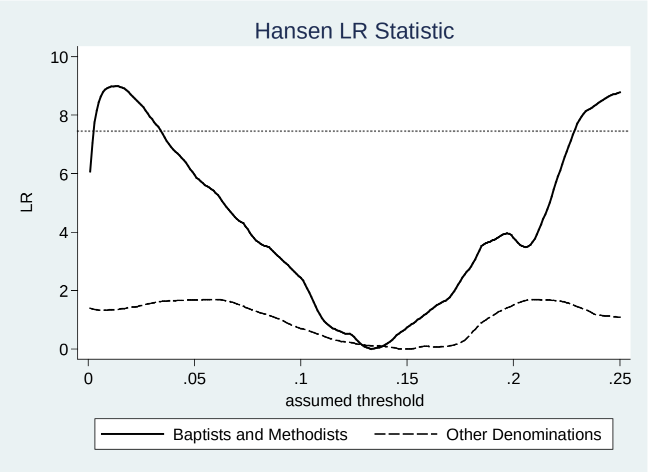
Notes: Bandwidth is 0.075 for all three series.

Appendix Figure A3: Hansen Test Statistics

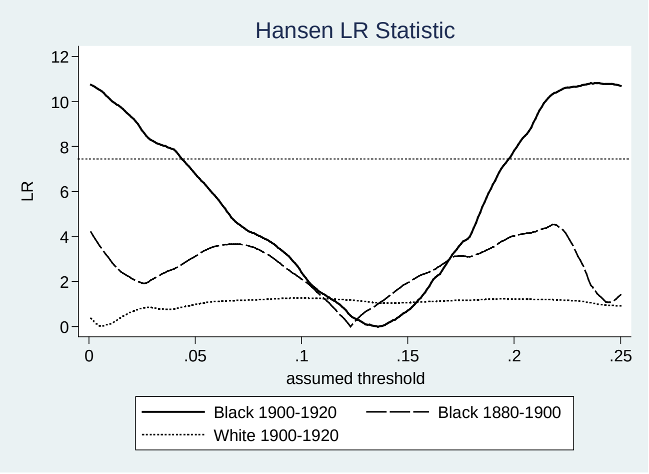
A. Republican Votes



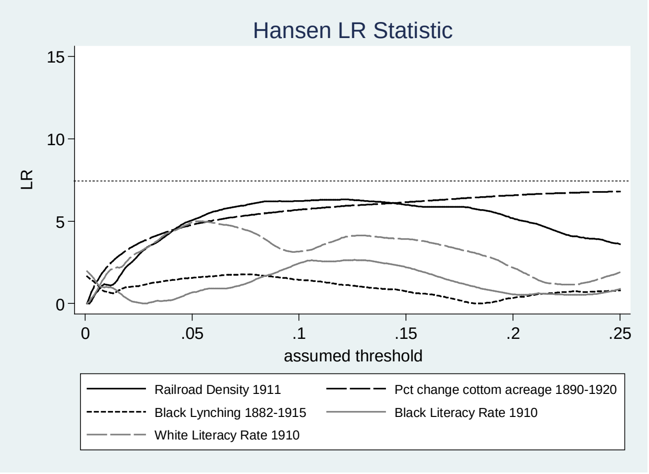
B. Church Congregation Size



C. Short Double-Differences for Black and White Migration

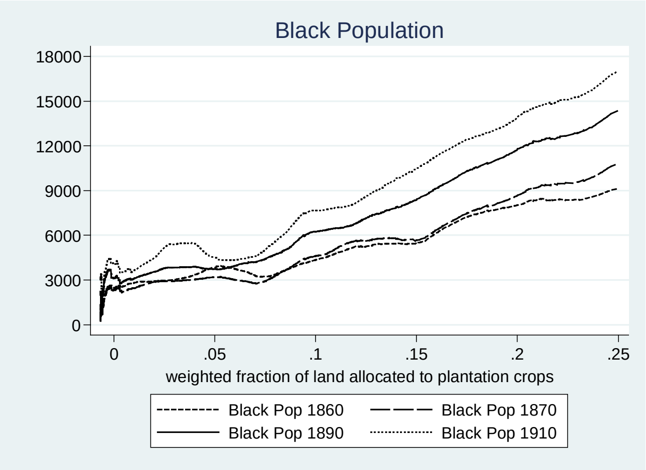


D. Alternative Explanations for Black Migration



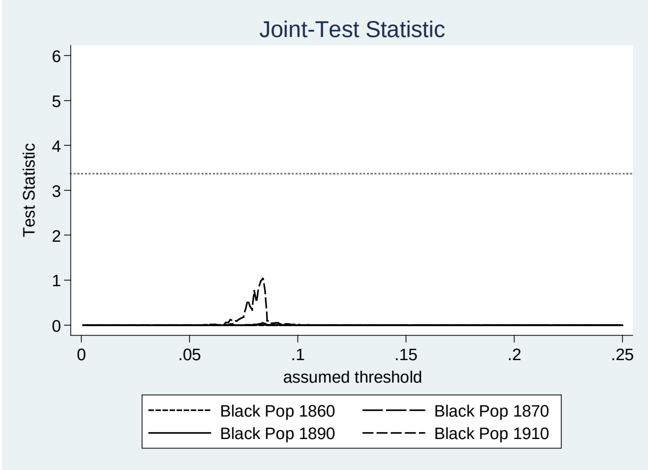
Appendix Figure A4: Black Population in relation to plantation share

