White discrimination in provision of black education: plantations and towns

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Abstract

We present a model of public provision of education for blacks in two discriminatory regimes, white plantation controlled, and white town controlled. We show that the ability to migrate to a non-discriminating district constrains the ability of both types of whites to discriminate. The model produces time series of educational outcomes for whites and blacks that mimic the behavior seen in Post Reconstruction South Carolina to the onset of the Civil Rights Act. It also fits the Post World War II black-white income differentials.

This paper examines the evolution of human capital, specifically education, of blacks and whites from 1840 to 2000. To reflect the changing environment over this long period, we break this time into different four eras, each with its own degrees of government and labor market discrimination against blacks. The ability of blacks to migrate at a cost limits the discrimination. Our model produces predictions for native born South Carolina residents of South Carolina, the black share of population of South Carolina, native born South Carolina non residents of South Carolina, per-worker output, relative-young-black-worker output, black and white education expenditures, relative black education expenditures, black and white class size, and relative black class size. All of these predictions are compared to historical South Carolina data. In general, the model fits the historical data well.

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After slavery was abolished by the 13th amendment to the US Constitution, a brief period of Reconstruction ensued where the rights of suffrage for southern blacks were largely protected through the occupation of the former Confederate states by federal troops. During Reconstruction, blacks comprised a majority or near majority of the population in most former Confederate states. Table 1 presents the time series evidence on the population of South Carolina from 1790 to the present as well as the racial composition of the population. Table 2 provides the black share for several southern states, the South, and the US.[1],[2] For the censuses of 1820 to 1920, inclusive, blacks were the majority population in South Carolina. Notice that the share of blacks living in these southern states fluctuated from 73 percent to 83 percent between 1790 and 1920. However the share of blacks that resided in these southern states fell sharply between 1920 and 1970 and after 1970 has remained roughly constant. In 1868 a constitution in South Carolina was drafted by a convention that consisted of 48 whites and 76 blacks. This constitution provided strong protection for the rights of suffrage, as well as progressive guidelines for public education.[3] Many northern whites and blacks also traveled to the South to instruct black children.[4]

Reconstruction effectively ended following the contested 1876 presidential election when as part of a compromise southern Democrats acknowledged Hayes, a Republican, president in return for the removal of federal troops from the former Confederate States. With the removal of federal troops, a movement towards the total disenfranchisement of blacks began. Disenfranchisement was achieved by both illegal and legal measures.[5] By the 1890s, most southern states reverted to white rule and discrimination against blacks became standard policy. Most southern states rewrote or amended their constitutions in order to disenfranchise blacks as well as poor whites. In South Carolina, the

[1] The data for 1790-1970 come from *Historical Statistics of the United States: Colonial Times to 1970*, 1980 data come from *Datapedia of the United States: 1790-2005*, 1990 and 2000 data come from *Statistical Abstract of the United States, 1992* and *2002*.

[2] South is defined as the 11 states that formed the old Confederate States of America: Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Texas and Virginia.

[3] The 1868 Constitution stated that people could only be deprived their right of suffrage when convicted for murder, treason, robbery or dueling. The constitution mandated for all schools to remain open for at least six months a year, and required school attendance for all children between the ages of 6 to 16.

[4] In 1871 17 percent of the teachers in South Carolina black schools were northern whites and blacks. This percentage dropped after the end of Reconstruction, and by 1879 only 3 percent of teachers in black schools were northerners. These figures assume no northerners taught in white schools. In contrast to South Carolina, The Legacy Museum documents that in 1880 out of 1256 black schools in Virginia only 785 had a black teacher. These northern white educators were often met with intimidation and harassment by southern whites. See Du Bois (1935) for examples.

[5] Kousser (1974) and Tindall (1952) provide specific examples of fraud, intimidation and violence surrounding southern elections following Reconstruction.

disenfranchisement culminated in 1895 with the adopted of a new constitution. Unlike the 1868 Constitution, this new constitution restricted the rights of suffrage, and did not impose progressive and universal standards for public education.[6] Blacks remained essentially disenfranchised in South Carolina until the 1960s.

Despite the discriminatory environment, black education measures still converged to the education measures of their white counterparts. In particular education inputs such as class size, school year length and teacher salary for blacks became much more similar to whites throughout the period 1880-1960, prior to the Civil Rights Acts of the 1960s, as well as prior to the 1954 Brown vs. Board of Education.[7]

We develop a model to describe two separate discriminatory regions, a plantation system and a yeomen-town system over four time periods: slavery, 1840-1860; Reconstruction, 1860-1890; Jim Crow, 1890-1950; and Civil Rights 1950-2000. The key distinction between the two systems is that whites employ blacks in the plantation system, but do not in the yeomen-town system. Although many blacks worked for whites in towns, most whites in towns did not employ blacks. We think of the decisions for providing education in terms of maximizing the utility of the median voter where the median voter does not employ blacks in towns, but does in plantation regions. Similarly, we think of yeomen regions as being populated by both black and white owners of family farms that typically do not employ outside help.

The extent of discrimination against blacks in education over the four time periods is the same for both the plantation system and the yeomen-town system. During slavery, there is discrimination in education. Education is then competitively provided to blacks during Reconstruction, reflecting the franchise of blacks which protected them from discrimination in educational provisions. During Jim Crow whites once again, are monopoly providers of education, as whites had taken total control of school boards and determined the allocation the funding between white and black schools. Finally, we assume non-discriminating homogeneous school districts from 1950-2000.[8] Although the ability to fiscally discriminate between the two systems is the same, the levels of discrimination differ between the two systems because of the distinction in employing blacks.

From 1840-1860 the plantation system is modeled as a slave system. In this slave system,

[6] The primary source of black disenfranchisement in the 1895 Constitution was its literacy test. Specifically, voters had to "properly" read any section of the constitution submitted to them by the voter registration officer. Payment of the poll tax was also a requisite for voting under this new constitution.

[7] For school year length, see Canaday (2003) for details of black convergence.

[8] In particular, we assume perfectly segregated school districts.

whites are monopsony employers of black farm laborers as well as monopoly providers of education to the children of blacks. After the Civil War, the work-gang system, the primary production method used on plantations during slavery, was frequently replaced by planters subdividing their plantations and having portions assigned to sharecroppers, portions rented out to tenants, and portions retained for themselves and worked by wage laborers.[9] Sharecroppers and share-tenants became the most common types of agriculture workers on plantations in the cotton South.[10]

Disagreement exists over the extent of competition in the southern agricultural labor market after slavery. Wiener (1979) takes a strong position towards non-competition. He contends collusion among planters, debt peonage, vagrancy laws restricting mobility, and terror all created and maintained a non-competitive environment. Also along the lines of non-competition, Ransom and Sutch (1978) argue after the Civil War rural merchants had local monopoly power in credit.[11] They claim matters were made even worse for farm tenants and croppers from crop liens requiring cotton production, which forced borrowers not to grow enough food crops to feed themselves, and as a result they had to buy these products from the merchants at monopoly-credit prices. In contrast, Robert D. Reid, Stephen J. Decanio, and Robert Higgs have taken positions towards competition.[12] Reid (1973) claims sharecropping agreements were a response to free market forces which could minimize risk and maximize returns for both the landlord and cropper by reducing post-contractual opportunism. DeCanio (1974) argues southern agricultural laborers received a slightly higher wage than the value of their marginal product, and southern income inequalities were due to racial disparities in the ownership of land and capital. Higgs (1977) contends that despite white racism towards blacks, competition prevented most discrimination in agricultural wages and credit and rental con-

[9] See Ransom and Sutch (1978), Wright (1986), Alston and Higgs (1982), and Reid (1973) for discussions on the decline of the work-gang system and the rise of tenancy after the Civil War. Our models abstract from the type of production technique used on plantations, as well as possible productivity differences between systems.

[10] Sharecroppers supplied only their land in return for a share of the crop, typically one-half for cotton. Share-tenants supplied their labor and farming supplied in return for a share of the crop, typically three-fourths for cotton. Share-tenants also had more legal rights over crops than did sharecroppers. Woodman (1995) provides details of the legal distinctions. Other types of tenants usually paid a fixed fee in cash or crops for use of the land. Wage farm laborers were typically young men. However, wage laborers began replacing sharecroppers and tenants in large numbers in the 1930s. Wright (1986) and Alston and Ferrie (1999) argue the incentives provided in New Deal agriculture programs fomented this occurrence.

[11] The archival work by Ransom and Sutch shows merchants were often planters themselves or were connected with planters through close family, social, or business ties.

[12] For more on this debate, see Wiener's 1979 attack on the works of Reid, Decanio, and Higgs in the AHR Forum, as well as the replies from Higgs and Harold D. Woodward.

tracts. Others have taken the middle ground between competition and non-competition. Wright (1984) argues planters were able to maintain cheap labor through the isolation of southern labor and capital markets. Alston and Ferrie (1999) contend paternalistic system that developed between planters and their workers fostered cheap and dependable labor.

During Reconstruction, we model a competitive labor market in the plantation system. That does not mean, under a non-competitive view of the post-bellum southern agricultural labor market that labor was not discriminated against or exploited during Reconstruction, however, black farm labor would have been better protected against such actions during this time compared to during Jim Crow. Interventions by the Freedmen's Bureau would have partially mitigated labor market exploitation. Woodman (1995) also shows in southern states the Radical Republicans enacted legislation that protected and increased the rights of workers, but once the Redeemers came to power they enacted new legislation that shifted the balance of power towards landlords. Reflecting the different views of labor-market competition during Jim Crow, we model the plantation labor market as both competitive and a monopsony. The first we label the Higgs model, the second we label as the Ransom-Sutch model. In the quantitative analysis we compare the numerical solutions of each regime for a variety of parameters against the historical data. We find that the Higgs model performs better than the Ransom-Sutch model in fitting the historical time series. Finally, we assume competitive labor markets from 1960-2000.

In the yeoman-town system, we assume no labor-market discrimination.[13] We carry out this assumption by having neither blacks nor whites employ the other type. This assumption fits more exactly for the case of yeoman farmers than for townspeople. However, in contrast with plantation regions, in towns few whites employed blacks, and as a result we believe that the black-labor situation played a much larger role in influencing black-education decisions in plantation regions than in towns. Our assumption allows us to completely remove black-labor concerns from black-education decisions in towns, while keeping it for plantation regions.

Using county level data for South Carlina, we are able to calculate the average class size for whites and blacks, average expenditures per pupil for whites and blacks and average expenditures per teachers for whites and blacks from 1880-1964.[14] After 1964 the information on education no longer comes broken down by race. However what the data do document is that black class sizes, spending per black pupil and spending per black teacher all converge to the levels of these

[13] Wright (1984) contends pre-World War I racial non-agricultural wage differences were not large for the same job, however, blacks were discriminated against by being shutout of better paying jobs.

[14] For more on the data see Canaday (2003).

variables of whites. This holds for blacks in overwhelmingly black counties that hereafter we refer to as plantation counties, as for blacks in white counties, hereafter referred to as yeoman counties.[15] Figure 1 illustrates this point for class size.[16] The figure also contains the average class size for whites and blacks at the entire state level in South Carolina. Observe that average class size has declined for whites from roughly 1900 to 1964, with a noticeable exception for the Great Depression. There is a large disparity, however, between whites prior to the 1930s. Yeoman whites had steadily increasing class size from 1880 to about 1910, while plantation whites show a much more muted rise. Class size reductions become noticeable from 1920 to the end of the period for both blacks at the statewide level and yeoman blacks, and with a slight delay for sharecropper blacks. Average class size for blacks is essentially constant from 1880 to 1920 at the state level, rising for yeoman blacks and widely varying for sharecropper blacks.

[15] When defining county type we followed a rule that generally high black population counties were plantation counties. However there are exceptions to this rule; for example Beaufort county had a high black population share early on but looked more like a yeoman county due to land confiscation by troops during the Civil War. The differences presented in the figures are for illustrative purposes only. Since about one third of the counties were left uncategorized for this graphical exercise, we merely wish to present the stark differences in levels of educational inputs between "plantation counties" and "yeoman counties."

[16] Plantation whites covers white children in the counties of Allendale, Calhoun, Dorchester, Hampton and Jasper. These counties account for sharecropper blacks. Yeoman whites and blacks are those in Anderson, Cherokee, Greenville, Oconee, Pickens, Spartanburg and York counties.

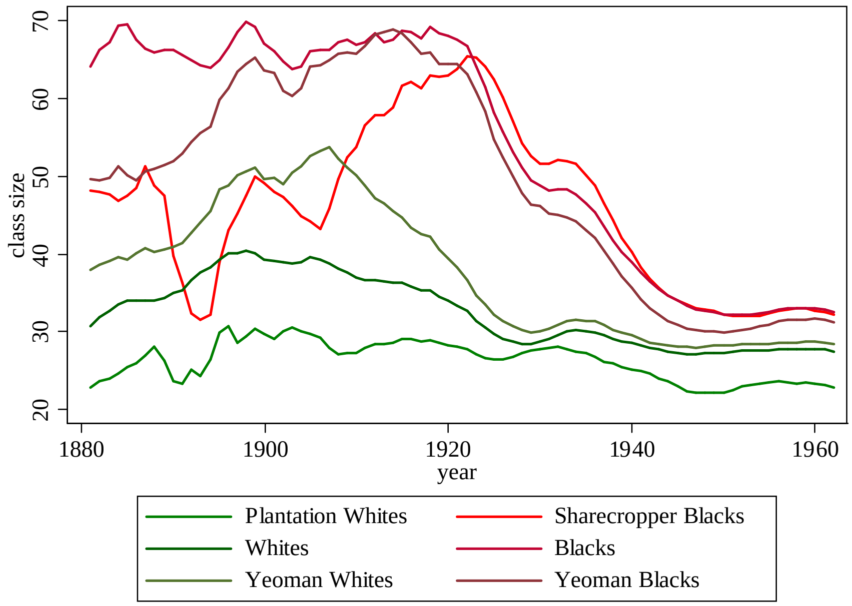


Figure 1: Black and white class size

Figure 2 presents information on real spending per pupil for whites and blacks from 1900 to 1962 in 2000 dollars. These expenditures do not include capital expenditures. Two distinct periods are visible in the figure. From 1897-1920 real spending per black pupil was constant at the state level and for yeoman blacks. However for sharecropper blacks, real spending per pupil fell from roughly 1905 to the end of World War I. At the conclusion of World War I, real spending per black pupil rose rapidly, stagnated during the Great Depression, and rose from about 1936 until the end of the sample. For the most part, spending per white pupil rose steadily throughout. Despite a boom in the 1920s and subsequent fall during the Depression, real spending per white pupil in 1960 is about where it would have been based on a simple trend from 1897 to 1920. Notice that the gap between whites and blacks is substantially reduced by 1959. In 1897 spending per white pupil was $88, whereas spending per black pupil was $27, or less than one third the amount for white pupils. By 1959 spending per white pupil had reached $1128 while spending per black pupil was $734, or almost two thirds of the amount spent on white pupils.

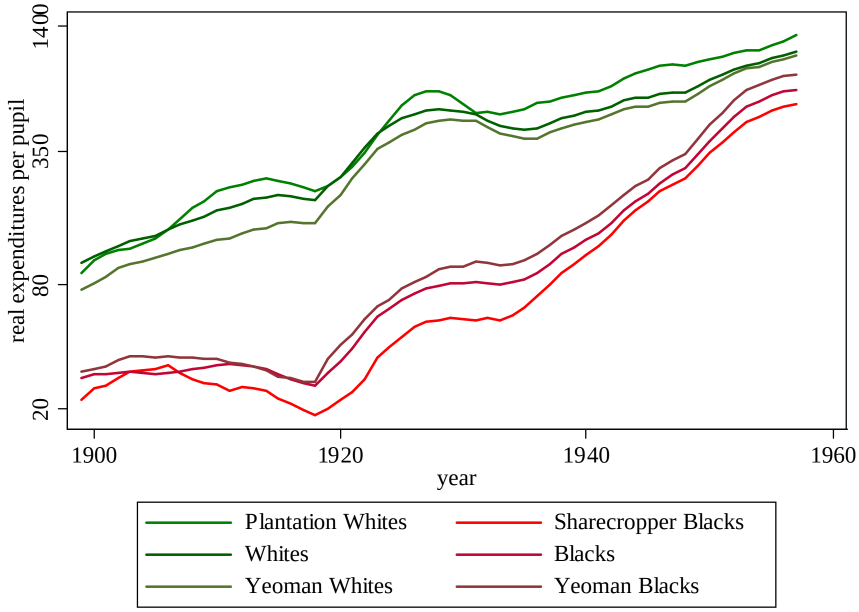


Figure 2: Real expenditures per pupil.

Finally we present expenditures per teacher in 2000 dollars for the period 1897 to 1959. We chose this measure instead of teacher salaries in order to measure resources available to teachers as opposed to salaries.

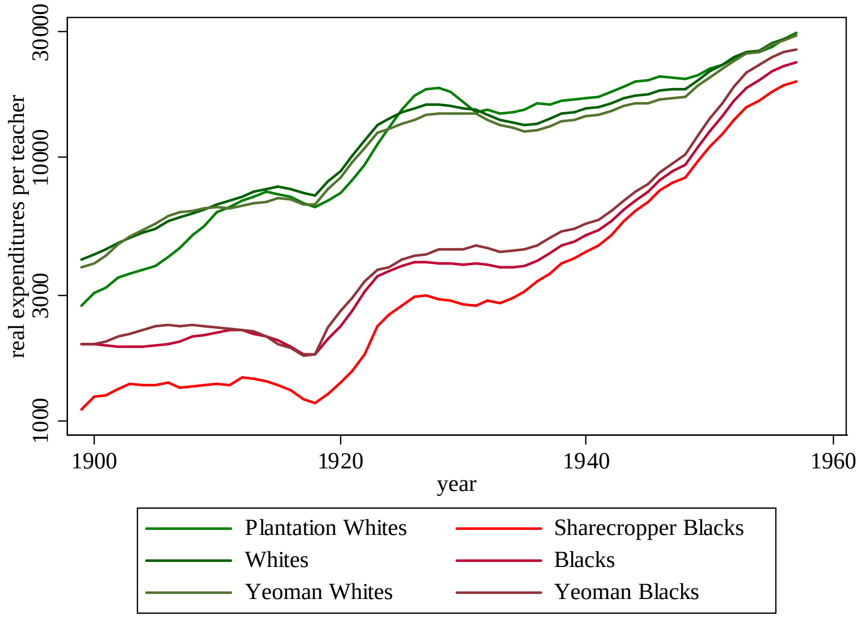


Figure 3: Real expenditures per teacher.

The same pattern emerges here as with real spending per pupil. However because class size reductions were greater for blacks than for whites, convergence in real spending per teacher is slower than in real spending per pupil. As shown in Tamura (2001) and in the model here, this is crucial for the story of convergence during the period of discrimination. In 1897 real spending per teacher for whites and blacks were $3570 and $1849, respectively. In 1959, the last year data are available, spending per teacher for whites and blacks were $31,750 and $24,445, respectively. Spending per black teacher converged from 52 percent of spending per white teacher in 1897 to 77 percent of spending per white teacher in 1959.

This pattern of strong convergence in educational inputs prior to the Civil Rights Acts of the 1960s and even prior to the 1954 Brown vs. Board of Education is evident not only for South Carolina, but also in the entire south. Table 3 presents evidence from Margo (1990) on black convergence in educational spending per pupil, school year length and class size to white levels over the 1900-1950 period. The model of this paper will explain this convergence as a function of declining monopsony power of plantation owners and declining discriminatory powers of white school boards.

The next section provides a brief overview of the literature. In the third section of the paper we present a model of discrimination by whites against blacks. We focus on three different types of work-school districts. The first is a plantation district where plantation whites combine land, their human capital and the total human capital of their black sharecroppers to produce output. From 1840-1879 white plantation owners are monopsony employers of black slaves and monopoly providers of schooling for slave children. From 1880-1959 white plantation owners compete in competitive labor markets against each other to hire black workers, but are monopoly providers of education to the children of their black workers. Finally from 1960-2000 both whites and blacks are hired in competitive labor markets without discrimination and each are median voters in their own school districts. In the second district, for 1840-1959, yeoman whites and blacks produce output in competitive input and output markets, but whites are the median voter as well as the school superintendent in the school district. This second district becomes non-discriminating in education provision from 1960-2000. Finally the third district is one in which blacks can migrate to at a cost in which they can produce output in competitive input and output markets, and also they are the median voter in the school district. The fourth section produces a comparison of time paths of human capital, class size and average spending per pupil between whites and blacks in two types of counties. One county includes plantation districts and districts where blacks face no discrimination, while the other county includes yeoman districts and districts where blacks face no discrimination. The final section concludes.