A. Black Population, 1860 to 1910



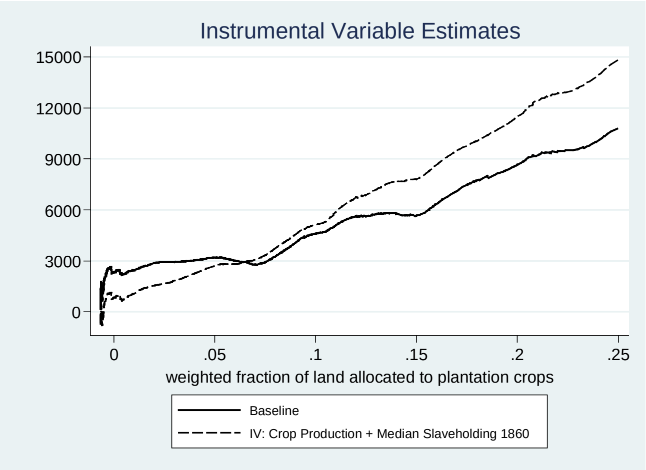
Notes: Bandwidth is 0.125 for all four series.

B. Joint-Test Statistic for Black Population, 1860 to 1910



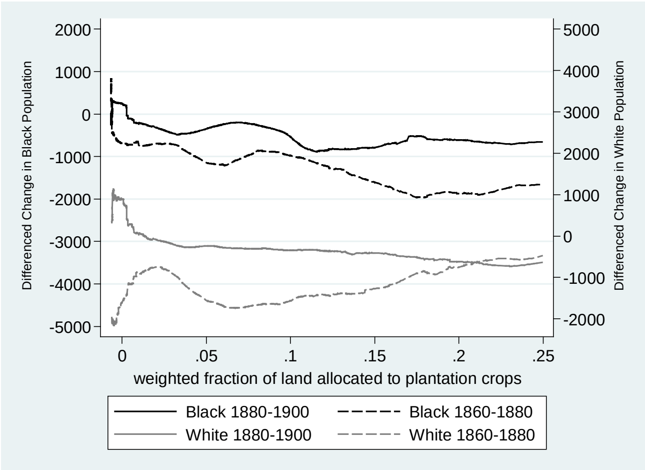
Notes: The 5% critical values of the maximum of the test statistics (based on simulations using the wild bootstrap) are, respectively, 3.27, 3.37, 3.68 and 3.65 for 1860, 1870, 1890, and 1910 "Black Pop". The scale parameter for the joint test was set to 1.25 times the standard deviation of the outcomes

C. Instrumental Variables Estimates for Black Population in 1870



Appendix Figure A5: Double-Differences of Black and White Populations before Great Migration

A. Short Double-Differences in relation to plantation share



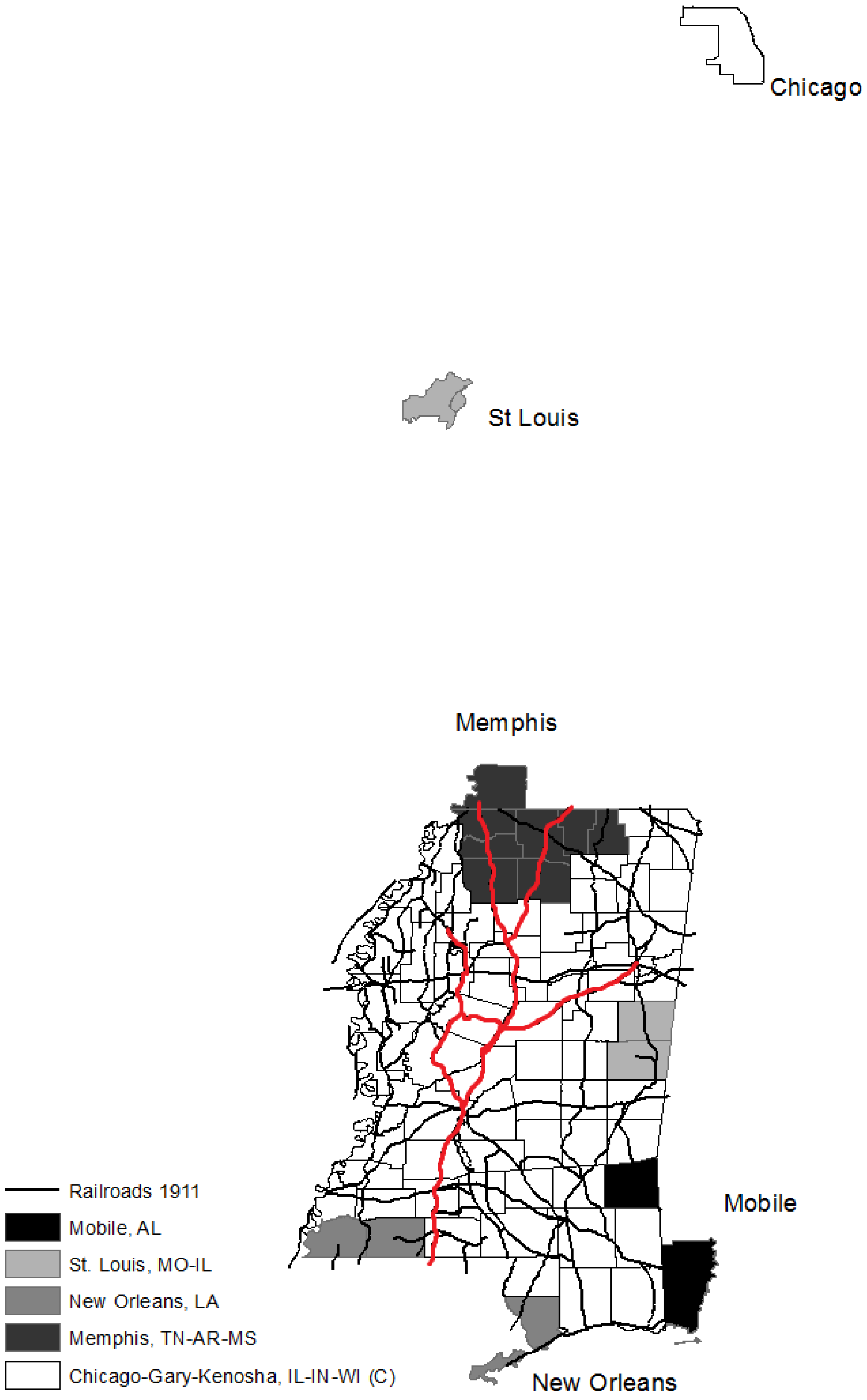
Notes: Bandwidth is 0.2 for all four series.

B. Long Double-Differences in relation to plantation share

Notes: Bandwidth is 0.15 for all four series.

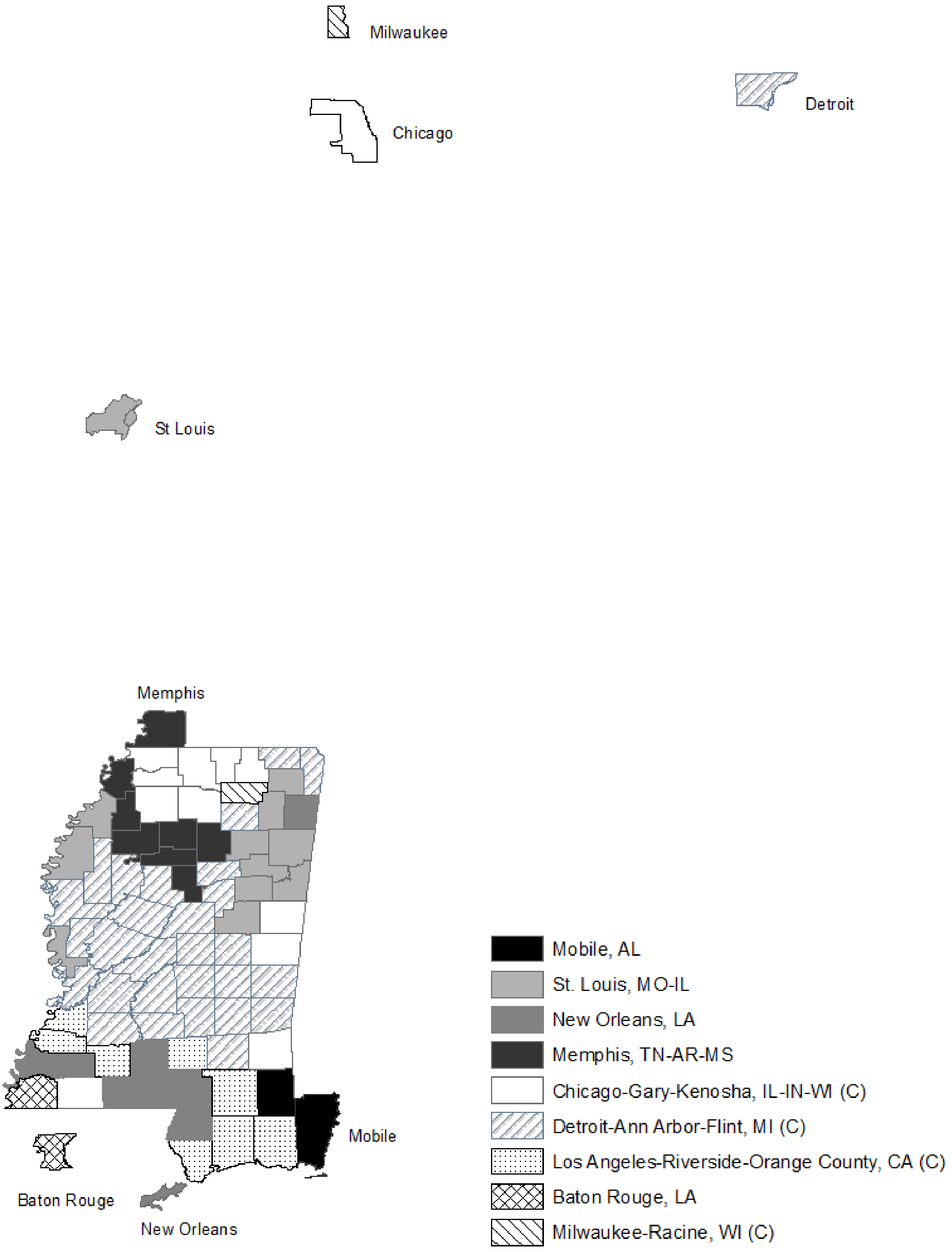
Appendix Figure A6: Migration Maps for Mississippi Counties