PREVIOUS WORK

Recent work by leading scholars considers the role of education in the South on convergence in economic status of blacks. This is a return to a fundamental question introduced by Myrdal (1948). Smith (1984,1986) and Smith and Welch (1989) examine the role of human capital accumulation by blacks in explaining economic convergence of blacks relative to whites. Smith (1984,1986) shows that the crucial periods of Southern Reconstruction, 1865-1876, and Jim Crow discrimination from 1880-1964, provide evidence on the importance of human capital for explaining black-white earnings differentials. In the first period, blacks were majority voters and hence controlled public education. During this short period black human capital accumulation would be much greater than during the period after Reconstruction when blacks increasingly became disenfranchised. However Reconstruction provided a short window of 11 years where blacks born in 1860 could have been educated practically through high school. The cohort that had this enhanced access to education, would perform differently in the labor market as adults compared to unfortunate blacks that were educated during the period of Jim Crow. Margo (1986a,b,1990) provides evidence of educational achievement in segregated schools and the effects of Jim Crow discrimination. He shows that despite discrimination, blacks did improve relative to whites, albeit more slowly than they would if education were not subject to discrimination. Margo (1991) develops a model to explain the limits of local government discrimination against blacks. Blacks had access to costly migration, and hence this constrained the discriminatory government's ability to extract rents. Smith and Welch (1989) document the convergence in educational achievement of blacks and whites throughout the 20th century. Margo and Finegan (1993) show that rising school enrollment was responsible for the decline in labor force participation of black teenagers. Butler, Heckman and Payner (1989), Heckman and Payner (1989), Heckman (1990), Heckman et al (2000) and Donohue et al. (2002) examine the importance of human capital accumulation, private philanthropy, federal intervention and migration in explaining black economic progress in the 20th century.[17] All of these papers focus on the importance of education on future economic performance of individuals. The papers by Donohue et al., and Heckman and Payner, however, highlight the importance of federal intervention in improving black outcomes. Orazem (1987) is quite similar to this paper in many dimensions. He examined two outcomes from segregated schools in Maryland from 1924-1938, daily school attendance and reading skills. He found that school inputs significantly explained variation in both average daily attendance and reading scores. Had blacks received more equal funding, their human capital accumulation would have been substantially enhanced. Bowles (1970) shows that better educated blacks were more likely to leave the South between 1955 and 1960 than poorly educated blacks. Margo (1991) shows the same for the time period 1900-1950.

Related to this literature is the work of Benabou (1993,1996ab). His work considers the macroeconomic implications of public schooling in a heterogeneous human capital world. Using a model with agglomeration returns to specialization, as in Tamura (1992, 1996, 2002, 2004), he shows that heterogeneity is detrimental not only for production in a static sense, but detrimental for economic growth. Differing education finance regimes produces differing rates of human capital convergence. Tamura (2001) provides a microfoundation for diminishing returns to educational resources. This feature is crucial for producing convergence in human capital. Diminishing returns to educational resources arise when teacher quality is relatively more important for human capital accumulation than class size (or teacher mentoring or teacher discipline). In this paper we assume

[17] In South Carolina from 1918-1934, total private philanthropy to black schools never exceeded 8 percent of total expenditures on black schools. Even if matching funding was required, total philanthropic expenditures would have induced no more than 15 percent of total expenditures on black schools, see Figure B-19 in Canaday (2003).

an extreme form of inequality in educational resources. Discriminating whites are able to extract rents from poor blacks. However in spite of this horrendous environment, black progress is merely hindered, not eliminated.

MODEL: DISCRIMINATION

In this section we present the two basic models of South Carolina education discrimination. There are two races of individuals, blacks and whites, and there are two discriminatory regions, plantations and towns. In the model we assume there are four distinct periods: slavery from 1840 to 1860, no discrimination from 1860 to 1890, Jim Crow from 1890 to 1950, and no discrimination from 1950 to the present.[18] Under slavery, blacks working on plantations are slaves and plantation owners are white. In the yeoman-town system, blacks are not slaves, but subject to discrimination in education provision from whites. During slavery we assume that blacks could run away, but at a cost both in terms of foregone consumption and utility.[19] On plantations, whites determine the consumption of their black slaves, the education expenditures for black slave children, their own consumption and the education expenditures for their own children.[20] White plantation owners understand that the more consumption that they allocate to their slaves, the greater proportion of slaves remain voluntarily. The more that they spend on the education of slave children, the greater proportion of slaves remain voluntarily. In equilibrium under slavery, no black slave leaves. There is a tradeoff, however in educational expenditures on slave children. When these children become adults, the more human capital they have, the cheaper it is for them to run away to a nondiscriminating district, but the more human capital they have, the more productive they are

[18] The American Civil War, 1861-1865, ended slavery in the Southern states of the United States. The 13th Amendment to the United States Constitution, ratified in 1865, abolished slavery in the United States. However as earlier mentioned, Reconstruction ended in the South with the contested 1876 Presidential election. US troops were removed from the South in 1877. The brief period 1865-1877 is treated in this paper as a continuation of slavery, but with exogenous migration of both whites and blacks. We assume that the full effects of Brown vs. Board of Education, 1954, and the Civil Rights Act of 1964 produce a discrimination free South Carolina starting with the 1970 generation.

[19] However we assume that since runaway slaves would be returned to their owners even if they escaped to a state without slavery, the cost of migration for black plantation slaves was prohibitive. We therefore assume in the numerical solutions that sufficiently high utility costs induce zero migration rates for these blacks during slavery.

[20] Furthermore we note that we assume the plantation owner places no weight on leisure utility of his slaves. Indeed Ransom & Sutch (1978) argure that much of the declining productivity in postbellum agriculture arises from increasing leisure of black plantation workers.

on the plantation. In towns, white yeomen have different decision rules. White yeoman control the tax rate on their own income, the tax rate on the black yeoman population and expenditures on their children's education and the children of black yeoman. Unlike white plantation owners, white yeoman do not employ blacks. Their return from discrimination comes from diverting tax resources from black yeoman to finance the education of their white children. As in Margo (1991), what constrains the white yeoman from extracting the entire black tax revenue is the potential for black yeoman to leave to a non-discriminating district. During Jim Crow, the town regime remains as before, however the plantation regime changes. We refer to them as the Higgs economy and the Ransom & Sutch economy. These two economies differ in the degree of discrimination present between 1890-1950. Under the Higgs economy all blacks are paid their marginal product of labor, however some blacks both on plantations and in some towns are discriminated against in education provision. Under the Ransom & Sutch economy, blacks on plantations are treated as slaves, that is to say they are victims of monopsony demand for their labor as well as discriminated against in education provision. Unlike the equilibrium result in slavery where no black slaves depart from the plantation, many black tenants will leave the plantation for non-discriminating regions. Finally in the no discrimination period, whites and blacks work in competitive non-discriminating labor markets and education provision is nondiscriminatory. The following table presents our time line of regimes under the two different economic arrangements during Jim Crow.

period	Higgs plantations	Higgs towns	Ransom & Sutch plantations	Ransom & Sutch towns
1840-1860	monopsony labor demand & education discrimination	competitive labor market & education discrimination	monopsony labor demand & education discrimination	competitive labor market & education discrimination
1860-1890	competitive labor market & no education discrimination	competitive labor market & no education discrimination	competitive labor market & no education discrimination	competitive labor market & no education discrimination
1890-1950	competitive labor market & education discrimination	competitive labor market & education discrimination	monopsony labor demand & education discrimination	competitive labor market & education discrimination
1890-1950	competitive labor market & no education discrimination	competitive labor market & no education discrimination	competitive labor market & no education discrimination	competitive labor market & no education discrimination

This section is divided into two parts, the first details the problem facing white plantation owners and black farm workers, and the second section presents the problem facing white yeoman and black yeoman. Since the problem facing white and black towns people is the same in both the slave regime and the Jim Crow regime there is no distinguishing between the two periods. However the plantation owner's problem varies between the slave regime and the Jim Crow regime. In the slave regime the plantation owner is a monopsonist as well as a monopoly provider of education to black slave children. In the Jim Crow regime, the plantation owner either hires back farm workers in a competitive labor market, but is a discriminator in provision of education (Higgs) or is a monopsonist employer of black farm workers and a discriminator in provision of education (Ransom & Sutch). Thus we present, sequentially, the slave regime and the Jim Crow regime models for the plantation region below.

White Plantation Owners and Black Farm Workers

Slave Regime.—

This subsection analyzes the problem facing white plantation owners and black workers under slavery. White plantation owners choose the amount of their income to finance schooling of their children, as well as the consumption for black slaves and educational expenditures on the children of black slaves. Black slaves decide whether to stay in the discriminating environment or migrate to a non-discriminating district.[21] Although in equilibrium all black slaves choose not to migrate, plantation owners still provide some schooling to the children of their black slaves because they make the future black slaves more productive, and reduces the willingness of current black slaves to run away, even at the expense of making it more costly to keep the future slaves on the plantation.

White plantation owners and black slaves work together to produce output. Assume that the single output is produced by these two types of labor in combination with land, which is owned by the white plantation owner. We assume that the output of the representative white plantation owner is given by:

$$y_t = Z_t L_t^{\sigma} h_t^{\alpha} (n_{bt} h_{bt}^{m})^{1-\alpha-\sigma} \tag{1}$$

where Z_t is the Total Factor Productivity in production, L_t is the land holdings of the white plantation owner, h_t is the human capital of the white plantation owner, n_{bt} is the number of black sharecroppers working on the plantation and h_{bt}^{m} is the mechanical human capital of the typical black slave.[22] This output specification allows that black slave mechanical human capital is a productive input, and hence contributes to a plantation owner's willingness to provide educational opportunities for sharecroppers. We assume that Z_t evolves as exogenous technological progress.[23] The production parameters satisfy, $1 > \alpha > 0$, $1 > \sigma > 0$, $\alpha + \sigma < 1$.

White plantation owners choose their own consumption, c_t, their expenditures on their children's education, X_t, and they monopsonistically provide their black slaves consumption and educa-

[21] In equilibrium no black slaves depart from the plantations until the end of the Civil War.

[22] In the economy there are two types of human capital, analytical (skilled) and mechanical. Analytical human capital can be used both on and off the plantation as an entrepreneur. Mechanical human capital is specific only to the plantation sector and only black slaves acquire this skill. This is similar to the dichotomous human capital in Becker, Murphy and Tamura (1990).

[23] We could have assumed that Z_t evolved exogenous to any individual, but endogenous in the sense of Romer (1986), Lucas (1988) or Tamura (1996,2002,2006). That is accumulation of human capital produces an external effect raising TFP. In the numerical solutions, we actually assume technological regress, $Z_{t+1} < Z_t$, which appears to accord with the declining soil productivity as well as the influence of the boll weevil.

tional provision, c_{bt}, X_{bt}. These are displayed in the following budget constraint facing the typical plantation owner:

$$c_t + X_t + n_{bt}(c_{bt} + X_{bt}) = y_t = Z_t L_t^{\sigma} h_t^{\alpha} (n_{bt} h_{bt}^m)^{1-\alpha-\sigma} \tag{2}$$

We model each plantation as its own education district with the plantation owner as the only voter. As in Tamura (2001), we assume that analytical human capital of the plantation owner's children depends on parental human capital, class size, $\frac{X_t}{g_w \overline{h}_t}$, and the relative human capital of teachers compared with parents, $\frac{\overline{h}_t}{h_t}$:

$$h_{t+1} = A h_t \left(\frac{X_t}{g_w \overline{h}_t} \right)^{\varepsilon \upsilon} \left(\frac{\overline{h}_t}{h_t} \right)^{(1-\varepsilon)\upsilon} \tag{3}$$

A white plantation owner's preferences are over their own consumption and the output available to their typical child. Their fertility is asexual and exogenous at g_w.[24]

$$\ln c_t + \delta \ln y_{t+1} \tag{4}$$

From (2) it is clear that plantation owners wish to provide for the human capital of their children, and also for the mechanical human capital of the black sharecropper children. Plantation owners are willing to provide mechanical human capital because it is directly productive in plantation production, but are less desirous of providing analytical human capital for the children of black sharecroppers, because it is only productive off of the plantation. We assume that education provision by plantation owners concentrate on mechanical education, hereafter referred to as mechanical education, versus universal education.[25] The mechanical education movement was spearheaded by a northerner, Samuel Chapman Armstrong, and an ex-slave, Booker T. Washington. Armstrong founded a school for black teachers in Hampton, VA in 1868 that emphasized the values of mechanical education. A similar school was founded by Washington in Tuskegee, AL in 1881. These schools placed little emphasis on trade and commercial training, and instead emphasized the values of hard work in unskilled tasks. The "Hampton-Tuskegee Idea" met vociferous opposition from many blacks, including W.E.B. Du Bois (1935).

Plantation owners hire within their black slave work force to provide mechanical education, but this education also produces as a joint product analytical human capital in fixed proportion.[26]

[24] In the numerical solutions below, we use the actual children ever born data for whites and blacks in South Carolina for g_w and g_b. The data comes from various US censuses.

[25] See Anderson (1987) for details regarding the mechanical and universal education movement.

[26] Appendix A shows the importance of having two types of black human capital. If there were only a single type of human capital, plantation owners would hire only the best teachers for the black slave children, just as they do for their own children. This is counterfactual.

The human capital accumulation technology for black plantation children is similar to Tamura (2001) and given by:

$$\begin{aligned} h^m_{bt+1} &= A h^m_{bt} \left(\frac{X_{bt}}{g_b h^T_t} \right)^{\varepsilon\nu} \\ h^a_{bt+1} &= \lambda_{t+1} h^a_{bt+1} \end{aligned} \quad (5)$$

where h^T_t is the human capital of the teacher. Since X_{bt} are resources spent hiring teachers, the term in parentheses is class size for black slave children.[27] We assume that white teachers are better at producing analytical human capital, but since this is not productive for the plantation owner, and increases the probability that tomorrow's slave with leave the plantation, this is clearly not a desirable option.[28] Since class size is the only input that matters in producing mechanical human capital, hiring white teachers with greater analytical human capital is a more costly method of producing mechanical human capital. Therefore only black slaves are hired to educate the children of slaves.[29] In this case black teachers are paid like their fellow sharecroppers, c_{bt}. Thus since only blacks will be hired to teach black slave children, class size will be given by:

$$\frac{s}{g_b} \quad (6)$$

where s is the proportion of slaves hired as teachers.[30]

[27] In lieu of a formal school, one can think of this as the "tutoring" of black children on the job (or in the fields) by black workers, compensated for teaching on the job the next generation of black workers.

[28] Assume that hiring white adults with greater amounts of analytical human capital produces mechanical and analytical human capital in the following manner:

$$\begin{aligned} h^m_{bt+1} &= A h^i_{bt} \left(\frac{X_{bt}}{g_b h^T_t} \right)^{\varepsilon\nu} \\ h^a_{bt+1} &= A \lambda_t h^m_{bt} \left(\frac{X_{bt}}{g_b h^T_t} \right)^{\varepsilon\nu} \left(\frac{h^T_t}{\lambda h^m_{bt}} \right)^{(1-\varepsilon)\nu} \end{aligned}$$

Observe that since $h^T_t > h^m_{bt}$, the white teacher produces less mechanical human capital than the black teacher, and more analytical human capital than the black teacher if $\varepsilon < \frac{1}{2}$, see Tamura (2001).

[29] To make this argument complete we must show that the reduction in the black slave workforce does not overturn this result. Let $(\widehat{c}_b, \widehat{X}_b)$ be the optimal choice of consumption and expenditures on education that a plantation owner would choose if she hired white teachers for the sharecropper children. The plantation owner's consumption is given by: $Z_t L^\sigma_t h^\alpha_t (n_{bt} h^i_{bt})^{1-\alpha-\sigma} - X_t - n_{bt}\widehat{c}_b - \widehat{X}_b$. Define $\widehat{s}$ as: $\widehat{s} Z_t L^\sigma_t h^\alpha_t (n_{bt} h^m_{bt})^{1-\alpha-\sigma} = \widehat{X}_b$. By concavity $Z_t L^\sigma_t h^\alpha_t (n_{bt} h^m_{bt})^{1-\alpha-\sigma} - X_t - n_{bt}\widehat{c}_b - \widehat{X}_b < Z_t L^\sigma_t h^\alpha_t ((1-\widehat{s}) n_{bt} h^m_{bt})^{1-\alpha-\sigma} - X_t - n_{bt}\widehat{c}_b$. Thus by hiring $\widehat{s}$ fraction of their sharecroppers as teachers, the plantation owner enjoys greater consumption and produces more mechanical human capital for the next generation of black slaves. In our solutions for hiring black slaves, the out migration rate is 0 for much of the period, so that providing more analytical human capital to their children does not have any salutory effect on their decision to stay.

[30] The correct class size is $\frac{s}{g_b}$ and not $\frac{s}{(1-s)g_b}$ because black teachers have the same fertility as black slaves, and

The number of black slaves per plantation is determined by the number of blacks who remain to work on the plantation. All blacks would like to migrate to an assumed non-disciminating district, however in equilibrium from 1840-1869 none will.[31] Define the number of blacks who work on the plantation as:

$$n_{bt} = N_{bt}\theta_t \tag{7}$$

where N_{bt} is the population of blacks per plantation at the start of period t, and θ_t is the proportion of blacks who choose to work on the plantation. We now turn to the determination of the fraction of blacks remaining on the plantation.

Plantation blacks face the choice of staying and working on the plantation and having their children receive education from the plantation district or pay a moving cost and migrate to a non-discriminating district both in terms of production and in terms of educational opportunities for their children. If a black chooses to stay on the plantation her utility is given by:

$$U(stay) = \ln c_{bt} + \delta \ln h^a_{bt+1} \tag{8}$$

where she cares about both the consumption she receives as well as the analytical human capital of her children. Fertility is asexual and exogenous for blacks as well, g_b. If a black migrates from the plantation she pays a cost that is proportional to her human capital as well as a psychic utility cost, and chooses the rate of taxation on her income to pay for the public schooling of her children. We assume that each individual that chooses to move pays the same proportional cost to move. Output produced by individuals not on the plantation is linear in their available analytical human capital. Thus utility from a move is given by:

$$U(move) = \ln\left(h^a_{bt}\left[1-\varphi\right]^{\kappa}\left[1-\tau_t\right]\right) + \delta \ln h^a_{bt+1} - f \tag{9}$$

where $[1-\varphi]^{\kappa}$ is the proportion of human capital that is available for production after a move, τ is the tax rate to pay for schooling of their children and f is the psychic utility cost of migration. The decision whether to move or not therefore comes from whether the utility after the move is bigger or smaller than the utility of staying. We assume:

$$1-\varphi = \theta \tag{10}$$

their children are educated on the plantation as well.

[31] In addition migrating blacks and whites (during Reconstruction and after 1950) need not remain in South Carolina. We exogenously specify a proportion that leave the state entirely in order to try and fit the population born in South Carolina but residing outside of South Carolina.