A. Railroads in 1911 and Top 1 Destination MSA for Black Migrants



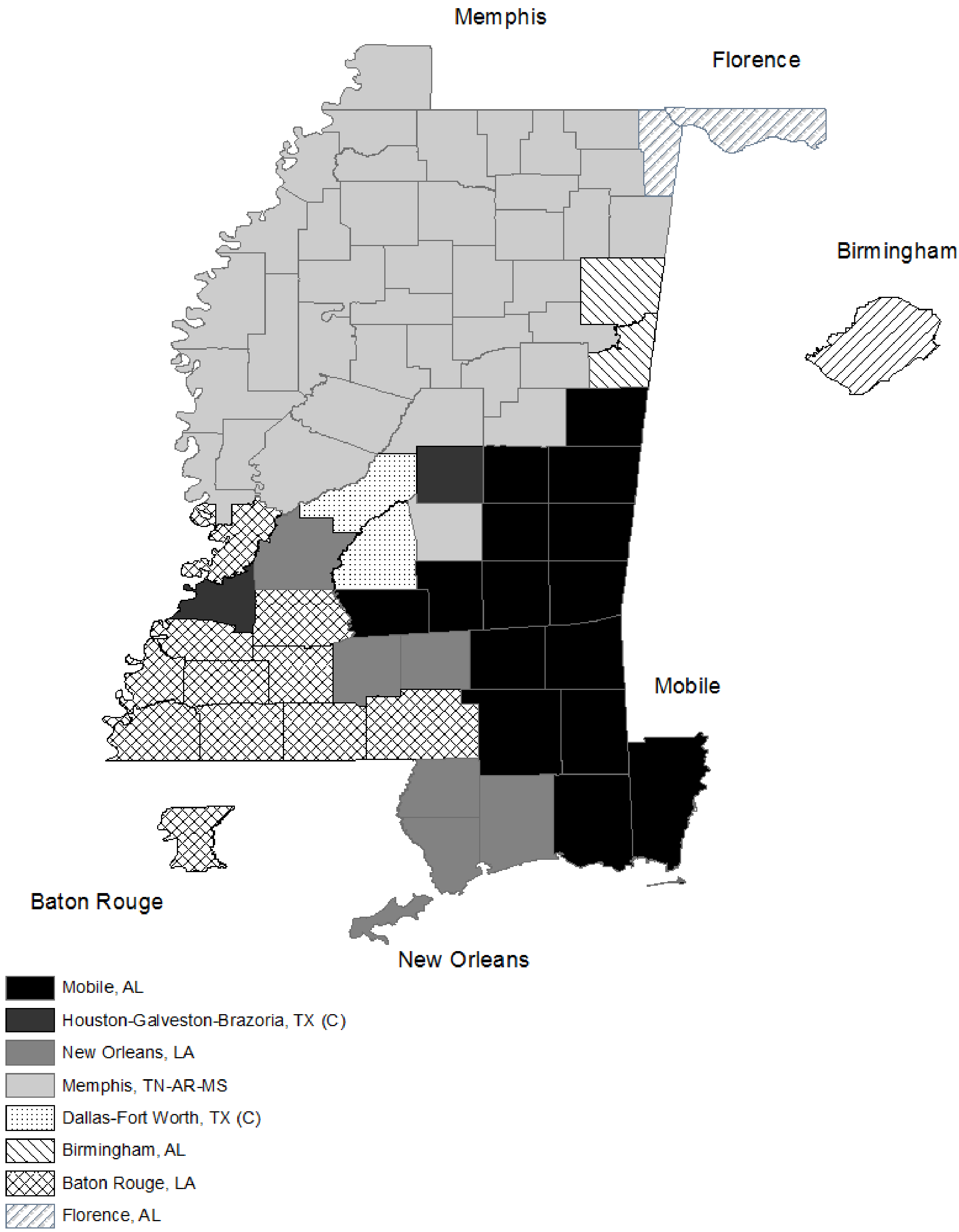
Notes: Illinois Central Railroad line highlighted in red.