We assume that if most black slaves do not migrate, the foregone cost to a mover is low, however if many leave then the foregone cost is high as the coordination cost of moving many becomes much higher. Since a proportion s of black slaves are hired to be teachers, and black slaves are paid the same whether they are working or teaching, the white plantation optimization problem becomes:

$$\max_{\{X_t, c_{bt}, s_{bt}\}} \left\{ \begin{array}{c} \ln\left[Z_t L_t^{\sigma} h_t^{\alpha} (N_{bt}\theta_t(1-s_{bt})h_{bt}^m)^{1-\alpha-\sigma} - X_t - N_{bt}\theta_t c_{bt}\right] \\ +\delta \ln\left[Z_{t+1} L_{t+1}^{\sigma} h_{t+1}^{\alpha} (N_{bt}\theta_t\theta_{t+1}\frac{g_b}{g_w} h_{bt+1}^m)^{1-\alpha-\sigma}\right] \end{array} \right\} \tag{11}$$

where land holdings evolve as:

$$L_{t+1} = \frac{L_t}{g_w} \tag{12}$$

that is to say, population growth of plantation owners reduces the amount of land holdings of their progeny.[32] Let the maximum human capital in the South Carolina economy be $\overline{h}$. Appendix B shows that the form of the stay proportion is:

$$\theta_t = \min\left\{ \left[\frac{c_{bt}^{\frac{1}{1+\delta\varepsilon\nu}} s_{bt}^{\frac{\delta\varepsilon\nu}{1+\delta\varepsilon\nu}} \left(\frac{\lambda_{t+1}}{\lambda_t}\right)^{\frac{\delta}{1+\delta\varepsilon\nu}} (1+\delta\varepsilon\nu) e^{\frac{f}{1+\delta\varepsilon\nu}}}{(\delta\varepsilon\nu)^{\frac{\delta\varepsilon\nu}{1+\delta\varepsilon\nu}} (h_{bt}^a)^{\frac{1-\delta(1-2\varepsilon)\nu}{1+\delta\varepsilon\nu}} \left(\overline{h}_t\right)^{\frac{\delta(1-2\varepsilon)\nu}{1+\delta\varepsilon\nu}}} \right]^{\frac{1}{\kappa}}, 1 \right\} \tag{13}$$

The greater the consumption given to black slaves the larger the proportion that stay, the greater the fraction of slaves hired as teachers the larger the proportion of slaves that stay. The higher the analytical human capital of black slaves the more likely they are to leave. The better the available teachers in the economy, the more likely the slave will leave. This causes the plantation owner to reduce the amount of education to provide to her slaves' children. The higher the psychic cost of moving the greater the proportion of stayers. Appendix C solves for the case where $\theta_t = 1$.[33] Under this case we can solve for c_{bt} as a function of the share of black slaves hired as teachers:

$$c_{bt} = s_{bt}^{-\delta\varepsilon\nu} (\delta\varepsilon\nu)^{\delta\varepsilon\nu} (1+\delta\varepsilon\nu)^{-(1+\delta\varepsilon\nu)} (h_{bt}^a)^{1-\delta(1-2\varepsilon)\nu} \left(\overline{h}_t\right)^{\delta(1-2\varepsilon)\nu} \left(\frac{\lambda_t}{\lambda_{t+1}}\right)^{\delta} e^{-f} \tag{14}$$

While $\theta_t = 1$, the plantation owner internalizes the effect of black teacher hires on the black stay share facing her children, $\theta_{t+1}(s_{bt})$. Her objective becomes:

$$\max_{\{X_t, s_{bt}\}} \left\{ \begin{array}{c} \ln\left[Z_t L_t^{\sigma} h_t^{\alpha} (N_{bt}(1-s_{bt})h_{bt}^m)^{1-\alpha-\sigma} - X_t - N_{bt} c_{bt}(s_{bt})\right] \\ +\delta \ln\left[Z_{t+1} L_{t+1}^{\sigma} h_{t+1}^{\alpha} (N_{bt}\theta_{t+1}\frac{g_b}{g_w} h_{bt+1}^m)^{1-\alpha-\sigma}\right] \end{array} \right\} \tag{15}$$

[32] We abstract from primogeniture issues of inheritance.

[33] This can be produced by assuming a sufficiently large psychic cost of migration, f.

In this case the first order conditions for the plantation owner are

$$\begin{aligned}\frac{1}{c_t} &= \frac{\alpha\delta\varepsilon\nu}{X_t} \\ \frac{(1-\alpha-\sigma)\,y_t}{c_t\,(1-s_{bt})} + \frac{N_{bt}}{c_t}\frac{\partial c_{bt}}{\partial s_{bt}} &= \frac{\delta\,(1-\alpha-\sigma)\,\alpha\varepsilon\nu}{s_{bt}} - \frac{\delta\,(1-\alpha-\sigma)\,[1-\delta\,(1-2\varepsilon)\,\nu]\,\varepsilon\nu}{(1+\delta\varepsilon\nu)s_{bt}}\end{aligned} \tag{16}$$

The first Euler equation states that a plantation owner equates the marginal cost of additional resources to educate her children with the marginal benefit of educational expenditures. The second Euler equation equates the marginal cost of smaller classes with the marginal benefit of smaller classes. It is easy to show that plantation owners spend a fixed fraction on their own consumption and education for their children out of available resources:

$$\begin{aligned}c_t &= \frac{1}{1+\alpha\delta\varepsilon\nu}\,\{y_t - N_{bt}c_{bt}\} \\ X_t &= \frac{\alpha\delta\varepsilon\nu}{1+\alpha\delta\varepsilon\nu}\,\{y_t - N_{bt}c_{bt}\}\end{aligned} \tag{17}$$

Appendix C solves for the optimal share of black slaves hired as teachers, s_{bt} as well as optimal consumption for black share croppers, c_{bt}.

Reconstruction.—

Here we describe the behavior of plantation owners and former black slaves during Reconstruction, 1860-1890. Very slow population growth in South Carolina during this period informed us that many whites and blacks migrated out of the state during this period. In order not to change the analytics, we assumed that the direct utility costs of migration were negative during this period. We assume that white plantation owners may also choose to migrate out of South Carolina. We do not allow sales of land by migrating white plantation owners to those that remained behind. Instead we assume that the plantations are merely abandoned.[34] While this is extreme, we do this for analytical tractability. We also feel that the ravages of the Civil War and the deaths of many white plantation heirs or owners could in fact be captured by this assumption. Finally we assumed that plantation owners had different preferences than their predecessors during slavery and their descendents during Jim Crow. Specifically we assume that uncertainty about the future made these remaining plantation owners care about the human capital of their children, and not their plantation

[34] Referring to Ransom & Sutch (1978) we assume that the competitive supply of black plantation workers implied that some land was no longer economically viable to farm due to the rising supply price of labor. Since black workers chose to consume more leisure under the competitive labor market than was chosen during slavery, some land would no longer be useful for production. We model this by assuming that these marginal plantations are merely abandoned.

revenues. Remaining plantation owners hire black workers in order to maximize profits:

$$\max_{n_{bt}} \left\{ Z_t L_t^{\sigma} h_t^{\alpha} (n_{bt} h_{bt}^m)^{1-\alpha-\sigma} - w_{bt} n_{bt} \right\} \tag{18}$$

Black workers are paid their marginal product:

$$(1-\alpha-\sigma)\, Z_t L_t^{\sigma} h_t^{\alpha} (n_{bt} h_{bt}^m)^{-(\alpha+\sigma)} h_{bt}^m = w_{bt} \tag{19}$$

Thus profits per plantation are given by:

$$\Pi_t = (\alpha+\sigma)\, Z_t L_t^{\sigma} h_t^{\alpha} (n_{bt} h_{bt}^m)^{1-\alpha-\sigma} \tag{20}$$

However a plantation owner during this period of uncertainty does not care about the next generation's plantation, but rather the human capital of his children. Thus a remaining plantation owner maximizes:

$$\ln \Pi_t + \ln(1-\tau_t) + \delta \ln h_{t+1} \tag{21}$$

where the first two terms of merely adult consumption. The plantation owner educates his children by hiring the highest human capital individuals as teachers. Therefore a plantation owner's children will have human capital given by:

$$h_{t+1} = A h_t \left(\frac{\tau_t \Pi_t}{g_w \overline{h}_t} \right)^{\varepsilon \nu} \left(\frac{\overline{h}_t}{h_t} \right)^{(1-\varepsilon)\nu} \tag{22}$$

Now some plantation owners will choose to abandon their plantation and become a townsmen.[35] Like departing blacks previously, some human capital must be used during the migration, and there is a utlity cost associated with a move. This cost may be negative. In equilibrium with positive plantation owner migration requires that the utility of remaining plantation owners equals that of migrating former plantation owners:

$$\ln \Pi_t + \ln(1-\tau_t) + \delta \ln h_{t+1}^{stay} = \ln \left[\theta_{pt}^{\kappa_p} h_t \right] + \ln(1-\tau_t) + \delta \ln h_{t+1}^{move} - f_p \tag{23}$$

where θ_{pt} is the proportion of white plantation owners that do not migrate, and where:

$$\Pi_t = (\alpha+\sigma)\, Z_t \left(\frac{L_t}{\theta_{pt}} \right)^{\sigma} h_t^{\alpha} \left(\frac{\theta_{bt} N_{bt}}{\theta_{pt}} h_{bt}^m \right)^{1-\alpha-\sigma} \tag{24}$$

Notice that the profit function now explicitly depends on both the non migration rates for whites and blacks. Recall that L_t is the land per plantation owner in period t, but if only θ_{pt} plantation

[35] Some will remain in South Carolina, others will leave the state. We do not have any theory as to which they do, we merely specify an exogenous share that stay in South Carolina.

owners stay, the amount of land per remaining plantation owner rises proportionately. Also $\theta_{bt}N_{bt}$ are the number of blacks who choose to work on the plantation per original number of plantation owners, but if not all plantation owners choose to stay, then the black labor force per plantation rises to $\frac{\theta_{bt}N_{bt}}{\theta_{pt}}$. As with their plantation counterparts, former plantation whites will only hire the highest human capital individuals as teachers. This implies that the tax rates to finance education will be identical between whites who are plantation owners and whites that used to be plantation owners. This tax rate is given by:

$$\tau_t = \frac{\delta\varepsilon\nu}{1+\delta\varepsilon\nu} \tag{25}$$

Equalizing utility then implies:

$$\ln \Pi_t = \kappa_p \ln \theta_{pt} + \ln h_t - \frac{f_p}{1+\delta\varepsilon\nu} \tag{26}$$

Blacks have a choice of remaining on the plantation and receiving the competitive wage or moving. In equilibrium a black must be indifferent between working on the plantation and leaving:

$$\ln w_{bt} + \ln(1-\tau_t) + \delta \ln h^a_{bt+1} = \ln\left(\lambda h^m_{bt}\theta^{\kappa_b}_{bt}\right) + \ln(1-\tau_t) + \delta \ln h^a_{bt+1} - f_b \tag{27}$$

As with the plantation whites, the tax rate chosen by plantation blacks or blacks that migrate off the plantation are the same and equal to the white tax rate. Thus the second term on both sides of the equation drops out. Equalizing utilities produces:

$$(1+\delta\varepsilon\nu)\ln w_{bt} = (1+\delta\varepsilon\nu)\ln\left(\lambda h^m_{bt}\theta^{\kappa_b}_{bt}\right) - f_b \tag{28}$$

Recall that the wage to black plantation workers and the profit to plantation owners are given by:

$$\begin{aligned} w_{bt} &= (1-\alpha-\sigma)\, Z_t \left(\frac{L_t}{\theta_{pt}}\right)^{\sigma} h^{\alpha}_t \left(\frac{\theta_{bt}N_{bt}}{\theta_{pt}} h^m_{bt}\right)^{-(\alpha+\sigma)} h^m_{bt} \\ \Pi_t &= (\alpha+\sigma)\, Z_t \left(\frac{L_t}{\theta_{pt}}\right)^{\sigma} h^{\alpha}_t \left(\frac{\theta_{bt}N_{bt}}{\theta_{pt}} h^m_{bt}\right)^{1-\alpha-\sigma} \end{aligned}$$

Substituting for profits and wages into the equalizing utility for white plantation owners and black plantation workers forms a two equation system in $(\theta_{bt}, \theta_{pt})$. Due to log preferences this system can be solved as:

$$\theta_{bt} = \min(1, \left\{ \frac{(1-\alpha-\sigma)^R Z_t^{\kappa_p} L_t^{\sigma\kappa_p} h_t^{1-\alpha+\alpha\kappa_p} \exp(\frac{f_b R-(1-\alpha)f_p}{1+\delta\varepsilon\nu})}{(\alpha+\sigma)^{1-\alpha} (h_{bt}^m)^{\kappa_p(1-\alpha-\sigma)} N_{bt}^{1-\alpha+(\alpha+\sigma)\kappa_p} (h_{bt}^a)^R} \right\}^Q) \quad (29)$$

$$\theta_{pt} = \min(1, \left\{ \frac{(\alpha+\sigma) Z_t L_t^{\sigma} (\theta_{bt} N_{bt} h_{bt}^m)^{1-a-\sigma} \exp(\frac{f_p}{1+\delta\varepsilon\nu})}{h_t^{1-\alpha}} \right\}^R) \quad (30)$$

$$Q = \frac{1}{(1-\alpha)(1+\kappa_b)+\kappa_b\kappa_p}$$

$$R = \frac{1}{1-\alpha+\kappa_p}$$

For blacks higher levels of human capital produce higher rates of migration. More productive platntations, more land per plantation and greater costs of migration lower the rates of migration.

Jim Crow Regime.—

In this section we model the Jim Crow regime for plantation owners. Under the Ransom & Sutch world, the plantation owners act as slave owners prior to the Civil War, albeit since black plantation workers have had three periods of education the black workers have lower costs of out migration. Thus the Ransom & Sutch economy looks like the slave regime from above. We do not reproduce the argument in this section. However under Higgs (1977) plantation owners hire black workers in a competitive labor market. However plantation owners are able to collude in provision of education to the children of their black workers. As under slavery, white plantation owners desire only to invest in the mechanical human capital of their black workers. However, as above, even though hiring only black teachers to accomplish this task, analytical skills are acquired by black school children in proportion to the amount of mechanical skills acquired. White plantation owners choose a tax rate on their own income and another tax rate on black incomes. Furthermore they choose how much of the education revenues to spend on their own children's education and how much to spend on black children. Plantation owners hire black workers in order to maximize profits:

$$\max_{n_{bt}} \left\{ Z_t L_t^{\sigma} h_t^{\alpha} (n_{bt} h_{bt}^m)^{1-\alpha-\sigma} - w_{bt} n_{bt} \right\} \quad (31)$$

Black workers are paid their marginal product:

$$(1-\alpha-\sigma) Z_t L_t^{\sigma} h_t^{\alpha} (n_{bt} h_{bt}^m)^{-(\alpha+\sigma)} h_{bt}^m = w_{bt} \quad (32)$$

Thus profits per plantation are given by:

$$\Pi_t = (\alpha+\sigma) Z_t L_t^{\sigma} h_t^{\alpha} (n_{bt} h_{bt}^m)^{1-\alpha-\sigma} \quad (33)$$

We assume that there are M identical plantations that form a school district. The budget constraint facing the plantation school district, ignoring the M population of planters, is given by:

$$X_t + \theta_{bt} N_{bt} s_{bt} w_{bt} = \Pi_t \tau_t + \theta_{bt} N_{bt} w_{bt} \tau_{bt} \tag{34}$$

School tax revenues, given by the right hand side, arise from taxation of the plantation owner's profits, Π_t, and black workers' incomes, where $\theta_{bt} N_{bt}$ is the number of blacks working per white plantation owner either as workers or teachers, in the school district. Their number is allocated between those working on the plantation and those teaching the children of black workers. School expenditures are allocated between spending on plantation owner's children and hiring black teachers for the schooling of black workers. Market equilibrium for black workers implies that black teachers and black plantation workers are paid the same wage, w_{bt}. In equilibrium the number of black workers hired by the plantation and school district is equal to the number of blacks supplying labor:

$$n_{bt} + \theta_{bt} N_{bt} s_{bt} = \theta_{bt} N_{bt} \tag{35}$$

It is obvious then that the equilibrium number of black workers per plantation is given by: $n_{bt} = \theta_{bt} N_{bt}(1 - s_{bt})$. We assume that the plantation school district chooses the number of black teachers to hire in order to maximize the utility of the typical plantation owner, taken as given the equilibrium wage for black teachers. Hence the school district's objective is to choose the tax rate on white plantation owners, τ_t, black workers, τ_{bt}, how many black teachers to hire, s_{bt}, and as a consequence how much to spend per white plantation child, $\frac{X_t}{g_w}$, in order to maximize:

$$\max_{\tau_t, s_{bt}} \left\{ \begin{array}{c} \ln(1-\tau_t) + (1+\delta)\ln(\alpha+\sigma) + \ln(Z_t L_t^{\sigma} h_t^{\alpha} (\theta_{bt} N_{bt}(1-s_{bt}) h_{bt}^m)^{1-\alpha-\sigma}) \\ +\delta \ln(Z_{t+1} L_{t+1}^{\sigma} h_{t+1}^{\alpha} (\theta_{bt+1} \theta_{bt} N_{bt} (1-s_{bt+1}) \frac{g_b}{g_w} h_{bt+1}^m)^{1-\alpha-\sigma}) \end{array} \right\} \tag{36}$$

taking as given the wage rate to hire black teachers, w_{bt}, and the function determining the proportion of black adults choosing to stay on the plantation, θ_{bt}. The first order conditions determining the optimal choice of white tax rates, black tax rates and the number of black teachers are:

$$\frac{1}{1-\tau_t} = \frac{\delta \alpha \varepsilon \upsilon \Pi_t}{X_t} \tag{37}$$

$$\frac{(1+\delta)(1-\alpha-\sigma)}{\theta_{bt}} \frac{\partial \theta_{bt}}{\partial \tau_{bt}} = -\frac{\delta \alpha \varepsilon \upsilon}{X_t} \frac{\partial X_t}{\partial \tau_{bt}} \tag{38}$$

$$\frac{1-\alpha-\sigma}{1-s_{bt}} = \frac{(1+\delta)(1-\alpha-\sigma)}{\theta_{bt}} \frac{\partial \theta_{bt}}{\partial s_{bt}} + \frac{\delta \alpha \varepsilon \upsilon}{X_t} \frac{\partial X_t}{\partial s_{bt}} + \frac{\delta (1-\alpha-\sigma)}{\theta_{bt+1}} \frac{\partial \theta_{bt+1}}{\partial s_{bt}} + \frac{\delta (1-\alpha-\sigma) \varepsilon \upsilon}{s_{bt}} \tag{39}$$

We leave it to the Appendix D to describe the solution for the choice variables, however we can fairly compactly present them explicitly as well as implicitly below:

$$s_{bt} = \left\{ \frac{\delta\varepsilon\nu\left[1+\delta+1+\delta\alpha\varepsilon\upsilon\right]}{\kappa\left(1+\delta\varepsilon\nu\right)+\alpha+\sigma} + \frac{\delta\varepsilon\nu\left[\kappa\left(1+\delta\varepsilon\nu\right)-\left[1-\delta\left(1-2\varepsilon\right)\nu\right]\right]}{\kappa\left(1+\delta\varepsilon\nu\right)} \right\} / T$$

$$T = \left\{ \begin{array}{c} \frac{\delta\varepsilon\nu[2+\delta+\delta\alpha\varepsilon\upsilon]+1+\delta(1-\alpha-\sigma)+(1+\delta\alpha\varepsilon\upsilon)[1+\kappa(1+\delta\varepsilon\nu)]+\kappa(1+\delta\varepsilon\nu)}{\kappa(1+\delta\varepsilon\nu)+\alpha+\sigma} \\ +\frac{\delta\varepsilon\nu[\kappa(1+\delta\varepsilon\nu)-[1-\delta(1-2\varepsilon)\nu]]}{\kappa(1+\delta\varepsilon\nu)} \end{array} \right\} \quad (40)$$

Observe that the share of black workers hired to be teachers is constant during the Jim Crow era. The tax rate on blacks is a linear function of the share of black workers that are teachers:

$$\begin{aligned} \tau_{bt} &= P + Q s_{bt} \quad (41) \\ P &= \frac{\kappa[1+\delta\varepsilon\upsilon](1+\alpha\delta\varepsilon\upsilon)-(\alpha+\sigma)(1+\delta)}{(1-\alpha-\sigma)(1+\delta)+(1+\alpha\delta\varepsilon\upsilon)\{1+\kappa[1+\delta\varepsilon\upsilon]\}} \\ Q &= \frac{(1+\delta)+(1+\alpha\delta\varepsilon\upsilon)}{(1-\alpha-\sigma)(1+\delta)+(1+\alpha\delta\varepsilon\upsilon)\{1+\kappa[1+\delta\varepsilon\upsilon]\}} \end{aligned}$$

The relevant case for the Jim Crow era is for $\tau_{bt} > s_{bt}$. That is to say, white plantation school districts divert some of the tax proceeds paid by black workers to finance white schools. This is the case that we assume in the numerical solutions below, and hence the parameter restrictions necessary for this are assumed.

The tax rate on white plantation owners as well as the education expenditures X_t per plantation are given by:

$$\tau_t = \frac{\alpha\delta\varepsilon\upsilon}{1+\alpha\delta\varepsilon\upsilon} - \left(\frac{1-\alpha-\sigma}{\alpha+\sigma}\right)\left(\frac{1}{1+\alpha\delta\varepsilon\upsilon}\right)\left(\frac{\tau_{bt}-s_{bt}}{1-s_{bt}}\right) \quad (42)$$

$$X_t = \Pi_t \frac{\alpha\delta\varepsilon\upsilon}{1+\alpha\delta\varepsilon\upsilon}\left[1+\left(\frac{1-\alpha-\sigma}{\alpha+\sigma}\right)\left(\frac{\tau_{bt}-s_{bt}}{1-s_{bt}}\right)\right] \quad (43)$$

All that is left to be determined is the proportion of blacks who choose to remain on the plantation, θ_{bt}. Observe that plantation profits, Π_t depend on the wage rate, which in turn depends on the share of blacks who choose to stay on the plantation. Appendix D shows that the share of blacks that choose to remain on the plantation is given by:

$$\theta_{bt} = \min\left\{ \left[\frac{w_{bt}^{\frac{1}{1+\delta\varepsilon\nu}} (1-\tau_{bt})^{\frac{1}{1+\delta\varepsilon\nu}} s_{bt}^{\frac{\delta\varepsilon\nu}{1+\delta\varepsilon\nu}} \left(\frac{\lambda_{t+1}}{\lambda_t}\right)^{\frac{\delta}{1+\delta\varepsilon\nu}} (1+\delta\varepsilon\nu) e^{\frac{f}{1+\delta\varepsilon\nu}}}{(\delta\varepsilon\nu)^{\frac{\delta\varepsilon\nu}{1+\delta\varepsilon\nu}} (h_{bt}^a)^{\frac{1-\delta(1-2\varepsilon)\nu}{1+\delta\varepsilon\nu}} (\overline{h}_t)^{\frac{\delta(1-2\varepsilon)\nu}{1+\delta\varepsilon\nu}}} \right]^{\frac{1}{\kappa}}, 1 \right\} \quad (44)$$

Since all black workers are paid their marginal product, we can substitute (29) into the determination of equilibrium wages of black workers to produce a solution for w_{bt}

$$w_{bt}^{\kappa[1+\delta\varepsilon\upsilon]+\alpha+\sigma} = \left\{\frac{(1-\alpha-\sigma)\,Z_t L_t^{\sigma} h_t^{\alpha}}{([1-s_{bt}]N_{bt})^{(\alpha+\sigma)}}\right\}^{\kappa[1+\delta\varepsilon\upsilon]} \frac{(h_{bt}^{m})^{(1-\alpha-\sigma)\kappa[1+\delta\varepsilon\upsilon]+(1-\delta(1-2\varepsilon)\nu)(\alpha+\sigma)}}{R^{\alpha+\sigma}} \quad (45)$$

$$R = \frac{(1-\tau_b)s_b^{\delta\varepsilon\upsilon}\left(\frac{\lambda_{t+1}}{\lambda_t}\right)^{\delta}(1+\delta\varepsilon\nu)^{(1+\delta\varepsilon\nu)}e^{f}}{(\delta\varepsilon\nu)^{\delta\varepsilon\nu}\left(\overline{h}_t\right)^{\delta(1-2\varepsilon)\nu}}$$

Town whites and blacks

In this subsection we analyze the problem facing the blacks and whites in town school districts. Black townsmen residing in a discriminatory school district choose whether to remain in the district or to move into a non-discriminating district.[36] We show that unlike the plantation districts, black town districts produce a constant rate of out migration, for a fixed psychic cost of moving. Consider the problem facing the typical white yeoman. Unlike her plantation owning counterpart, the white townsman does not hire blacks in production. Instead both blacks and whites produce separately from each other. Whites choose the tax rates on their income, on black income in their district and the educational expenditures on white children and black children. Blacks and whites have the same preferences; they care about both their adult consumption and the human capital of their progeny:[37]

$$\ln c_t + \delta \ln h_{t+1} \quad (46)$$

Blacks face the choice of staying and working in a discriminatory environment or pay a moving cost and migrate to a nondiscriminating district both in terms of production and in terms of educational opportunities for her children. If a black chooses to stay in the discriminating town her utility is given by:

$$U(stay) = \ln c_{bt}^{y} + \delta \ln h_{bt+1}^{y} \quad (47)$$

where she cares about both the consumption she receives as well as the human capital of her children. Fertility is asexual and exogenous for blacks as well, g_b. If a black migrates from the discriminatory district she pays a proportional human capital cost, chooses the rate of taxation on her income to pay for the public schooling of her children. As before we assume that each individual that chooses to move pays the same proportional cost to move. Output produced by non-plantation individuals

[36] For ease of exposition in this section we hereafter refer to white and black townsmen as whites and blacks.

[37] Since there is no value to mechanical human capital off the plantation, both discriminating and non-discriminating town school districts provide education for analytical human capital. As such we drop the superscript on black human capital for simplicity.

is linear in her available human capital. Preferences are given by:

$$U(move) = \ln\left(h_{bt}\theta_{bt}^{\kappa}\left[1-\tau_t\right]\right) + \delta \ln h_{bt+1} - f \tag{48}$$

where θ_b is the proportion of blacks who remain in the discriminating school district, τ is the tax rate to pay for schooling of their children and f is the psychic utility cost of migration. The decision whether to move or not therefore comes from whether the utility after the move is bigger or smaller than the utility of staying.

Whites set the tax rate on both their incomes and the blacks in their district, as well as the expenditures on the education of their children and the expenditures on the children of blacks. Income is linear in the human capital of the adult. Therefore the budget constraint for blacks and whites, and the budget constraint for the public school district with N_{bt}^{y} blacks per white, where the superscript denotes that it is a town district, are:

$$c_t^y = h_t^y\left(1-\tau_t^y\right) \tag{49}$$

$$c_{bt}^y = h_{bt}^y\left(1-\tau_{bt}^y\right) \tag{50}$$

$$X_t^y + N_{bt}^y\theta_{bt}^y X_{bt}^y = h_t^y\tau_t^y + h_{bt}^y\tau_{bt}^y N_{bt}^y\theta_t^y \tag{51}$$

Whites do not care about the human capital of the children of blacks, they only care how much they can extract from blacks in order to pay for the education of their children. We assume that the extraction cannot be used to directly support consumption of whites. Holding the amount spent on the education of the children of blacks constant, X_{bt} constant, hiring the best teachers produces the higher proportion of stayers in the black yeoman population, greater θ_{bt}^y. This proves the following proposition:

Proposition 1 *It is optimal to hire the best possible teachers for both the white children and the black children.*

The white town district differs from the white plantation district in that black students receive a much higher skilled teacher.

Thus human capital in the next period for whites and blacks are:

$$h_{t+1}^y = Ah_t^y\left(\frac{X_t^y}{g_w h_t^T}\right)^{\varepsilon\nu}\left(\frac{h_t^T}{h_t^y}\right)^{(1-\varepsilon)\nu} \tag{52}$$

$$h_{bt+1}^y = Ah_{bt}^y\left(\frac{X_{bt}^y}{g_b h_t^T}\right)^{\varepsilon\nu}\left(\frac{h_t^T}{h_{bt}^y}\right)^{(1-\varepsilon)\nu} \tag{53}$$

With these results and ignoring terms not involving choice variables, the problem facing the typical white is:

$$\max_{\{\tau_t^y,\tau_{bt}^y,X_{bt}^y\}} \{\ln(1-\tau_t^y) + \delta\varepsilon\nu \ln[h_t^y\tau_t^y + h_{bt}^y\tau_{bt}^y N_{bt}^y\theta_t^y - N_{bt}^y\theta_t^y X_{bt}^y]\} \tag{54}$$

where the proportion of blacks that stay, ignoring the y superscript, in the discriminating district is

$$\theta_{bt}^y = \min\left\{\left[(1-\tau_{bt}^y)^{\frac{1}{1+\delta\varepsilon\nu}} X_{bt}^{y\frac{\delta\varepsilon\nu}{1+\delta\varepsilon\nu}} h_{bt}^{-\frac{\delta\varepsilon\nu}{1+\delta\varepsilon\nu}}(1+\delta\varepsilon\nu)(\delta\varepsilon\nu)^{\frac{-\delta\varepsilon\nu}{1+\delta\varepsilon\nu}} e^{\frac{f}{1+\delta\varepsilon\nu}}\right]^{\frac{1}{\kappa}}, 1\right\} \tag{55}$$

Notice that the functional form of the proportion of stayers in the black population is simlar to that found in the black plantation district. Inserting this into the white's preferences and differentiating with respect to the three control variables produces the following Euler equations:

$$\frac{1}{1-\tau_t^y} = \frac{\delta\varepsilon\nu h_t^y}{X_t^y} \tag{56}$$

$$\frac{\delta\varepsilon\nu N_{bt}^y\theta_t h_{bt}^y}{X_t^y} + \frac{\delta\varepsilon\nu}{X_t^y}\{N_{bt}^y h_{bt}^y\tau_{bt}^y - X_{bt}^y N_{bt}^y\}\frac{\partial\theta_t}{\partial\tau_{bt}^y} = 0 \tag{57}$$

$$-\frac{\delta\varepsilon\nu N_{bt}^y\theta_t}{X_t^y} + \frac{\delta\varepsilon\nu}{X_t^y}\{N_{bt}^y h_{bt}^y\tau_{bt}^y - X_{bt}^y N_{bt}^y\}\frac{\partial\theta_t}{\partial X_{bt}^y} = 0 \tag{58}$$

Unlike in the case of the plantation district, these Euler equations regarding the white tax rate, the black tax rate and the black expenditures on education can be easily solved, the details are contained in Appendix E. We present the results here:

$$\tau_{bt}^y = \frac{(1+\delta\varepsilon\nu)\kappa + \delta\varepsilon\nu}{(1+\kappa)(1+\delta\varepsilon\nu)} \tag{59}$$

$$X_{bt}^y = \frac{\delta\varepsilon\nu}{(1+\kappa)(1+\delta\varepsilon\nu)}h_{bt} \tag{60}$$

$$\tau_t^y = \frac{1}{1+\delta\varepsilon\nu}\max\left\{0, \delta\varepsilon\nu - \frac{\kappa}{(1+\kappa)^{\frac{1+\kappa}{\kappa}}}\frac{e^{\frac{f}{\kappa(1+\delta\varepsilon\nu)}}N_{bt}^y h_{bt}^y}{h_t^y}\right\} \tag{61}$$

$$\theta_t^y = e^{\frac{f}{\kappa(1+\delta\varepsilon\nu)}}\left(\frac{1}{1+\kappa}\right)^{\frac{1}{\kappa}} \tag{62}$$

Tax rates for blacks are much larger than they would be in a nondiscriminating district. The relative tax rate is given by:

$$\frac{\tau_{bt}^y}{\tau_t} = 1 + \frac{\kappa}{(1+\kappa)\delta\varepsilon\nu} \tag{63}$$

Under a calibrated version of the model the tax rate for education would equal the share of resources spent on education. In the US public and private expenditures on K-12 and higher education relative to GDP in 2001 amounts to (392+30+277)/10208 = .068. In a non-discriminating district the optimal tax rate is given by $\frac{\delta\varepsilon\nu}{1+\delta\varepsilon\nu}$. This produces an estimate of $\delta\varepsilon\nu = .073$. Replacing this into (48) implies that the discriminatory tax rate for black yeomen is 7.85 times greater than the non-discriminating tax rate, for $\kappa = 1$. If tax rates were identical, but the form of the discrimination took the form of differential property value assessment, this requires that black property was assessed at 7.85 times the value of a non-discriminating district. While blacks are being taxed at a much higher rate than their tax rate in a non-discriminating district, they receive less than they pay in. Taking the ratio of the expenditures to tax revenues produces:

$$\frac{X_{bt}^{y}}{\tau_{bt}^{y} h_{bt}^{y}} = \frac{\delta\varepsilon\nu}{(1+\delta\varepsilon\nu)\,\kappa + \delta\varepsilon\nu} \tag{64}$$

Again, using the calibrated values for $\delta\varepsilon\nu$ and $\kappa = 1$ imply that for every dollar paid in taxes, blacks receive only 6.4 cents! Thus white yeoman are able to divert almost 95 cents of every dollar received from black tax payers for white children's education![38]

No discrimination.—

In this regime, 1860-1889 and 1950-present, all parties are producing in competitive markets and non-discriminating districts. We also assume that there is complete segregation of schools, so that there are no subsidies from richer whites to poorer blacks in education funding. This is a stark assumption, but one that does not produce wildly inconsistent results. As such the equilibrium is quite simple. All school districts have the same tax rate, all school districts hire the same quality teachers and there exists income convergence. The equilibrium tax rates and expenditures per pupil are given by:

$$\tau_t = \frac{\delta\varepsilon\nu}{1+\delta\varepsilon\nu} \tag{65}$$

$$X_t = \frac{\delta\varepsilon\nu h_t}{(1+\delta\varepsilon\nu)\, g_i} \tag{66}$$

where g_i is the growth rate of population of group i.

[38] Data for 1920 from the plantation county Calhoun County shows an extraction rate of more than 40 percent. Hampton County, another plantation county may have had an extraction rate of more than 100 percent by 1920. For more on this see Canaday (2004). These are conservative estimates as about one third of education revenues came from taxes on railroads and other businesses. These revenues were always spent only on whites. Thus if blacks were to have received education expenditures from this source equal to their share of the child population, our measured extraction rates would be much higher. These suggest that it is possible that yeoman county extraction rates were extremely large. However it seems that the model produces excess extraction compared to the data. We believe that this is due to Southern fears of US government intervention.

NUMERICAL SOLUTIONS AND COMPARISON OF PLANTATIONS AND TOWNS

In this section we numerically solve for the time paths of the human capital of white plantation owners, white townsmen, black slaves, black plantation workers and black townsmen. We construct two types of counties. In the first county type all blacks are initially slaves on identical plantations, before becoming black workers subject to discrimination in education provision. The second county type contains black townsmen. We solve the model over four distinct regimes, 1840-1860 slavery, 1860-1890 Reconstruction, 1890-1950 Jim Crow, and 1950-2000 no discrimination.[39] The models, Higss (competitive) and Ransom & Sutch (monopsony) were solved over a grid of possible values of ε. Since the data clearly indicate convergence in educational inputs as well as convergence in incomes of whites and blacks, the teacher model of Tamura (2001) requires that $\varepsilon < .5$. We searched over five possible values of ε, .2, .265, .33, .40, .465. In comparing fits with multiple series, class sizes, teacher salary, etc., we chose as our metric evaluating the goodness of fit the aggregate $\overline{R}^2$. Thus we solved the models allowing for time varying values of the utility cost of migration, f_t, in order to best fit the following series: population of South Carolina born in South Carolina, the black share of South Carolina population, average black South Carolina class size, average white South Carolina class size and average South Carolina class size, average black South Carolina expenditures per pupil, average white South Carolina expenditures per pupil, average South Carolina expenditures per pupil, average expenditure per black South Carolina teacher, average expenditures per white South Carolina teacher, average South Carolina expenditures per teacher, real output per South Carolina worker, relative young black South Carolina output per worker, relative young black US output per worker, relative black South Carolina output per worker, relative black US output per worker, South Carolina children ever born, black life expectancy, white life expectancy and South Carolina life expectancy, South Carolina born residing outside of South Carolina. Ignoring series subscripts, we run the following regressions:

$$\ln y_t = \alpha + \beta \ln \widehat{y}_t + u_t$$

[39] As mentioned previously, slavery was eliminated by the XIII Amendment to the US Constitution in 1865. However the removal of federal troops after the 1876 Presidential election ended Reconstruction. A period in the model is 10 years, so the choices of parents in 1860 are assumed to be made with slavery in existence, but in equilibrium a common proportion of whites and blacks migrate out of South Carolina by 1870. Similarly we assume that parents in 1870 act as if slavery exists, but that in equilibrium a common proportion of whites and blacks migrate out of South Carolina by 1880. From 1880-1950 Jim Crow exists in districts with white control of school districts.

where y_t is the observation, $\widehat{y}_t$ is the model's predicted value, and u_t is a random error term assumed $N(0, \sigma^2)$. If the model perfectly explained the data, then the regression would return a coefficient of one on the log predicted value, a zero intercept and an R^2 equal to 1.[40] In these series, the preferred Higss (competitive) model was $\varepsilon = .265$. The preferred Ransom & Sutch (monopsony) model was $\varepsilon = .4$. In total there were 23 series that were fit. These 23 series were fit over three possible time periods, all years (1840-2000), pre Civil Rights years (1840-1950), and post Civil Rights years (1950-2000). The cummulative $\overline{R}^2$ for Higgs was 40.6010, distributed as (16.4226, 11.7185, 12.4599). The cummulative $\overline{R}^2$ for Ransom & Sutch was 38.552, distributed as (15.0062, 11.4272, 12.1218). Thus the Higgs model beat the Ransom & Sutch model over all years, in each sub period and in cummulative.

In order to present the material in a relatively clean manner, we calculate class size, for each district, blacks and whites in plantation counties (some are slaves and and some are in non-discriminating districts in plantation counties), black and white townsmen in town counties (some are in discriminating districts and others are in non-discriminating districts). In our solution we must choose parameters for δ, ε, ν, σ, α, κ, λ, A, g_b, g_w, and f. For land's share of output we assume that $\sigma = .15$. Furthermore we assume that α, the share of output that the plantation owner would receive in a competitive world is $\frac{3}{4}$. These two parameters imply that plantation owners would receive 90 percent of output from the plantation in a competitive economy. This places an extreme value on the income inequality of white plantation owners relative to their black slaves or workers. While we do not appeal to micro evidence for many of these parameters, we pick parameters in order to replicate some observable quantities. As mentioned earlier, average class size converges to the value $\frac{1+\delta\varepsilon\nu}{\delta\varepsilon\nu}g$, where g is the growth rate of population. In steady state we assume $g_b = g_w = 1.01$. From Turner, Tamura, Mulholland and Baier (2007), average class size for South Carolina in 2000 was 14.7. Average spending rate on education in the model converges to $\frac{\delta\varepsilon\nu}{1+\delta\varepsilon\nu}$. For the US total public and private spending per K-12 and higher education relative to GDP in 2001 was .068. The data on the black and white population in South Carolina from 1840-2000 provide information on relative population growth rates of blacks and whites. We pick fertility in order to match the fertility history of white and black South Carolina born, South Carolina residents. Table 4 presents the parameters as well as the calibrated steady state class size, actual class size and rate of spending on education. The demographic characteristics are given in the bottom panel of Table

[40] This technique for evaluating the goodness of fit of the solution with the actual data is used in Tamura (2006) and Simon and Tamura (2007).

4.

Table 5 presents the results of a regression of the actual log of South Carolina born South Carolina residents on the log of the models' predictions, for all years (top panel), 1840-1950 (middle panel) and 1950-2000 (bottom panel). The results are comparable between the Higgs model and the Ransom & Sutch model. Table 6 provides the results for the regressions of the log share of black population in South Carolina on the log of the models' predicted black population shares. As with Table 5, the top panel covers all years, 1840 to 2000; the middle panel covers the pre Civil Rights years (1840-1950), and the bottom panel contains the remaining years (1950-2000). Table 6 shows that for these data, the Ransom & Sutch model slightly outperforms the Higgs model, particularly for the 1950-2000 period. Figures 4 and 5 illustrate how well the solutions fit the data. From the figures, it is apparent that the model solutions fit the data quite well.