B. Top 2 Destination MSA for Black Migrants



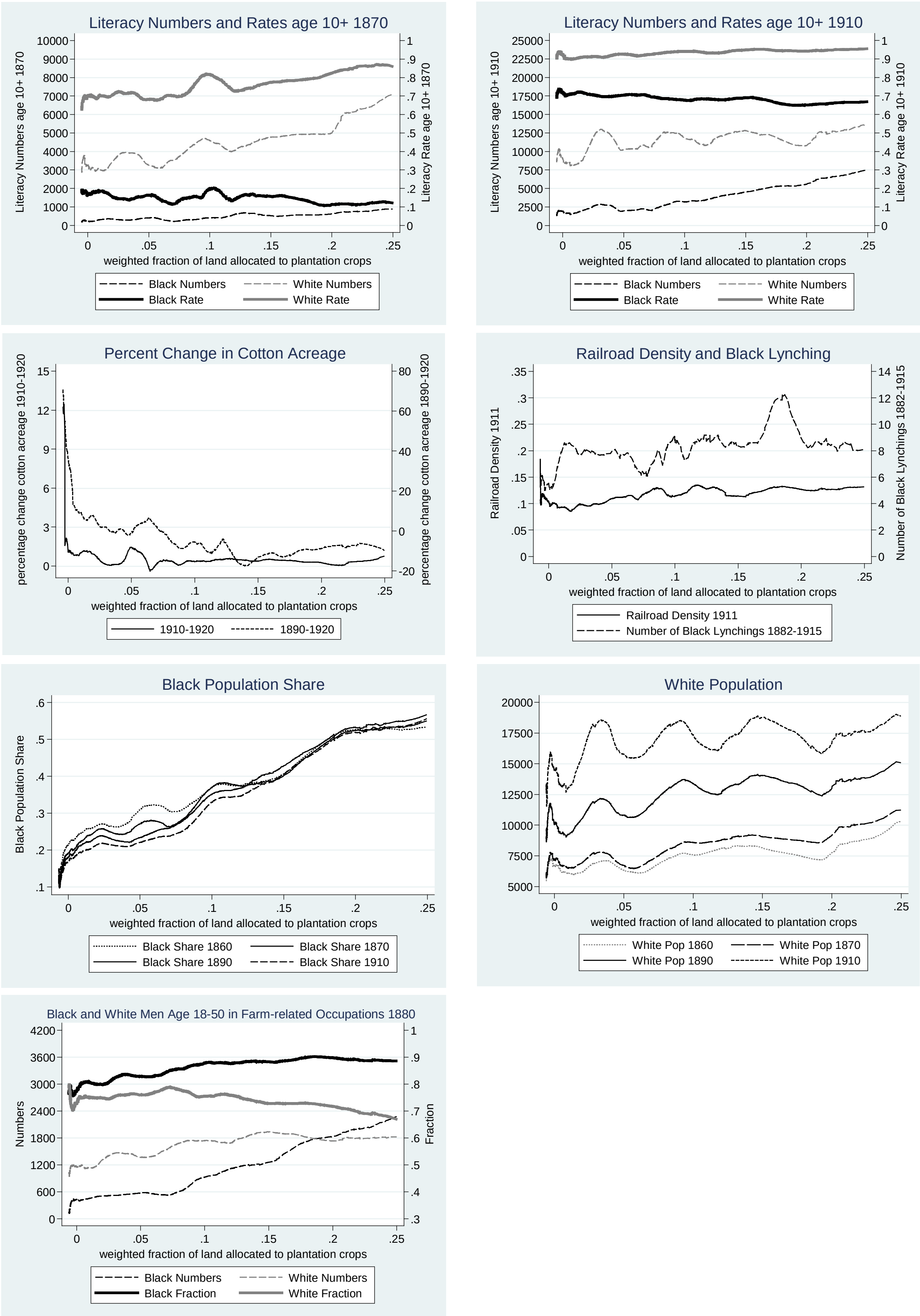
Notes: Los Angeles-Riverside-Orange County MSA not shown.

C. Top 1 Destination MSA for White Migrants



Notes: Houston-Galveston-Brazoria and Dallas-Fort Worth MSA's not shown.