Figure 4: South Carolina born residents of South Carolina

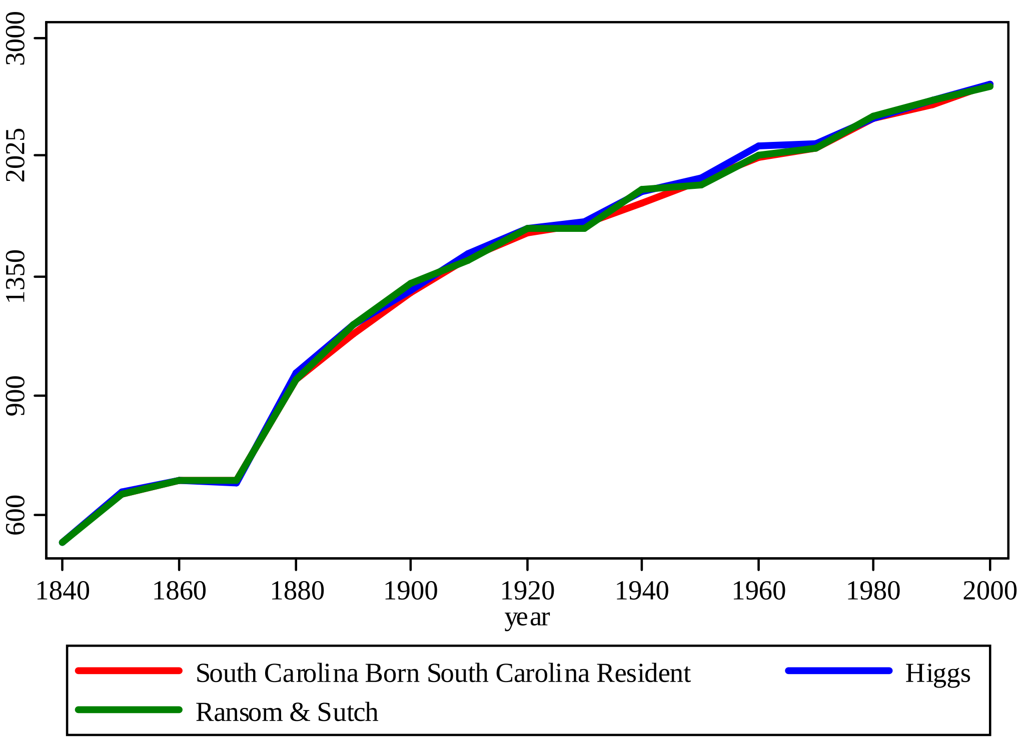


Figure 5: Black Share of South Carolina population

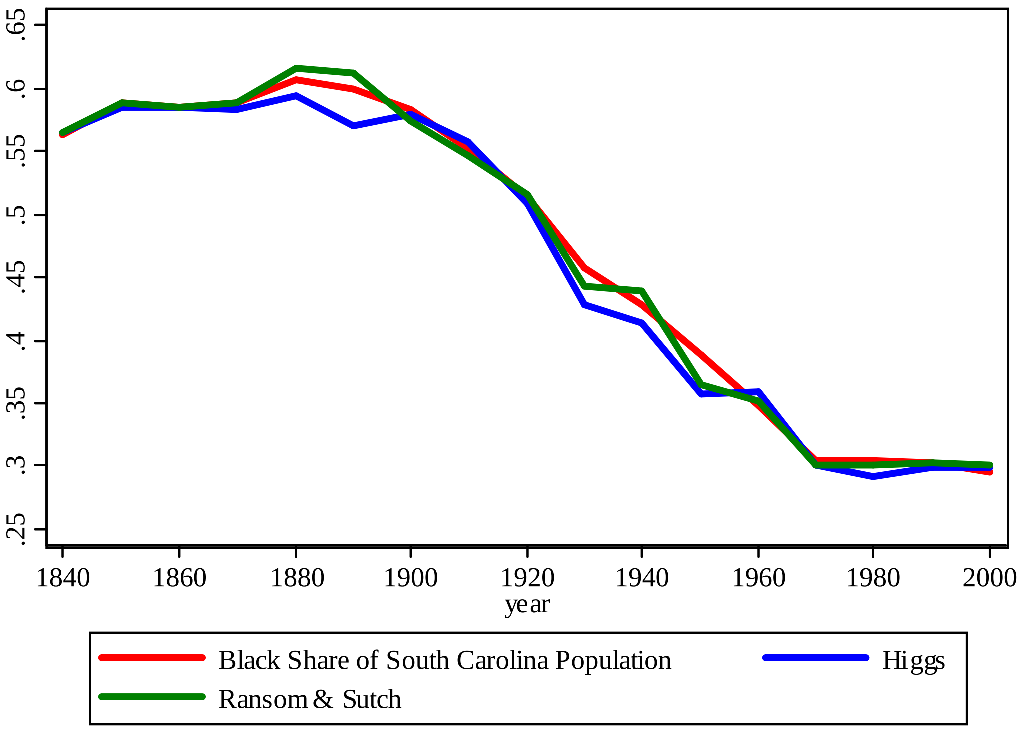
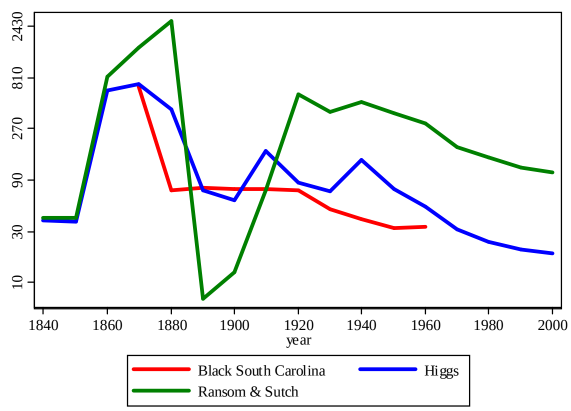


Figure 6 contains the Higgs and Ransom & Sutch model solutions for black South Carolina class size (left panel) and white South Carolina class size (right panel). The red lines in each graph contains the actual South Carolina data series. For both models, black class size falls generally from 1870 or 1880 until 1900 or 1910. There is a sharp increase in black class size in 1910 that arises from very large fertility of black women in that period. However from 1910 onward there is generally steady decline in black class size. For whites the models predict rising class size for whites reaching a peak in 1890 before declining.[41] Table 7 contains the regression results for these solutions. In the top panel we compare the two competing models for black class size. Since there is no black white schooling information after 1959, we confined the results to all years and the 1840-1950 subperiod. The Higgs model clearly outperforms the Ransom & Sutch model by a large degree. The $\overline{R}^2$ for the two time periods are .5 and .45 respectively, whereas for the Ransom & Sutch model they are

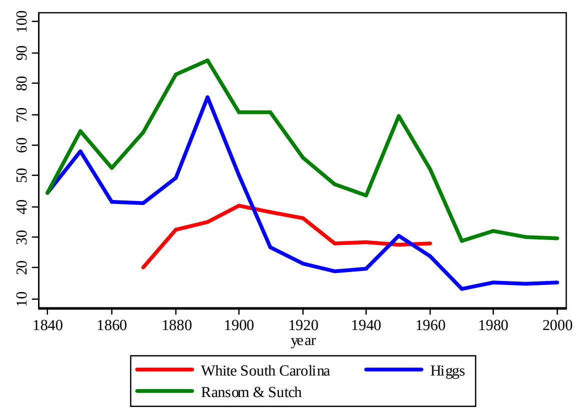
[41] In Figure 1, we graphed average class size for whites and blacks for the entire state. For the Plantation Counties and Town Counties we only used information on a subset of counties in the state in order to get a general feel for the data.

-.11 and -.12. In the middle panel, the Ransom & Sutch model outperforms the Higgs model for white class size, however to a lesser degree. The two $\overline{R}^2$ are -.08 and -.11 for Higgs versus .05 and .02 for Ransom & Sutch. For South Carolina class size the Higgs model outperforms the Ransom & Sutch model for all years by more than .55, is worse for the 1840-1950 period by .09 and .07 for the 1950-2000 period.

Figure 6: South Carolina Black Class Size



South Carolina White Class Size



South Carolina Class Size

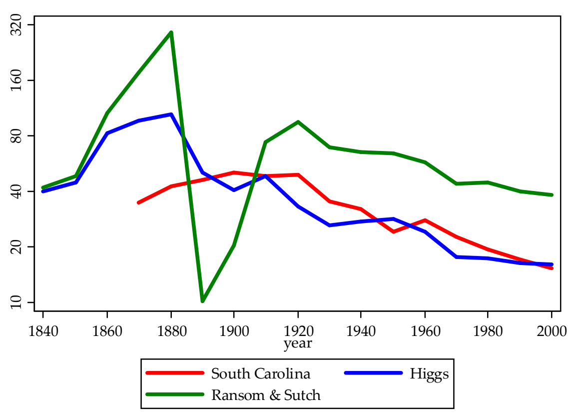
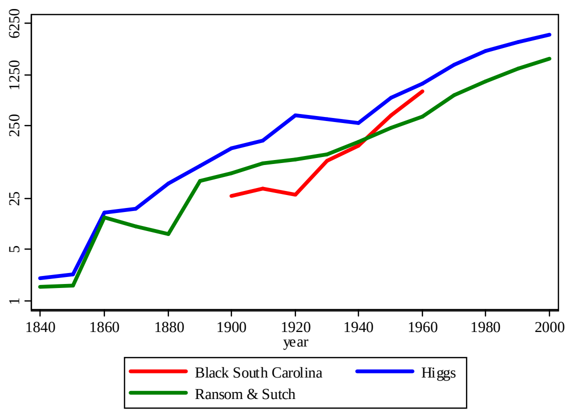
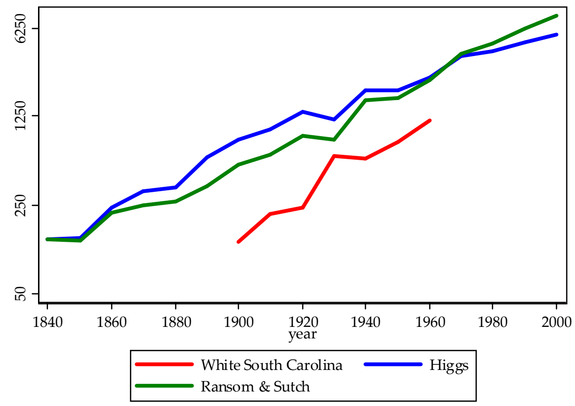


Figure 7 presents our results for average expenditures per pupil. The left panel presents the results for black expenditures per pupil and the right panel presents the results for white expenditures per pupil. It is clear that the both models fit the rising trend of real expenditures per pupil. Table 8 presents the results of the regressions. As with class size, there is no black, white breakdown for expenditures per pupil after 1959. Overall, the Ransom & Sutch model outperforms the Higgs model in fitting all three series. The average gap is .14 $\overline{R}^2$ units.

Figure 7: Black expenditures per pupil



White expenditures per pupil



South Carolina expenditures per pupil

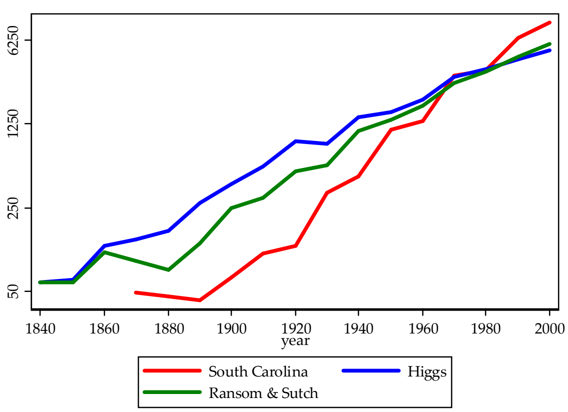


Figure 8 presents the results for relative black expenditures per pupil. Table 9 presents the results for relative expenditures and relative class size. The Ransom & Sutch model beats the Higgs model in relative expenditures by .1, but the Higgs model bests the Ransom & Sutch model by .33.

Figure 8: Relative Spending per Black South Carolina Pupil

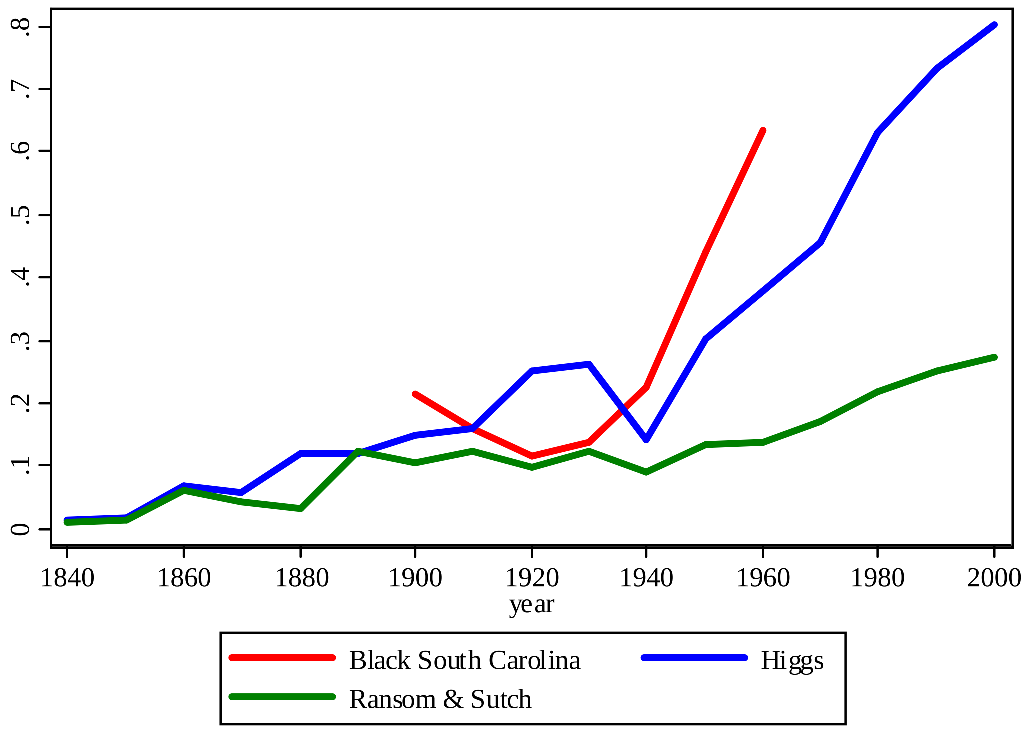
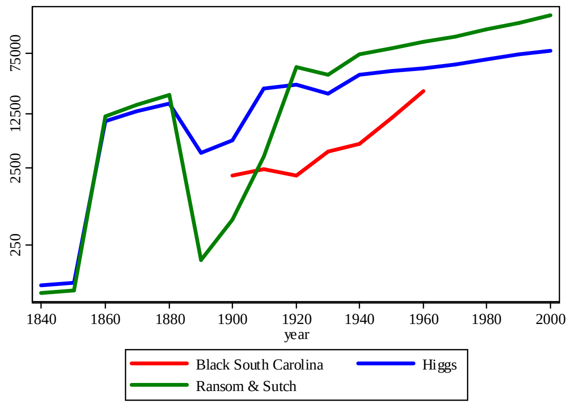
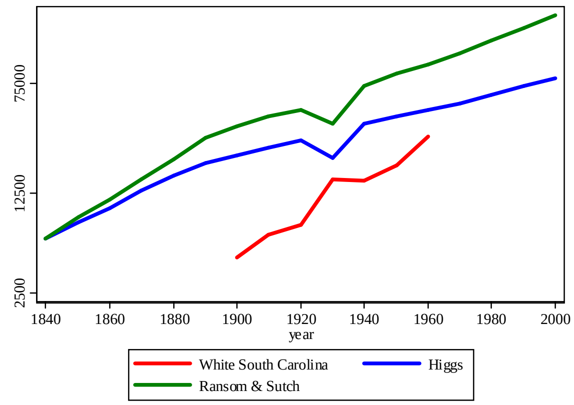


Figure 9 presents real expenditures per teacher. Both models capture rising spending per teacher for both blacks and whites. However it is clear from the graphs that average spending per teacher, like average spending per pupil, is too high for most of the period. Table 10 presents the regression results for black and white teacher spending. Overall, the Higgs model does better than the Ransom & Sutch model, although the Ransom & Sutch model actually has better $\overline{R}^2$ for four out of the seven series.

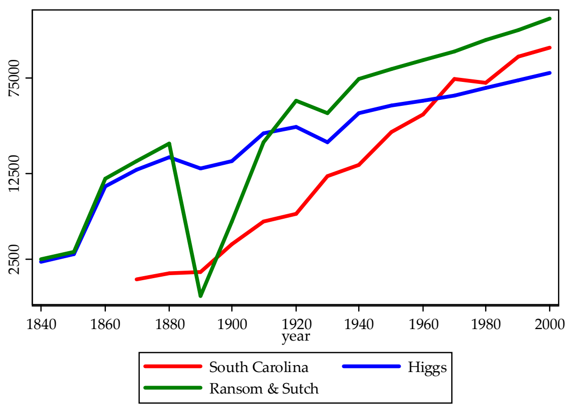
Figure 9: Real Spending Per Black Teacher



Real Spending Per White Teacher

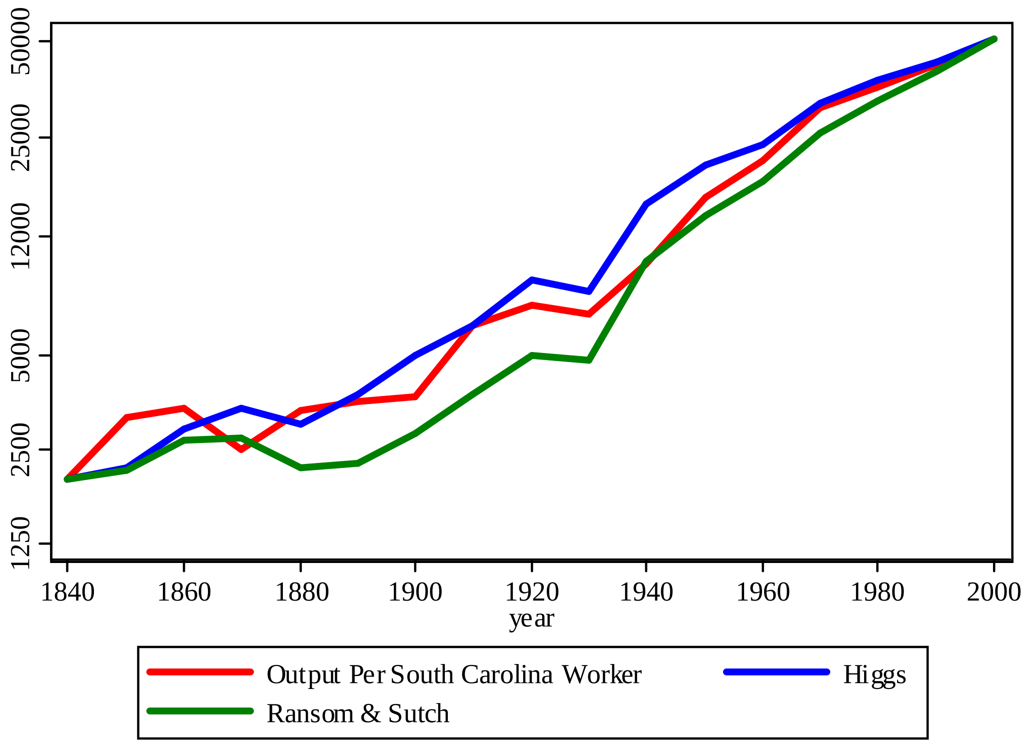


Real Spending Per South Carolina Teacher



We present the fit of the model for output per worker. The data are from Turner, Tamura, Mulholland and Baier (2007). There exists more volatility in output per worker in the data than in the model. However the fit is quite good. We calibrated the model in order to fit 1840 and 2000 output per worker, however the intervening years were determined by the model. The strength of the fit is evident in Figure 10 and Table 11. Overall the Higgs model has a slight positive bias in output per worker, whereas the Ransom & Sutch model has a slight negative bias in output per worker. The combined $\overline{R}^2$ are essentially identical, 2.88 compared with 2.85.

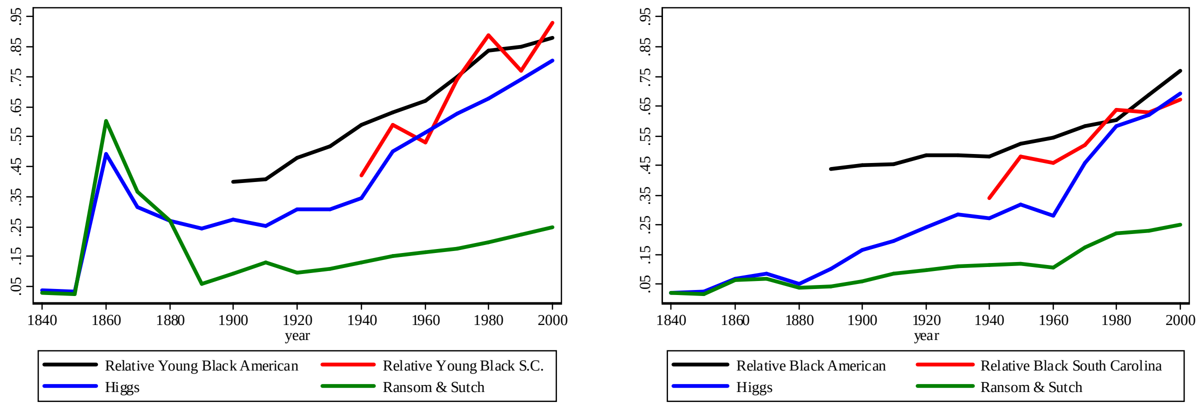
Figure 10: Real Output per South Carolina Worker



The model produces relative income for blacks. We use data from a variety of sources in order to compare our predictions with historical data. There are two different relative incomes, one for young workers just out of school, and another for all workers. We used data from the censuses 1940-2000 for South Carolina in order to estimate average income for blacks and whites, young workers and all workers. Finally we use data from Smith and Welch (1989), Smith (1993) and Couch and Daly (2000) for relative black income for the United States. The results of this are contained in Figure 11, the regression results in Table 12, and the data in Table 13. For young blacks either in comparison with the young whites in the US or with young whites in South Carolina, there is little to distinguish between the Higgs model and the Ransom & Sutch model. However for all blacks in comparison with all whites in the US and all whites in South Carolina, the Higgs model clearly bests the Ransom & Sutch model. Also for the 1950-2000 period, the Higgs model clearly outperforms the Ransom & Sutch model. The average gain in $\overline{R}^2$ is .14. Table 13 also shows the model's prediction of black relative income prior to the 20th century. Blacks earned less than 10 cents on the dollar of a typical white.

Figure 11: Relative Black Income: Young Workers

Relative Black Income: All Workers

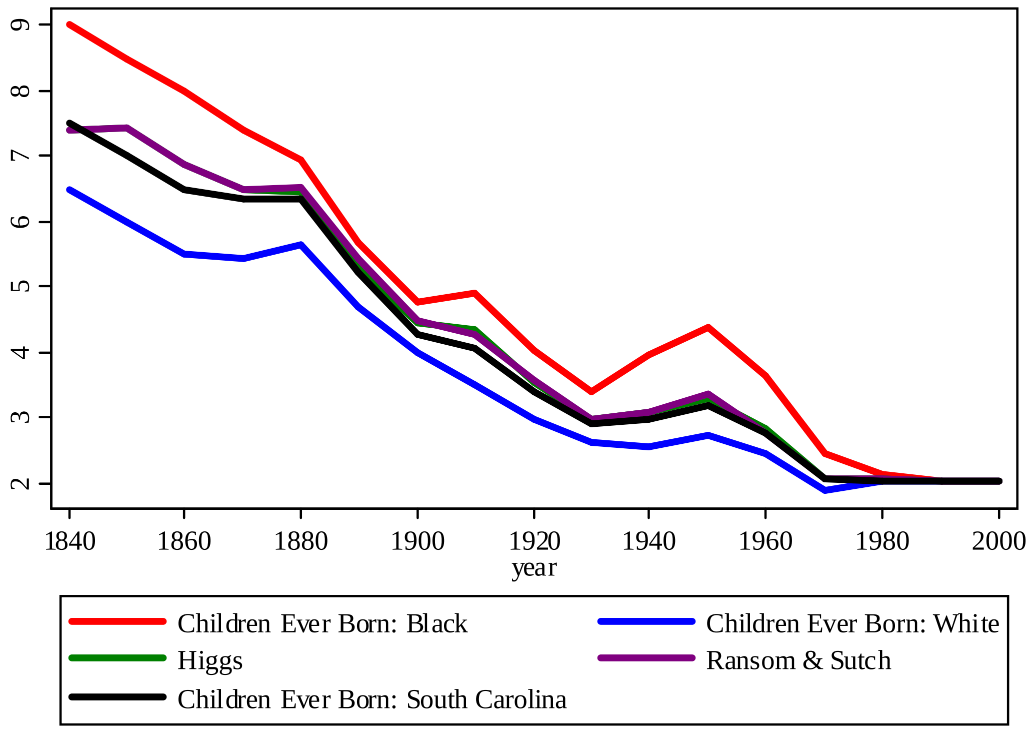


Recall that we exogenously specified the fertility of both blacks and whites. The Figure 12 presents the children ever born by each generation of workers.[42] As can be seen, the general fit for blacks and whites, as well as South Carolina fertility compared to the US average is excellent. We use children ever born to ever married women, instead of the more commonly used total fertility rate in order to eliminate effects of timing of births.[43] Black women had almost 2 more children than white women in 1840, 7 versus 5.25. Their demographic transition to lower fertility occurred about one decade later than for white women, 1880 versus 1870. By 1980, however, black women were having almost the identical number of children in their lifetime, 2.12 versus 2.02 as white women. Table 14 presents the evidence on the goodness of the two models; they both perform virtually identically well.

[42] In the calculations of children ever born, we took the weighted fertility of 15-24 year olds, 25-34 year olds and 35-44 year olds. The weights were the survival probabilities that were exogenously chosen for each age group.

[43] This is the same measure used in Simon and Tamura (2006) and Tamura and Simon (2006).

Figure 12: Children Ever Born, Black, White and South Carolina

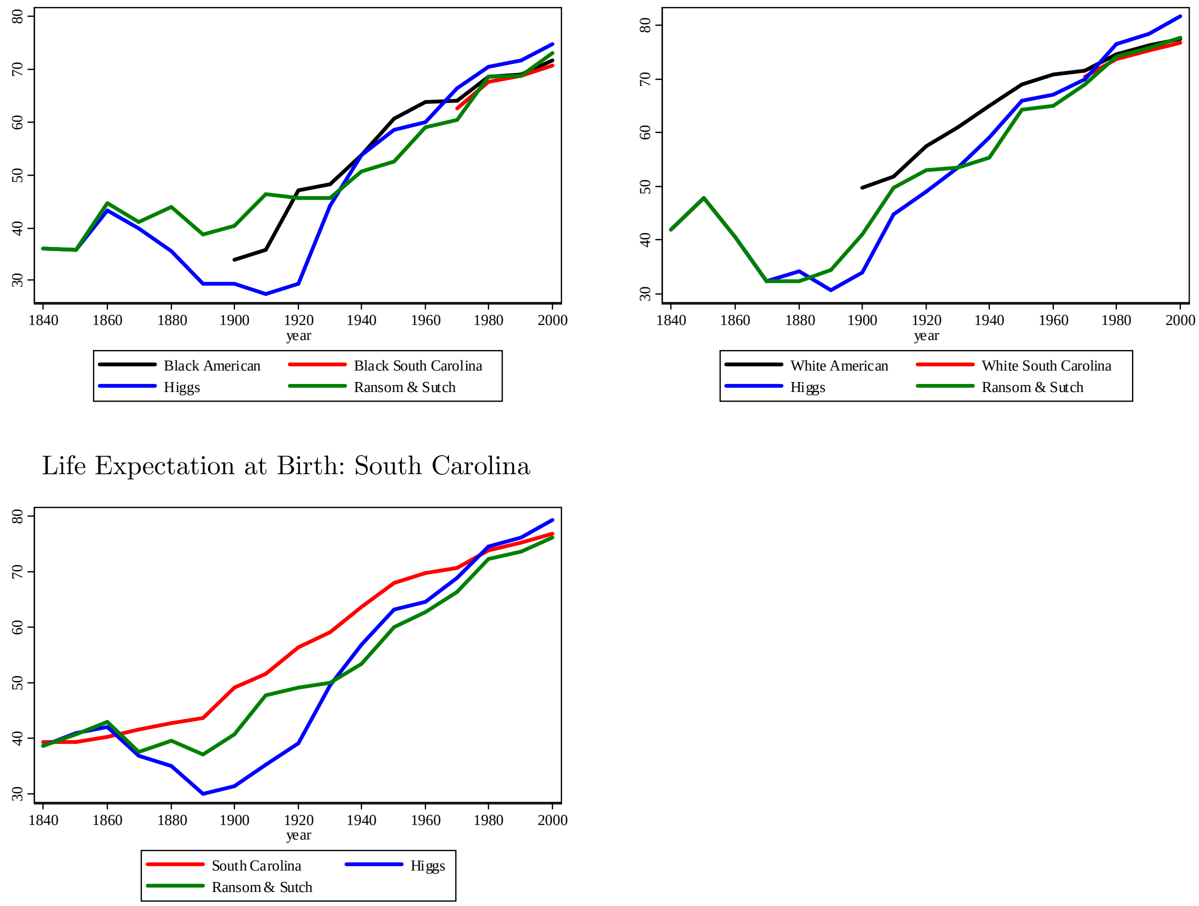


In order to fit the population of South Carolinians born in South Carolina, we used the aforementioned exogenous fertility process as well as exogenous survival probabilities.[44] The result produces life expectation at birth for both whites and blacks. These are contained in Figure 13. Table 15 contains the regression results on goodness of fit. The model does a very good job at fitting the life expectation at birth.[45]

[44] In the model solution, we think of the typical decision maker modeled above as being a woman aged 15. We use a period length of 10 years, so that at the end of the period she is 25, and her surviving children are 15. Thus the model produces overlapping generations of 5, 15, 25, 35, 45, 55 and 65 for the first 110 years. Starting in 1960 we assume that some 75 year olds survive and in 1970 some 85 year olds survive. These are the survival probabilities mentioned in the paper.

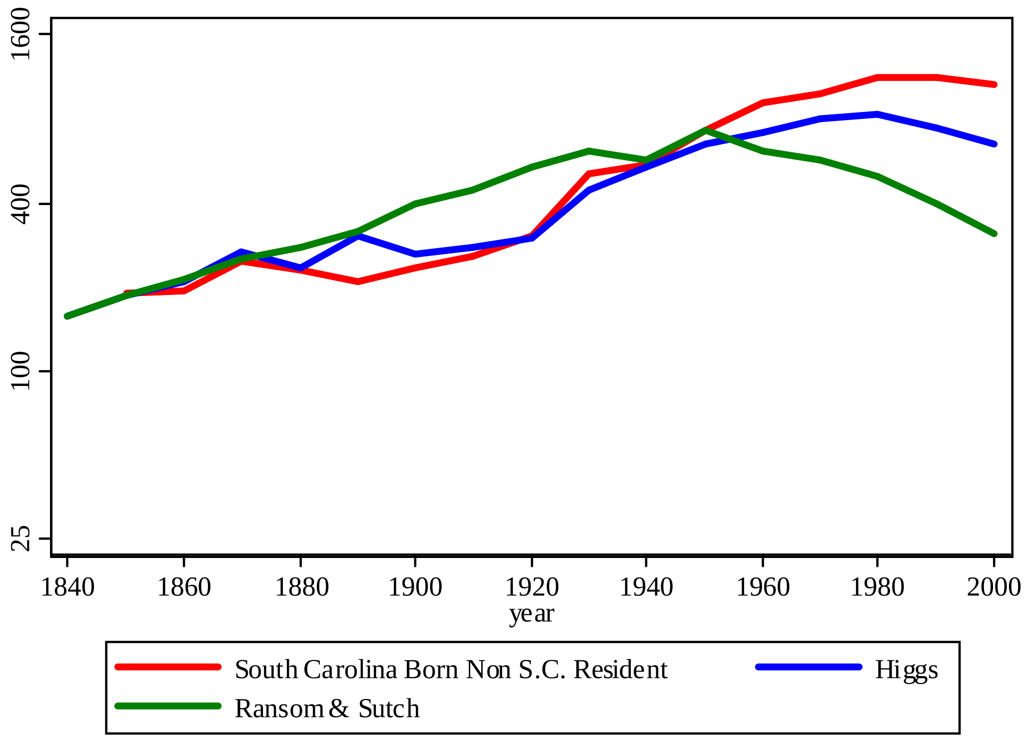
[45] There are no differences between the Civil Rights model and the World War I model, and hence we report only those from the Civil Rights model.

Figure 13: Life Expectation at Birth: Black



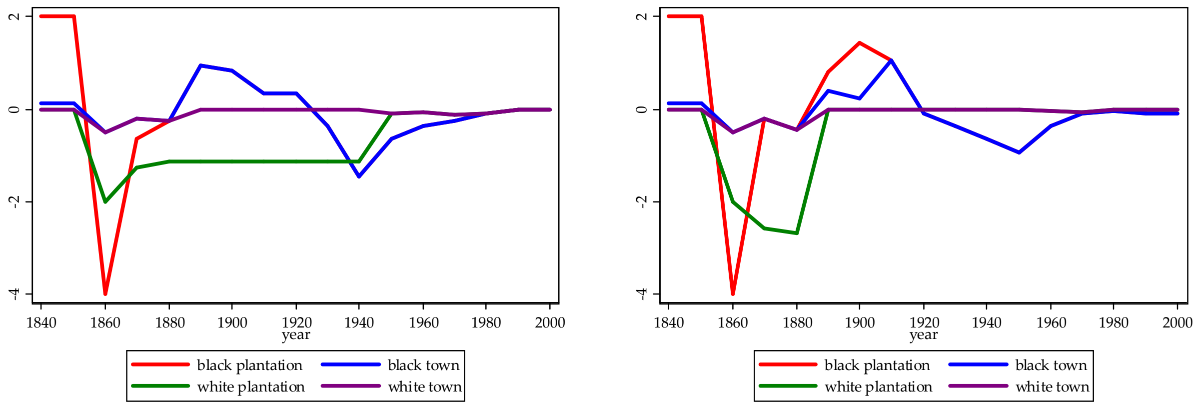
Finally we present the population born in South Carolina but living in a different state. This out migration provides a test of our model. Should the data be quite different from that predicted by the model, we would conclude that something is off in our ability to fit the departure rate of black workers from discriminating districts. Figure 14 presents the time series from the census as well as the model predictions. The model overpredicts the number of South Carolina born individuals, who have migrated out of South Carolina. However by 1930, the model predictions are dramatically too low. Table 16 presents the regression results of the goodness of fit. It is evident that the model fails conclusively, producing a negative $\overline{R}^2$. So while the model has been successful at fitting some features of the South Carolina history, it fails to capture the out migration of South Carolina born individuals. To remedy this we present a slight modification of the model by allowing for exogenous changes in the psychic cost of moving.

Figure 14: South Carolina born but Non South Carolina Resident



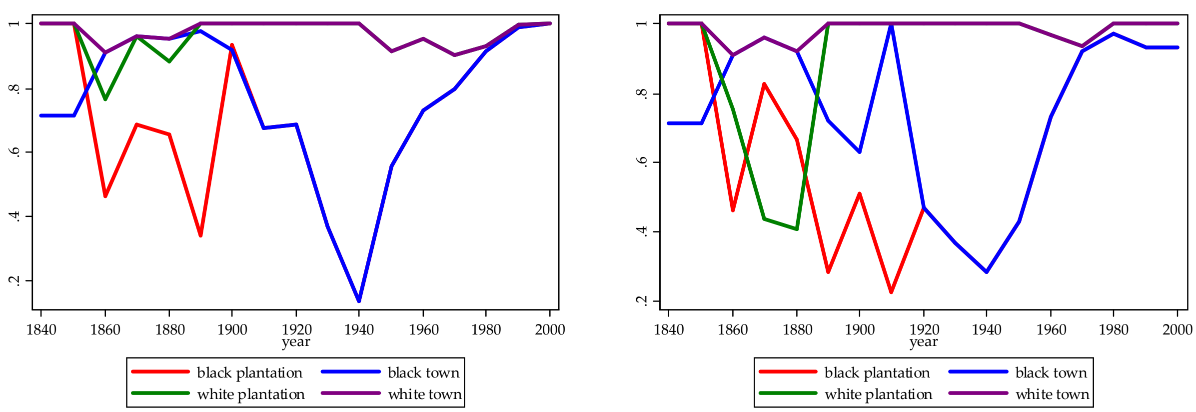
Finally we present the parameters of the cost of migration as well as the probability that an individual of each type chooses to stay where he was born. Figure 15 contains the utility cost of migration for black plantation workers, black town workers, white plantation owners and white town workers. The left panel is the Higgs model and the right panel is the Ransom & Sutch model.

Figure 15: Higgs　　　　Ransom & Sutch



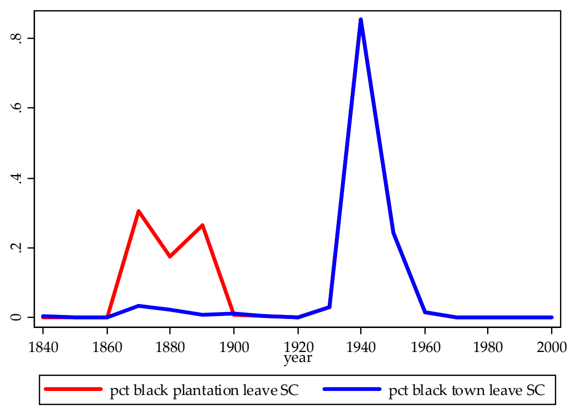
There are few differences in the models. Under the Higgs model, white plantation owners and white town workers have different costs of migration until 1950. Black plantation workers and black town workers become identical in their costs of migration after 1870. In the Ransom & Sutch specification white plantation owners and white town workers have identical costs of migration after 1880. Black plantation workers have identical costs of migration as their black town worker counterparts after 1900. Figure 16 contains the stay probabilities for each of these individual types.

Figure 16: Stay probabilities: Higgs　　　　Stay probability: Ransom & Sutch

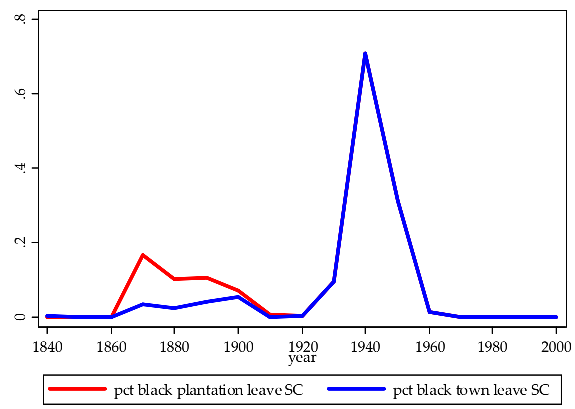


In both cases there are very low retention rates black plantation workers and black town workers over the 1860-1940 period. Under the Ransom & Sutch model there is large outflow of white plantation owners during Reconstruction. Not all of the outflow from the place of birth for blacks is a departure from South Carolina however. The final graph presents the proportion of blacks that depart from the state entirely.

Figure 17: Departure rate from S C: Higgs



Departure rate from S C: Ransom & Sutch



Again there is very little to distinguish between these two models. Both have higher rates of out of state migration right after the Civil War than before. The out migration rate in 1940 and 1950 is very high, capturing the effect of World War II on outflows.

CONCLUSION

This paper produces a model of human capital accumulation of whites and blacks in the presence of discrimination. There are two types of school districts, plantation districts and yeoman districts. During slavery in plantation districts, white plantation owners are monopsony employers of black sharecroppers and discriminating providers of black education. During Jim Crow in plantation districts, white plantation owners are competitive employers of black sharecroppers but discriminating providers of black education. In yeoman districts, white yeomen are discriminating providers of black education, but are not employers of black workers. For blacks in both discriminating districts, migration is costly, however it need not be prohibitive. This migration provides a reservation utility for black sharecroppers and black yeoman. The model indicates that black mobility and teacher quality, during the period of Jim Crow discrimination in South Carolina, was sufficient to offset the tremendous levels of discrimination facing blacks. That is to say, despite overwhelming disadvantages, blacks were able to achieve human capital growth during Jim Crow discrimination between 1880-1920. We also find that World War II appears to have been responsible for a break in the black-white relationship. Improved information about outside alternatives for blacks provide the impetus for even more rapid human capital accumulation for blacks prior to the United States government Civil Rights interventions: *Brown vs. Board of Education* (1954) and the *Voting Rights Act* (1964). Had plantation production and discrimination ended earlier, the rates of convergence would have increased dramatically.

Our preferred Higgs model produces predictions for native born South Carolina residents of South Carolina, the black share of population of South Carolina, per worker output, relative young black worker output, relative black worker output, black and white education expenditures, relative black education expenditures, black and white class size and relative black class size. All of these predictions are compared to historical South Carolina data. In general the model fits the historical data well.