Appendix Figure A7: Nonparametric Regressions for Alternative Explanations



Notes: Bandwidth is 0.1 for all series except for in "Black Population Share" and "White Population" figures, where bandwidth is 0.125 for each series

Appendix Table A1: Labor Intensities
[absolute value of t-ratios]

Social Connectedness Measure:	M1	M2	M3
Dependent Variable:	---	Black population 1880-1900	Black men in farming occupations 1880
	(1)	(2)	(3)
$\hat{\beta}_{COTTON}$	0.08	0.07^{***}	0.03^{***}
		[10.05]	[14.27]
$\hat{\beta}_{SUGARCANE}$	0.13	0.26^{***}	0.06^{***}
		[5.21]	[3.78]
$\hat{\beta}_{RICE}$	0.15	0.10^{*}	0.14^{***}
		[1.68]	[2.58]
$\hat{\beta}_{TOBACCO}$	0.33	0.16^{***}	0.11^{***}
		[5.63]	[8.55]
$\hat{\alpha}$	---	0.0003	-0.0004
		[0.81]	[1.19]
R-squared	---	0.323	0.598
Number of Observations		3418	1134

Notes: Labor intensities in column 1 come from Olstead and Rhodes (2010), Niles Weekly Register (1835), House (1954), and Earle (1992), respectively. Estimated labor intensities in column 2 come from a county-level regression of black population in 1880, 1890 and 1900 on crop acreage, 1880-1900, with county fixed-effects included. In column 3, the dependent variable is the number of black men in the county who are aged 18-to-50 and work as farm laborers, farmers (owners and tenants), or other laborers. Estimated standard errors are corrected for heteroskedasticity and also for within-county clustering in column 2.
***, **, and * indicate statistical significance at the 1, 5, and 10 percent level, respectively.

References:

Earle, Carville. 1992. *Geographical Inquiry and American Historical Problems*, Palo Alto: Stanford University Press.

House, Albert W. 1954. Labor Management Problems on Georgia Rice Plantations, 1840-1860, *Agricultural History* 28(4): 149-155.

Niles Weekly Register. 1835. "Culture of Sugar Cane" from the New Orleans Bulletin, Volume 49: 129 (October 23).

Olstead, Alan and Paul W. Rhode. 2010. Slave Productivity in Cotton Production by Gender, Age, Season, and Scale, University of California, Davis, typescript.

Appendix Table A2: Regression results for network-based outcomes, threshold locations from Hansen test statistic, without mean shift at threshold
[absolute value of t-ratios]

	Republican votes for President in 1872	Republican votes for Governor in 1871-1873	Black State Represent	Baptist & Methodist church size in 1890	Black Bapt. & Methodist church size in 1890	Diff-in-diffs in Black population, 1900-1920	Diff-in-diffs in Black population, 1890-1930
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Slope change	7845.5***	7763.3***	3.023***	162.06**	194.52*	11312.0***	15539.3**
	[3.91]	[4.13]	[5.36]	[2.28]	[1.73]	[2.73]	[2.27]
Baseline slope	-26.01	-177.07	0.322	32.43	35.0	42.66	1010.2
	[0.02]	[0.16]	[0.99]	[0.83]	[0.41]	[0.04]	[0.25]
Threshold location	0.0741	0.0780	0.0830	0.1328	0.0828	0.1364	0.0700
Bootstrapped p-value of slope change	<0.001	<0.001	<0.001	<0.001	0.042	0.006	0.026
R-squared	0.075	0.079	0.167	0.015	0.023	0.021	0.037
Sample size	1040	1005	1135	1104	939	1126	1125

Notes: Threshold locations based on the Hansen test statistic for a slope change without a mean shift. Data has been deviated from state-specific means, and estimated standard errors are corrected for heteroskedasticity.
***, **, and * indicate statistical significance at the 1, 5, and 10 percent level, respectively.

Appendix Table A3: Regression results for network-based outcomes, threshold locations from Hansen test statistic, with mean shift at threshold
[absolute value of t-ratios]

	Republican votes for President in 1872	Republican votes for Governor in 1871-1873	Black State Represent	Baptist & Methodist church size in 1890	Black Bapt. & Methodist church size in 1890	Diff-in-diffs in Black population, 1900-1920	Diff-in-diffs in Black population, 1890-1930
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Slope change	7796.8***	7839.6***	3.025***	161.81**	196.84	11617.3**	14780.6**
	[3.91]	[4.23]	[5.51]	[2.41]	[1.61]	[2.45]	[2.20]
Baseline slope	46.56	-186.21	0.316	32.31	30.18	193.9	2111.7
	[0.02]	[0.13]	[0.78]	[0.73]	[0.26]	[0.16]	[0.39]
Threshold mean shift	-7.56	1.09	0.0007	0.043	0.602	-55.16	-110.6
	[0.07]	[0.01]	[0.02]	[0.01]	[0.09]	[0.17]	[0.24]
Threshold location	0.0741	0.0780	0.0830	0.1328	0.0828	0.1364	0.0700
R-squared	0.075	0.079	0.167	0.015	0.023	0.021	0.037
Sample size	1040	1005	1135	1104	939	1126	1125

Notes: Threshold locations based on the Hansen test statistic for a slope change with a mean shift at the threshold. Data has been deviated from state-specific means, and estimated standard errors are corrected for heteroskedasticity.
***, **, and * indicate statistical significance at the 1, 5, and 10 percent level, respectively.

Appendix Table A4: Simulations with measurement error or heterogeneity in threshold locations

Simulated models	Does Simulation Match Empirical Findings?		
	Variance of measurement error or threshold heterogeneity		
	Small	Moderate	Large
	(1)	(2)	(3)
A. Measurement error in M1 measure of connectedness			
I) Slope change only	**Yes:** 1/6th noise-variance ratio; joint-test statistic and t-ratios match empirical finding	**Weak:** 1/3rd noise-variance ratio; joint-test statistic less concave	**No:** 50% noise-variance ratio; joint-test stat much less concave; nonparametric graph does not match empirical finding
Ii) Mean shift only	**No:** joint-test statistic flat; at true threshold, baseline slope, mean shift and slope change insignificant	**No:** joint-test statistic flat	**No:** joint-test statistic flat
Iii) Slope change + mean shift	**No:** joint-test statistic concave; but highly significant mean shift at implied threshold	**Weak:** joint-test statistic concave; but marginally significant mean shift at implied threshold	**No:** joint-test stat much less concave; highly significant baseline slope at implied threshold
B. Random heterogeneity in threshold locations			
I) Slope change only	**Weak:** 0.2 ratio of threshold location variance to M1 variance; joint-test stat concave; but marginally signif mean shift at implied threshold	**Yes:** 0.5 ratio of threshold location variance to M1 variance; joint-test stat and t-ratios match empirical finding	**No:** 1:1 ratio of threshold location variance to M1 variance; joint-test stat much less concave; nonparametric graph does not match empirical finding
Ii) Mean shift only	**No:** joint-test statistic flat; at true threshold, baseline slope, mean shift and slope change insignificant	**No:** joint-test statistic flat; at true threshold, baseline slope, mean shift and slope change insignificant	**No:** joint-test statistic flat
Iii) Slope change + mean shift	**No:** joint-test statistic concave; but highly significant mean shift at implied threshold	**No:** joint-test stat much less concave; significant mean shift and marginally signif baseline slope at implied threshold	**No:** joint-test statistic flat; nonparametric graph fairly linear in M1
C. Threshold heterogeneity correlated w/ M1 measure			
I) Slope change only	**Weak:** Weak correlation w/ M1, joint-test concave but signif mean shift at implied threshold. Results slightly worse as correlation w/ M1 grows	**Weak:** Weak correlation w/ M1, joint-test concave but marginally signif mean shift at implied threshold. Results worse as correlation w/ M1 grows	**No:** Joint-test much less concave; marginally significant baseline slope at implied threshold as correlation w/ M1 grows
Ii) Mean shift only	**No:** joint-test statistic flat	**No:** joint-test statistic flat	**No:** joint-test statistic flat
Iii) Slope change + mean shift	**No:** Weak correlation w/ M1, significant mean shift at implied threshold. Signif of mean shift grows as M1 correlation grows	**No:** Nonparametric graph fairly linear in M1; slope change t-ratios much less concave; mean shift at implied threshold grows in signif as M1 correlation grows	**No:** Nonparametric graph fairly linear in M1; joint-test statistic becomes much flatter

Notes: (i) A model with a slope change at a threshold will generate the observed patterns in the data consistent with the theory, even with a small or moderate amount of noise (measurement error in the plantation share variable or heterogeneity in the threshold location). (ii) A model with just a mean-shift at a threshold or both a mean-shift and a slope change (with the same level of significance in the baseline specification) never matches the reported results. Once noise is added, either the joint-test statistic is flat or the mean-shift coefficient is significant at the implied threshold.

Appendix Table A5: Regression results for Republican Votes for President and Governor, threshold locations from Table 1
[absolute value of t-ratios]

	Republican Votes for President in 1872				Republican Votes for Governor in 1871-1873			
	(1a)	(1b)	(1c)	(1d)	(2a)	(2b)	(2c)	(2d)
Slope change	7695.329***	7613.842***	7117.307***	7031.434***	7655.857***	7113.551***	6694.030***	6537.651***
	[4.10]	[4.62]	[4.96]	[4.54]	[4.25]	[4.55]	[5.00]	[4.88]
Baseline slope	-141.576	-3129.184**	401.618	294.700	-60.898	-3094.916**	655.036	389.934
	[0.10]	[1.97]	[0.37]	[0.24]	[0.05]	[2.13]	[0.64]	[0.35]
Threshold mean shift	117.765	117.831	32.029	32.212	32.385	98.886	-34.887	-37.002
	[1.06]	[1.22]	[0.33]	[0.34]	[0.33]	[1.02]	[0.39]	[0.44]
# of literate blacks in 1870		0.917***	0.544***	0.519***		0.951***	0.513***	0.441***
		[7.25]	[5.38]	[4.86]		[6.24]	[5.84]	[5.59]
Black literacy rate in 1870		-1338.323***				-1312.950***		
		[6.10]				[5.42]		
White literacy rate in 1870		589.655***				421.966**		
		[3.46]				[2.46]		
White-black diff in 1870 pop.			0.048***	0.043			0.044***	0.031
			[3.31]	[1.16]			[5.38]	[1.14]
Wht-blk diff in 1870 # literate				0.012				0.031
				[0.22]				[0.78]
R-squared	0.209	0.525	0.680	0.681	0.185	0.548	0.693	0.702
Sample size	1,040	854	1,005	1,005	1,005	816	971	971

Notes: See notes to Table 1. All regressions include state fixed effects.
***, **, and * indicate statistical significance at the 1, 5, and 10 percent level, respectively.