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Table 1: South Carolina Population

year	*population* (*thousands*)	black share	rate of growth: SC	rate of growth: US
1790	249	.438	-	-
1800	345	.432	.326	.301
1810	415	.484	.185	.310
1820	502	.528	.190	.286
1830	581	.556	.146	.289
1840	594	.564	.022	.283
1850	669	.589	.119	.307
1860	703	.586	.050	.304
1870	706	.589	.004	.236
1880	995	.607	.343	.231
1890	1151	.599	.146	.227
1900	1340	.584	.152	.191
1910	1515	.552	.123	.191
1920	1684	.514	.106	.139
1930	1738	.457	.032	.150
1940	1898	.429	.088	.070
1950	2115	.389	.108	.135
1960	2380	.348	.118	.170
1970	2583	.305	.082	.126
1980	3121	.304	.189	.108
1990	3447	.302	.107	.093
2000	4012	.295	.152	.124

Table 2: Southern State Black Share

year	AL	GA	LA	MS	NC	SC	VA	US	Southern Share of black population
1790		.361			.269	.438	.442	.193	.733
1800		.368		.500	.293	.432	.454	.187	.733
1810		.425	.545	.548	.322	.484	.485	.189	.739
1820	.328	.443	.523	.440	.344	.528	.496	.184	.757
1830	.384	.426	.583	.482	.359	.556	.498	.181	.775
1840	.433	.411	.551	.524	.357	.564	.490	.168	.791
1850	.447	.425	.506	.512	.364	.589	.471	.157	.806
1860	.454	.441	.494	.552	.365	.586	.450	.141	.823
1870	.477	.460	.501	.536	.366	.589	.419	.127	.807
1880	.475	.470	.515	.574	.379	.607	.418	.131	.826
1890	.448	.468	.500	.576	.347	.599	.383	.119	.817
1900	.452	.467	.471	.585	.329	.584	.357	.116	.814
1910	.425	.451	.431	.561	.316	.552	.325	.107	.807
1920	.384	.416	.389	.522	.298	.514	.299	.099	.770
1930	.357	.368	.369	.502	.290	.457	.268	.097	.707
1940	.347	.347	.359	.492	.275	.429	.247	.098	.690
1950	.320	.309	.329	.453	.258	.389	.221	.100	.602
1960	.300	.285	.319	.421	.245	.348	.206	.106	.523
1970	.262	.259	.299	.368	.222	.305	.185	.111	.451
1980	.256	.268	.294	.352	.224	.304	.189	.118	.454
1990	.253	.270	.308	.356	.220	.302	.188	.123	.453
2000	.260	.287	.325	.363	.216	.295	.196	.123	.473

Table 3: Black Convergence in Educational Inputs[46]

State	Input	1890	1910	1935	1950
Alabama					
	expenditures	0.99	0.31	0.33	0.76
	school yr length	1.07	0.74	0.88	1.01
	class size	1.27	1.45	1.41	1.14
Florida					
	expenditures	0.49	0.28	0.41	0.80
	school yr length	1.00	0.81	0.97	1.00
	class size	1.55	2.00	1.15	1.09
Louisiana					
	expenditures	0.50	0.17	0.27	0.62
	school yr length	1.03	0.49	0.73	0.99
	class size	1.74	1.66	1.62	1.24
Mississippi					
	expenditures	0.50	0.28	0.23	0.31
	school yr length	1.09	0.91	0.82	0.87
	class size	1.49	2.11	1.39	1.29
North Carolina					
	expenditures	1.01	0.54	0.64	0.93
	school yr length	1.03	0.90	1.00	1.00
	class size	0.92	1.22	0.94	1.10
South Carolina					
	expenditures	NA	0.19	0.28	0.64
	school yr length	NA	0.64	0.73	0.97
	class size	1.92	1.87	1.34	1.10
Virginia					
	expenditures	0.69	0.42	0.52	0.88
	school yr length	1.08	0.89	0.97	1.00
	class size	1.45	1.30	1.03	1.11

[46] Relative expenditures per pupil ratios are taken from Margo (1990) Table 2.5, pp. 21-22; relative school year length are from Margo (1990) Table 2.6, p. 26, and relative class size are from Margo (1990) Table 2.7, p. 27.

Table 4: Parameter Values and Steady State Solutions vs. Data

parameter	Higgs Model	Ransom & Sutch Model	
δ	.54	.54	
ν	.52830189	.35	
ε	.265	.400	
σ	.15	.15	
α	.70	.70	
λ_t			
t $<$ 1880	.15	.15	
t $\geq$ 1880	.25	.25	
A	2.18	2.18	
initial conditions	white pop	discriminated black population	non discriminated black population
Plantation county	.275	7.70	.001375
Yeoman county	7.7	2.156	.0385
	white human capital	discriminated black human capital	non discriminated black human capital
Plantation county	50	20	3.5
Yeoman county	22.727273	2	3.5
	solution steady states		data
class size	14.4	14.4	14.7
education share	.0703	.0703	.0685

Table 5: South Carolina Born, South Carolina Resident (standard error)

all years	Higgs	Ransom & Sutch
predicted value	0.991	1.000
	(0.0078)	(.0076)
intercept	0.0552	-0.0117
	(0.057)	(0.055)
N	16	16
Prob > F	.0114	.0023
$\overline{R}^2$	.9991	.9991

1840 - 1950	Higgs	Ransom & Sutch
predicted value	0.984	0.991
	(0.010)	(0.011)
intercept	0.104	0.044
	(0.070)	(0.076)
N	11	11
Prob > F	.0302	.0086
$\overline{R}^2$	.9990	.9988

1950 - 2000	Higgs	Ransom & Sutch
predicted value	1.050	1.044
	(0.064)	(0.057)
intercept	-0.395	-0.353
	(0.496)	(0.443)
N	6	6
Prob > F	.2495	.1506
$\overline{R}^2$	.9815	.9851

Table 6: Black Share of South Carolina Population

(standard error)

all years	Higgs	Ransom & Sutch
predicted value	0.987	0.992
	(0.025)	(0.017)
intercept	0.007	-0.023
	(0.022)	(0.014)
N	17	17
Prob > F	.0671	.0092
$\overline{R}^2$	.9895	.9952

1840 - 1950	Higgs	Ransom & Sutch
predicted value	0.867	0.990
	(0.033)	(0.039)
intercept	-0.064	-0.024
	(0.022)	(0.024)
N	12	12
Prob > F	.0006	.0262
$\overline{R}^2$	.9845	.9835

1950 - 2000	Higgs	Ransom & Sutch
predicted value	1.058	0.998
	(0.203)	(0.098)
intercept	0.085	-0.15
	(0.235)	(0.110)
N	6	6
Prob > F	.6106	.4554
$\overline{R}^2$	.8391	.9536

Table 7: South Carolina Black & White Class Size

(standard error)

Black	Higgs	Ransom & Sutch	Higgs 1840 - 1950	R & S 1840 - 1950
predicted value	0.743	0.043	0.724	0.054
	(0.232)	(0.131)	(0.264)	(0.133)
intercept	0.698	4.034	0.804	4.07
	(1.13)	(0.737)	(1.31)	(0.746)
N	10	10	9	9
Prob>F	.0501	.0002	.0792	.0005
$\overline{R}^2$	.5061	-.1101	.4488	-.1163

White	Higgs	Ransom & Sutch	Higgs 1840 - 1950	R & S 1840 - 1950
predicted value	0.084	0.369	0.070	0.351
	(0.151)	(0.299)	(0.164)	(0.331)
intercept	3.14	1.89	3.19	1.97
	(0.529)	(1.25)	(0.581)	(1.39)
N	10	10	9	9
Prob>F	.0010	0	.0023	0
$\overline{R}^2$	-.0831	.0546	-.1136	.0160

South Carolina	Higgs	Ransom & Sutch	Higgs 1840 - 1950	R & S 1840 - 1950	Higgs 1950 - 2000	R & S 1950 - 2000
predicted value	0.489	-0.049	0.141	-0.078	0.757	0.787
	(0.131)	(0.111)	(0.173)	(0.064)	(0.294)	(0.270)
intercept	1.73	3.62	3.14	3.98	0.783	-0.038
	(0.462)	(0.449)	(0.661)	(0.266)	(0.874)	(1.05)
N	14	14	9	9	6	6
Prob>F	.0070	.0000	.0041	.0000	.4979	.0003
$\overline{R}^2$	.4983	-.0663	-.0437	.0572	.5305	.6002

Table 8: South Carolina Black & White Expenditures Per Pupil

(standard error)

Black	Higgs	Ransom & Sutch	Higgs 1840 - 1950	R & S 1840 - 1950
predicted value	1.593	2.012	1.363	2.023
	(0.399)	(0.180)	(0.585)	(0.286)
intercept	-4.61	-5.05	-3.38	-5.11
	(2.31)	(0.867)	(3.28)	(1.32)
N	7	7	6	6
Prob>F	.0134	.0052	0.0273	.0233
$\overline{R}^2$	.7133	.9538	.4701	.9076

White	Higgs	Ransom & Sutch	Higgs 1840 - 1950	R & S 1840 - 1950
predicted value	1.723	1.254	1.653	1.248
	(0.411)	(0.266)	(0.568)	(0.379)
intercept	-6.50	-2.71	-6.01	-2.68
	(2.99)	(1.86)	(4.08)	(2.59)
N	7	7	6	6
Prob>F	.0013	.0032	.0053	.0117
$\overline{R}^2$	.6840	.7796	.5993	.6640

South Carolina	Higgs	Ransom & Sutch	Higgs 1840 - 1950	R & S 1840 - 1950	Higgs 1950 - 2000	R & S 1950 - 2000
predicted value	1.557	1.283	1.172	1.084	1.761	1.405
	(0.128)	(0.069)	(0.221)	(0.138)	(0.152)	(0.102)
intercept	-4.67	-2.31	-2.40	-1.25	-6.07	-3.16
	(0.899)	(0.462)	(1.39)	(0.893)	(1.22)	(0.815)
N	14	14	9	9	6	6
Prob>F	.0001	.0002	.0006	.0021	.0188	.0349
$\overline{R}^2$	.9184	.9637	.7726	.8836	.9636	.9742

Table 9: Relative Black Expenditures Per Pupil & Relative Black Class Size

(standard error)

	Higgs expenditures	Ransom & Sutch expenditures	Higgs class	Ransom & Sutch class
predicted value	0.812	1.859	0.632	0.090
	(0.617)	(1.16)	(0.308)	(0.138)
intercept	-0.239	2.607	-0.007	0.741
	(0.957)	(2.55)	(0.485)	(0.345)
N	7	7	10	10
Prob>F	.9363	.0425	.1452	.0006
$\overline{R}^2$	.1089	.2075	.2632	-.0679

Table 10: Black & White Expenditures Per Teacher: Plantation, Town and South Carolina

(standard error)

Black	Higgs	Ransom & Sutch	Higgs 1840 - 1950	R & S 1840 - 1950
predicted value	0.864	0.236	0.574	0.163
	(0.439)	(0.124)	(0.358)	(0.096)
intercept	-0.326	6.18	2.41	6.67
	(4.47)	(1.23)	(3.61)	(0.922)
N	7	7	6	6
Prob>F	.0062	.0022	.0038	.0015
$\overline{R}^2$	.3247	.3044	.2390	.2762

White	Higgs	Ransom & Sutch	Higgs 1840 - 1950	R & S 1840 - 1950
predicted value	1.671	1.370	1.308	1.186
	(0.658)	(0.421)	(0.854)	(0.583)
intercept	-7.95	-5.67	-4.26	-3.70
	(6.83)	(4.63)	(8.80)	(6.36)
N	7	7	6	6
Prob>F	.0091	.0005	.0190	.0025
$\overline{R}^2$	.4756	.6153	.2120	.3853

South Carolina	Higgs	Ransom & Sutch	Higgs 1840 - 1950	R & S 1840 - 1950	Higgs 1950 - 2000	R & S 1950 - 2000
predicted value	2.432	0.723	2.039	0.391	2.480	1.683
	(0.173)	(0.144)	(0.347)	(0.164)	(0.385)	(0.244)
intercept	-15.73	1.96	-11.87	4.81	-16.2	-8.90
	(1.80)	(1.53)	(3.48)	(1.59)	(4.23)	(2.90)
N	14	14	9	9	6	6
Prob>F	0	.0045	.0001	.0031	.0399	.0012
$\overline{R}^2$	.9378	.6499	.8073	.3707	.8899	.9031

Table 11: Real Output Per Worker

(standard error)

	Higgs	Ransom & Sutch
predicted value	0.955	0.932
	(0.043)	(0.037)
intercept	0.330	0.809
	(0.393)	(0.325)
N	17	17
Prob>F	.1851	.0003
$\overline{R}^2$	.9689	.9760

1840 - 1950	Higgs	Ransom & Sutch
predicted value	0.789	0.918
	(0.070)	(0.096)
intercept	1.71	0.916
	(0.599)	(0.791)
N	12	12
Prob > F	.0177	.0052
$\overline{R}^2$	.9200	.8912

1950 - 2000	Higgs	Ransom & Sutch
predicted value	1.235	0.879
	(0.054)	(0.049)
intercept	-2.52	1.36
	(0.558)	(0.501)
N	6	6
Prob > F	.0094	.0090
$\overline{R}^2$	.9906	.9846

Table 12: Relative Young and All Black Income: US and South Carolina

(standard error)

	young US Higgs	young US R & S	young SC Higgs	young SC R & S
predicted value	0.646	0.727	0.949	1.183
	(0.051)	(0.051)	(0.175)	(0.235)
intercept	0.026	0.933	0.103	1.63
	(0.045)	(0.101)	(0.103)	(0.406)
N	11	11	7	7
Prob > F	0	0	.0891	0
$\overline{R}^2$	.9413	.9535	.8259	.8021

	all US Higgs	all US R & S	all SC Higgs	all SC R & S
predicted value	0.285	0.290	0.556	0.608
	(0.039)	(0.050)	(0.104)	(0.162)
intercept	-0.289	-0.006	-0.184	0.455
	(0.051)	(0.110)	(0.096)	(0.298)
N	12	12	7	7
Prob > F	0	0	.0036	0
$\overline{R}^2$	.8290	.7477	.8206	.6868

1950 - 2000	young US Higgs	young US R & S	all US Higgs	all US R & S
predicted value	0.770	0.709	0.424	0.375
	(0.092)	(0.116)	(0.050)	(0.105)
intercept	0.069	0.906	-0.256	0.174
	(0.043)	(0.193)	(0.041)	(0.188)
N	6	6	6	6
Prob > F	.0008	0	.0002	0
$\overline{R}^2$	.9321	.8793	.9354	.7025

Table 13: Black-White Human Capital Ratios & Black-White Earnings Ratios[47]

year	young model no WWI	young model WWI	young census SC	young census US	all model no WWI	all model WWI	all census SC	all census US
1840	.04	.04			.02	.02		
1850	.04	.04			.01	.01		
1860	.04	.04			.01	.01		
1870	.05	.05			.03	.03		
1880	.07	.07			.04	.04		
1890	.06	.06			.06	.06		.44
1900	.07	.06		.40	.06	.06		.45
1910	.07	.09		.41	.22	.21		.46
1920	.17	.17		.48	.12	.10		.48
1930	.29	.24		.52	.12	.11		.49
1940	.38	.32	.42	.59	.13	.14	.34	.48
1950	.47	.40	.59	.63	.15	.18	.48	.52
1960	.62	.52	.53	.67	.31	.33	.46	.54
1970	.60	.60	.74	.75	.47	.45	.52	.58
1980	.61	.67	.89	.84	.58	.51	.64	.60
1990	.71	.74	.77	.85	.61	.57	.63	.69
2000	.80	.80	.93	.88	.64	.63	.67	.77

[47] For relative young black male earnings, the Census for South Carolina has sample sizes for (blacks, whites): (621, 735 | 1940), (127, 283 | 1950), (410 | 1234 | 1960), (772, 2394 | 1970), (841, 2332 | 1980), (784, 2024, | 1990) and (864 | 1816 | 2000). For US young black males we used Smith (1984), Table 12. We report 15-25 year old males from 1890-1980. The 1990 value comes from Smith (1993), Table 1. The 2000 value comes from Couch and Daly (2000) for 1998 on black males with less than 6 years of work experience. For South Carolina black males, ages 20-60 who worked at least 39 weeks, we used census data for 1940-2000. The sample sizes (blacks, whites) are: (835, 1526 | 1940), (231, 589 | 1950), (799, 2835 | 1960), (1328, 4416 | 1970), (1376, 4520 | 1980), (1482, 4930 | 1990), (1865, 5471 | 2000). For US black males 20-64 we use Table 1 in Smith (1984) for 1890-1980. For Smith (1993) the 1990 value comes Card and Krueger (1993), Table 1. The 2000 value comes from Couch and Daly (2000) for year 1998.

Table 14: South Carolina Children Ever Born
(standard error)

	Higgs	Ransom & Sutch
predicted value	0.985	0.985
	(0.011)	(0.014)
intercept	-0.005	-0.016
	(0.016)	(0.021)
N	17	17
Prob > F	.0006	.0003
$\overline{R}^2$	.9979	.9966
1840 - 1950	Higgs	Ransom & Sutch
predicted value	1.008	1.039
	(0.020)	(0.021)
intercept	-0.045	-0.109
	(0.033)	(0.034)
N	12	12
Prob > F	.0030	.0001
$\overline{R}^2$	.9956	.9957
1950 - 2000	Higgs	Ransom & Sutch
predicted value	0.954	0.894
	(0.016)	(0.034)
intercept	0.026	0.069
	(0.014)	(0.030)
N	6	6
Prob > F	.0203	.0287
$\overline{R}^2$	.9986	.9930

Table 15: Black, White & SC Life Expectation

(standard error)

	black Higgs	black Ransom & Sutch	white Higgs	white Ransom & Sutch
predicted value	1.041	0.665	0.580	0.548
	(0.123)	(0.043)	(0.038)	(0.040)
intercept	-0.23	1.38	1.79	1.93
	(0.524)	(0.183)	(0.165)	(0.173)
N	4	4	4	4
Prob>F	.0214	.0075	.0056	.0067
$\overline{R}^2$	.9593	.9875	.9872	.9843

	all Higgs	all Ransom & Sutch
predicted value	0.663	0.702
	(0.094)	(0.112)
intercept	1.44	1.29
	(0.367)	(.435)
N	17	17
Prob>F	.0002	.0008
$\overline{R}^2$	.7514	.7050

	SC 1840 - 1950 Higgs	SC 1840 - 1950 Ransom & Sutch	SC 1950 - 2000 Higgs	SC 1950 - 2000 Ransom & Sutch
predicted value	0.587	0.680	0.499	0.344
	(0.203)	(0.290)	(0.039)	(0.037)
intercept	1.71	1.37	2.16	2.83
	(0.751)	(1.07)	(0.166)	(0.157)
N	12	12	6	6
Prob>F	.0033	.0088	.0004	.0001
$\overline{R}^2$	.4020	.2905	.9703	.9447

Table 16: South Carolina Born But Residing Outside of South Carolina

(standard error)

	Higgs	Ransom & Sutch
predicted value	1.309	1.205
	(0.073)	(0.110)
intercept	-1.78	-1.20
	(0.442)	(0.668)
N	16	16
Prob > F	.0013	.1703
$\overline{R}^2$	.9549	.8880

1840 - 1950	Higgs	Ransom & Sutch
predicted value	1.137	0.926
	(0.109)	(0.093)
intercept	-0.823	0.337
	(0.627)	(0.542)
N	11	11
Prob > F	.3348	.1200
$\overline{R}^2$	.9150	.9069

1950 - 2000	Higgs	Ransom & Sutch
predicted value	0.938	-0.237
	(0.657)	(0.583)
intercept	0.708	8.46
	(4.33)	(3.86)
N	6	6
Prob > F	.0207	.0314
$\overline{R}^2$	.1717	-.2007

Table 17: Immigration to the United States: 1900-1950 (millions)[48]

year	total immigration	total European immigration
1900-1904	3.255	3.095
1905-1909	4.947	4.539
1910-1914	5.175	4.524
1915-1919	1.173	0.532
1920-1924	2.775	1.787
1925-1929	1.521	0.789
1930-1934	0.427	0.260
1935-1939	0.272	0.186
1940-1944	0.204	0.098
1945-1949	0.653	0.376
1950-1954	1.099	0.717
1955-1959	1.400	0.690
1960-1964	1.419	0.550

[48] Series C89-119 "Immigrants, by Country: 1820-1970," *Historical Statistics of the United States: Colonial Times to 1970.*

A. IMPORTANCE OF TWO TYPES OF HUMAN CAPITAL

In this formulation we show that the assumption of two types of human capital is crucial for the result of hiring black teachers. Suppose that there was only one type of human capital. Furthermore assume that human capital is accumulated as:

$$h_{t+1} = Ah_t \left(\frac{X_t}{g_b h_t^T} \right)^{\varepsilon\nu} \left(\frac{h_t^T}{h_t} \right)^{(1-\varepsilon)\nu}$$

This technology allows for either of two different regimes, either the district hires the highest human captial adults to be teachers, or the lowest human capital adults to be teachers. In this paper we assume that the teacher population comes from either within a plantation district or from the yeoman district. In other words we ignore the possibility of importing teachers from outside of the state. Tamura (2001) shows that which hiring regime is chosen simply depends on the magnitude of ε. If $\varepsilon < \frac{1}{2}$, then human capital is maximized for a given expenditure, X, by hiring the highest human capital adults to be teachers. If on the other hand $\varepsilon > \frac{1}{2}$, then the mazimizing choice is to hire only the lowest human capital adults to be teachers. Thus the regime choice depends on the relative importance of class size versus relative teacher quality.