Appendix Table A6: Regression results for Black state representative and Black Baptist-Methodist church size, threshold locations from Table 1
[absolute value of t-ratios]

	Black State Representative				Black Baptist and Methodist Congregation Size in 1890			
	(1a)	(1b)	(1c)	(1d)	(2a)	(2b)	(2c)	(2d)
Slope change	3.039***	2.393***	3.331***	2.682***	193.750*	183.384*	199.021*	186.179*
	[5.53]	[4.39]	[5.24]	[4.43]	[1.76]	[1.74]	[1.84]	[1.76]
Baseline slope	0.227	-0.496	-0.131	-0.671	9.608	-51.968	-39.078	-56.592
	[0.61]	[1.31]	[0.27]	[1.44]	[0.10]	[0.55]	[0.41]	[0.60]
Threshold mean shift	0.034	0.068	0.056	0.063	6.797	8.542	7.834	9.158
	[0.80]	[1.59]	[1.19]	[1.37]	[1.06]	[1.36]	[1.22]	[1.44]
Black population in 1870		0.032***		0.030***				
(÷1000)		[5.39]		[4.94]				
White population in 1870		-0.005***		-0.005***				
(÷1000)		[3.37]		[3.24]				
Black literacy rate in 1870			-0.034	-0.020				
			[0.74]	[0.47]				
White literacy rate in 1870			0.265***	0.127**				
			[4.34]	[2.17]				
Black literacy rate in 1880						28.298		23.615
						[1.50]		[1.15]
White literacy rate in 1880						119.972***		97.432***
						[5.24]		[3.51]
Black literacy rate in 1900							37.602**	28.964
							[2.10]	[1.60]
White literacy rate in 1900							140.659***	54.543*
							[4.70]	[1.70]
R-squared	0.338	0.447	0.363	0.437	0.222	0.257	0.250	0.264
Sample size	1,135	1,022	860	853	939	927	923	912

Notes: See notes to Table1 1. All regressions include state fixed effects.
***, **, and * indicate statistical significance at the 1, 5, and 10 percent level, respectively.

Appendix Table A7: Regression results for short and long double-differences for Black Migration, threshold locations from Table 1
[absolute value of t-ratios]

	Difference-in-differences in Black Population, 1900-1920				Difference-in-differences in Black Population, 1890-1930			
	(1a)	(1b)	(1c)	(1d)	(2a)	(2b)	(2c)	(2d)
Slope change	11134.457***	11906.763***	11256.301***	10951.246**	15571.765**	17508.109**	18799.901***	17534.844**
	[2.73]	[2.84]	[2.66]	[2.43]	[2.34]	[2.55]	[2.63]	[2.41]
Baseline slope	365.969	-1700.725	-1466.330	-3483.113*	-54.488	-6279.332	-6682.577	-6937.878
	[0.25]	[1.09]	[0.94]	[1.67]	[0.01]	[1.37]	[1.43]	[1.50]
Threshold mean shift	-197.735	-214.581	-228.465	-264.333	337.192	333.982	306.227	69.450
	[0.72]	[0.78]	[0.83]	[0.81]	[0.72]	[0.74]	[0.67]	[0.16]
Black population in 1910		-0.026	-0.020	0.032		-0.074	-0.084	-0.029
		[0.85]	[0.64]	[1.00]		[1.02]	[1.19]	[0.41]
White pop. share in 1910		-1825.032***	-1916.325***	-1599.903**		-5052.777***	-4680.125***	-4055.976***
		[3.00]	[3.20]	[2.58]		[3.48]	[3.25]	[3.03]
Black literacy rate in 1910			-39.776	-671.845			-571.594	-101.452
			[0.09]	[1.03]			[0.80]	[0.09]
White literacy rate in 1910			-1507.657	-4553.810***			4032.266	5237.912
			[1.12]	[4.13]			[1.03]	[1.50]
Railroad density in 1911				-159.841				-1256.033*
				[0.38]				[1.78]
Pct change in cotton acreage 1890-1920				-0.006				-0.059
				[0.23]				[1.38]
R-squared	0.130	0.146	0.151	0.179	0.143	0.179	0.185	0.262
Sample size	1,126	1,126	1,116	734	1,125	1,125	1,115	735

Notes: See notes to Table 1. All regressions include state fixed effects.
***, **, and * indicate statistical significance at the 1, 5, and 10 percent level, respectively