Assume $\varepsilon < \frac{1}{2}$. Perhaps surprisingly plantation owners decide to use the same quality of teachers for black sharecropper children as they do for their own children. Furthermore the teacher quality chosen by blacks in the non-discriminating district is the same as if they stayed, of course class sizes differ. We state this as the following proposition:

Proposition 2 *If there is only one type of human capital, white plantation owners choose to employ the same quality teachers for the children of their black sharecroppers as for their own children. Furthermore these teachers are the same quality as teachers black parents would choose if they lived in a nondiscriminating school district.*

Proof. White plantation owner can choose to hire either teachers for the children of black sharecroppers from the black population, or from the white population. If white plantation owners hire from the black population and ignoring stay shares equal to unity, Appendix B shows that the proportion of blacks that stay, θ, is given by:

$$\theta_t = \left[c_{bt}^{\frac{1}{1+\delta\varepsilon\nu}} X_{bt}^{\frac{\delta\varepsilon\nu}{1+\delta\varepsilon\nu}} h_{bt}^{-1} \left(\frac{\overline{h}_t}{h_t} \right)^{-\frac{\delta(1-2\varepsilon)\nu}{1+\delta\varepsilon\nu}} (1+\delta\varepsilon\nu)(\delta\varepsilon\nu)^{\frac{-\delta\varepsilon\nu}{1+\delta\varepsilon\nu}} e^{\frac{f}{1+\delta\varepsilon\nu}} \right]^{\frac{1}{\kappa}} \tag{67}$$

If on the other hand white plantation owners hire white teachers, and ignoring stay shares equal to unity, Appendix B shows that the share of blacks that stay under this hiring rule is given by:

$$\widehat{\theta}_{bt} = \left[\widehat{c}_{bt}^{\frac{1}{1+\delta\varepsilon\nu}} \widehat{X}_{bt}^{\frac{\delta\varepsilon\nu}{1+\delta\varepsilon\nu}} h_{bt}^{-1} (1+\delta\varepsilon\nu)(\delta\varepsilon\nu)^{\frac{-\delta\varepsilon\nu}{1+\delta\varepsilon\nu}} e^{\frac{f}{1+\delta\varepsilon\nu}}\right]^{\frac{1}{\kappa}} \tag{68}$$

Assume that the children of the current white plantation owners choose optimally, so that θ_{t+1} is chosen in order to maximize the utility of white plantation owners in period $t+1$. Let h_{bt+1} be any arbirtrary human capital of black sharecropper children chosen by white plantation owners. In order to achieve h_{bt+1} white plantation owners either can hire the best teachers or black teachers. The cost of hiring the best teachers relative to hiring black teachers is given by:

$$\widehat{X}_{bt} = X_{bt}\overline{h}_t \left(\frac{h_t}{\overline{h}_t}\right)^{\frac{1-\varepsilon}{\varepsilon}} \tag{69}$$

Consider the case where the proportion of black sharecroppers that stay is held constant between these two different hiring scenarios. Equating (54) with (55), substituting for $\widehat{X}_{bt}$ implies:

$$\widehat{c}_{bt} = c_{bt} h_t^{-\delta\varepsilon\nu} < c_{bt} \tag{70}$$

Thus total expenditures by white plantation owners on black sharecroppers is strictly less when they hire the best teachers, for any probability of staying as well as any human capital choice for the children of black sharecroppers. Thus it must be the case that white plantation owners choose to hire the best teachers for the education of black sharecropper children. Since the white plantation owner's children's problem is identical to the problem facing their parent's their optimal choice is to hire the best possible teachers for the education of their black sharecropper children. ■

Since a non-discriminating white teacher is paid the same whether he or she is teaching blacks or whites, then teacher salaries would be identical on plantations and off of plantations. This is counterfactual with the data. Thus we assume that there are two types of human capital.[49]

B. BLACK SLAVE MIGRATION PROBABILITY

If a black sharecropper-slave chooses to stay on the plantation and white plantation owners hire the black sharecroppers to teach black sharecropper children, then the sharecropper's utility is:

$$\ln c_{bt} + \delta \ln \left[A\lambda_{t+1} h_{bt}^m \left(\frac{s_{bt}}{g_b}\right)^{\varepsilon\nu}\right]$$

[49] We thank Bill Dougan for this insight.

If the blacksharecropper moves to a non-discriminating district her utility is given by:

$$\ln\left[\lambda_t h_{bt}^m \theta_{bt}^\kappa (1-\tau_{bt})\right] + \delta \ln\left[A\lambda_t h_{bt}^m \left(\frac{\tau_t \lambda_t h_{bt}^m \theta_{bt}^\kappa}{g_b h_t^T}\right)^{\varepsilon\nu} \left(\frac{h_t^T}{\lambda_t h_{bt}^m}\right)^{(1-\varepsilon)\nu}\right] - f$$

where θ_{bt} is the share of black slaves that remain on the plantation. Solving for the optimal tax rate in the non-discriminating district produces the following result:

$$\tau_{bt} = \frac{\delta\varepsilon\nu}{1+\delta\varepsilon\nu}$$

Observe that the optimal tax rate is independent of the level of human capital of the individual. Thus the blacks choice of tax rate is unanimous.

Equating utilities and simplifying produces:

$$\begin{aligned} \ln c_{bt} + \delta\varepsilon\nu \ln s_{bt} &= (1-\delta(1-2\varepsilon)\nu)\ln h_{bt}^m + (1+\delta-\delta(1-2\varepsilon)\nu)\ln\lambda_t - \delta\ln\lambda_{t+1} \\ &\quad +\delta(1-2\varepsilon)\nu\ln\overline{h}_t + (1+\delta\varepsilon\nu)\kappa\ln\theta_{bt} + \ln[1-\tau_{bt}] + \delta\varepsilon\nu\ln\tau_{bt} - f \end{aligned}$$

where $h_t^T = \overline{h}_t = \max\{h_t\}$, since $\varepsilon < \frac{1}{2}$. Substituting for τ_{bt} and solving for θ_{bt}, the probability of staying on the plantation produces:

$$\theta_t = \min\left\{\left[\frac{c_{bt}^{\frac{1}{1+\delta\varepsilon\nu}} s_{bt}^{\frac{\delta\varepsilon\nu}{1+\delta\varepsilon\nu}} \left(\frac{\lambda_{t+1}}{\lambda_t}\right)^{\frac{\delta}{1+\delta\varepsilon\nu}} (1+\delta\varepsilon\nu) e^{\frac{f}{1+\delta\varepsilon\nu}}}{(\delta\varepsilon\nu)^{\frac{\delta\varepsilon\nu}{1+\delta\varepsilon\nu}} \left(h_{bt}^a\right)^{\frac{1-\delta(1-2\varepsilon)\nu}{1+\delta\varepsilon\nu}} \left(\overline{h}_t\right)^{\frac{\delta(1-2\varepsilon)\nu}{1+\delta\varepsilon\nu}}}\right]^{\frac{1}{\kappa}}, 1\right\}$$

C. PLANTATION OWNER CHOICES: UNDER SLAVERY

We solve the slavery choice under the assumption that equilibrium slave migration is 0. Under no migration $\theta_{bt} = 1$ and therefore black consumption is given by:

$$c_{bt} = s_{bt}^{-\delta\varepsilon\nu} (\delta\varepsilon\nu)^{\delta\varepsilon\nu} (1+\delta\varepsilon\nu)^{-(1+\delta\varepsilon\nu)} \left(h_{bt}^a\right)^{1-\delta(1-2\varepsilon)\nu} \left(\overline{h}_t\right)^{\delta(1-2\varepsilon)\nu} \left(\frac{\lambda_t}{\lambda_{t+1}}\right)^{\delta} e^{-f}$$

While the plantation owner solves the problem in which $\theta_{bt} = 1$, she internalizes the effect higher black teacher hires today has on raising the cost of keeping black slaves on the plantation for her children. Substituting this into the plantation owner's objective function and differentiating with respect to black teacher hires and collecting terms produces:

$$\begin{aligned} 0 \;=\; & -\frac{(1-\alpha-\sigma) Z_t L_t^\sigma h_t^\alpha h_{bt}^{1-\alpha-\sigma} s_{bt}}{\left[N_{bt}(1-s_{bt})\right]^{\alpha+\sigma}} + \frac{(1-\alpha-\sigma)\left[1-\left(\frac{1-\delta[1-2\varepsilon]\nu}{\kappa[1+\delta\varepsilon\nu]}\right)\right] Z_t L_t^\sigma h_t^\alpha \left[h_{bt}(1-s_{bt})\right]^{1-\alpha-\sigma}}{(1+\alpha\delta\varepsilon\nu) N_{bt}^{\alpha+\sigma}} \\ & + s_{bt}^{-\delta\varepsilon\nu} h_{bt}^{1-\delta(1-2\varepsilon)\nu} (\delta\varepsilon\nu)^{\delta\varepsilon\nu} (1+\delta\varepsilon\nu)^{-(1+\delta\varepsilon\nu)} \overline{h}_t^{\delta(1-2\varepsilon)\nu} \left(\frac{\lambda_t}{\lambda_{t+1}}\right)^{\delta} e^{-f} \left[1 - \frac{1-\alpha-\sigma}{1+\alpha\delta\varepsilon\nu}\left[1-\left(\frac{1-\delta[1-2\varepsilon]\nu}{\kappa[1+\delta\varepsilon\nu]}\right)\right]\right] \end{aligned}$$

For $s_{bt} = 0$, the right hand side of the equation is ∞. For $s_{bt} = 1$, the right hand side is $-\infty$. The right hand side is monotone decreasing in s_{bt}. Therefore there is only one solution to the equation. We solved for the critical value of s_{bt} using the bisection method.

D. PLANTATION OWNER CHOICES: UNDER JIM CROW

In this Appendix we illustrate how we calculate the choices of plantation owners under Jim Crow. In this regime, plantation owners are price taking firms hiring black sharecropper labor in competitive markets. The white plantation school districts, however, are discriminating in their provision of education to black children. The typical white plantation owner maximizes plantation profits by hiring blacks at competitve wage w_{bt}:

$$\max_{n_{bt}} \left\{ Z_t L_t^{\sigma} h_t^{\alpha} (n_{bt} h_{bt}^m)^{1-\alpha-\sigma} - w_{bt} n_{bt} \right\}$$

Black workers are paid their marginal product:

$$(1-\alpha-\sigma)\, Z_t L_t^{\sigma} h_t^{\alpha} (n_{bt} h_{bt}^m)^{-(\alpha+\sigma)} h_{bt} = w_{bt}$$

Thus profits per plantation are given by:

$$\Pi_t = (\alpha+\sigma)\, Z_t L_t^{\sigma} h_t^{\alpha} (n_{bt} h_{bt}^m)^{1-\alpha-\sigma}$$

We assume that there are M identical plantations that form a school district. The budget constraint facing the plantation school district, ignoring the M population of planters, is given by:

$$X_t + \theta_{bt} N_{bt} s_{bt} w_{bt} = \Pi_t \tau_t + \theta_{bt} N_{bt} w_{bt} \tau_{bt}$$

School tax revenues, given by the right hand side, arise from taxation of the plantation owner's profits, and black workers' incomes, where $\theta_{bt} N_{bt}$ is the number of blacks working per white plantation owner, either as plantation workers or teachers, in the school district. Their number is allocated between those working on the plantation and those teaching the children of black workers. School expenditures are allocated between spending on plantation owner's children and hiring black teachers for the schooling of black workers, given by $\theta_{bt} N_{bt} s_{bt}$. Market equilibrium for black workers implies that black teachers and black plantation workers are paid the same wage, w_{bt}. In equilibrium the number of black workers hired by the plantation and school district is equal to the number of blacks supplying labor:

$$n_{bt} + \theta_{bt} N_{bt} s_{bt} = \theta_{bt} N_{bt}$$

It is obvious then that the equilibrium number of black workers per plantation is given by: $n_{bt} = \theta_{bt} N_{bt}(1 - s_{bt})$. We assume that the plantation school district chooses the number of black teachers to hire in order to maximize the utility of the typical plantation owner, taken as given the equilibrium wage for black teachers. Hence the school district's objective is to choose the tax rate on white plantation owners, τ_t, black workers, τ_{bt}, how many black teachers to hire, s_{bt}, and as a consequence how much to spend per white plantation child, $\frac{X_t}{g_w}$, in order to maximize:

$$\max_{\tau_t, s_{bt}} \left\{ \begin{array}{c} \ln(1-\tau_t) + (1+\delta)\ln(\alpha+\sigma) + \ln(Z_t L_t^{\sigma} h_t^{\alpha}(\theta_{bt} N_{bt}(1-s_{bt}) h_{bt}^m)^{1-\alpha-\sigma}) \\ +\delta \ln(Z_{t+1} L_{t+1}^{\sigma} h_{t+1}^{\alpha}(\theta_{bt+1}\theta_{bt} N_{bt}(1-s_{bt+1}) \frac{g_b}{g_w} h_{bt+1}^m)^{1-\alpha-\sigma}) \end{array} \right\}$$

taking as given the wage rate to hire black teachers, w_{bt}, and the function determining the proportion of black adults choosing to stay on the plantation, θ_{bt}. The first order conditions determining the optimal choice of white tax rates, black tax rates and the number of black teachers are:

$$\begin{aligned}
\frac{1}{1-\tau_t} &= \frac{\delta\alpha\varepsilon\upsilon\Pi_t}{X_t} \\
\frac{(1+\delta)(1-\alpha-\sigma)}{\theta_{bt}}\frac{\partial\theta_{bt}}{\partial\tau_{bt}} &= -\frac{\delta\alpha\varepsilon\upsilon}{X_t}\frac{\partial X_t}{\partial\tau_{bt}} \\
\frac{1-\alpha-\sigma}{1-s_{bt}} &= \frac{(1+\delta)(1-\alpha-\sigma)}{\theta_{bt}}\frac{\partial\theta_{bt}}{\partial s_{bt}} + \frac{\delta\alpha\varepsilon\upsilon}{X_t}\frac{\partial X_t}{\partial s_{bt}} + \frac{\delta(1-\alpha-\sigma)}{\theta_{bt+1}}\frac{\partial\theta_{bt+1}}{\partial s_{bt}} \\
&\quad + \frac{\delta(1-\alpha-\sigma)\varepsilon\upsilon}{s_{bt}}
\end{aligned}$$

Assuming positive outmigration of some black workers, the share of black sharecroppers that remain on the plantation is given by:

$$\theta_{bt} = \left\{ [w_{bt}(1-\tau_{bt})]\, s_{bt}^{\delta\varepsilon\nu} h_{bt}^{-(1-\delta(1-2\varepsilon)\nu)} \overline{h}_t^{-\delta(1-2\varepsilon)\nu} \lambda_t^{-(1+\delta[1-(1-2\varepsilon)\nu])} \lambda_{t+1}^{\delta} (1+\delta\varepsilon\nu)^{1+\delta\varepsilon\nu} (\delta\varepsilon\nu)^{-\delta\varepsilon\nu} e^{f} \right\}^{\frac{1}{\kappa(1+\delta\varepsilon\nu)}}$$

Given the budget constraint for the school district and the black stay share from above we get:

$$\begin{aligned}
\frac{\partial X_t}{\partial\tau_{bt}} &= \theta_{bt} N_{bt} w_{bt} + \frac{\partial\theta_{bt}}{\partial\tau_{bt}} N_{bt} w_{bt}(\tau_{bt} - s_{bt}) \\
\frac{\partial X_t}{\partial s_{bt}} &= -\theta_{bt} N_{bt} w_{bt} + \frac{\partial\theta_{bt}}{\partial s_{bt}} N_{bt} w_{bt}(\tau_{bt} - s_{bt}) \\
\frac{\partial\theta_{bt}}{\partial\tau_{bt}} &= -\frac{1}{\kappa(1+\delta\varepsilon\nu)}\frac{\theta_{bt}}{(1-\tau_{bt})} \\
\frac{\partial\theta_{bt}}{\partial s_{bt}} &= \frac{\delta\varepsilon\nu}{\kappa(1+\delta\varepsilon\nu)}\frac{\theta_{bt}}{s_{bt}} \\
\frac{\partial\theta_{bt+1}}{\partial s_{bt}} &= -\left(\frac{1-\delta(1-2\varepsilon)\nu}{1+\delta\varepsilon\nu}\right)\frac{\varepsilon\nu}{\kappa}\frac{\theta_{bt+1}}{s_{bt}}
\end{aligned}$$

Competitive factor market for black sharecroppers and the school budget constraint imply:

$$\begin{aligned}\frac{1-\alpha-\sigma}{\alpha+\sigma}\Pi_t\left(\frac{1}{1-s_{bt}}\right) &= N_{bt}\theta_{bt}w_{bt} \\ \Pi_t\left\{\tau_t+\left(\frac{1-\alpha-\sigma}{\alpha+\sigma}\right)\left(\frac{\tau_{bt}-s_{bt}}{1-s_{bt}}\right)\right\} &= X_t\end{aligned}$$

Replacing for X_t into the Euler equation for the tax rate on white plantation profits produces:

$$\begin{aligned}\tau_t &= \frac{\delta\alpha\varepsilon\upsilon}{1+\delta\alpha\varepsilon\upsilon}-\left(\frac{1-\alpha-\sigma}{\alpha+\sigma}\right)\frac{1}{1+\delta\alpha\varepsilon\upsilon}\left(\frac{\tau_{bt}-s_{bt}}{1-s_{bt}}\right) \\ X_t &= \Pi_t\frac{\delta\alpha\varepsilon\upsilon}{1+\delta\alpha\varepsilon\upsilon}\left\{1+\left(\frac{1-\alpha-\sigma}{\alpha+\sigma}\right)\left(\frac{\tau_{bt}-s_{bt}}{1-s_{bt}}\right)\right\}\end{aligned}$$

This clearly shows the fiscal diversion from black sharecroppers to white plantation owners. The difference between the tax rate on black income and the proportion of black workers that are hired as teachers illustrates the results of the discrimination of white plantation school districts. Collecting terms and replacing for the appropriate derivatives, the second two Euler equations become:

$$\begin{aligned}\left\{\frac{(1+\delta)(1-\alpha-\sigma)}{\theta_{bt}}+\frac{\delta\alpha\varepsilon\upsilon}{X_t}N_{bt}w_{bt}(\tau_{bt}-s_{bt})\right\}\frac{\partial\theta_{bt}}{\partial\tau_{bt}} &= -\frac{\delta\alpha\varepsilon\upsilon}{X_t}\theta_{bt}N_{bt}w_{bt} \\ \left\{\frac{(1+\delta)(1-\alpha-\sigma)}{\theta_{bt}}+\frac{\delta\alpha\varepsilon\upsilon}{X_t}N_{bt}w_{bt}(\tau_{bt}-s_{bt})\right\}\frac{\partial\theta_{bt}}{\partial s_{bt}} &= \frac{1-\alpha-\sigma}{1-s_{bt}}-\frac{\delta(1-\alpha-\sigma)\varepsilon\upsilon}{s_{bt}}+\frac{\delta\alpha\varepsilon\upsilon\theta_{bt}N_{bt}w_{bt}}{X_t} \\ &\quad +\frac{\delta(1-\alpha-\sigma)}{s_{bt}}\left(\frac{1-\delta(1-2\varepsilon)\nu}{1+\delta\varepsilon\nu}\right)\frac{\varepsilon\nu}{\kappa}\end{aligned}$$

The ratio of payments to all black workers and expenditures on white pupils can be written as:

$$\frac{N_{bt}\theta_{bt}w_{bt}}{X_t}=\frac{(1-\alpha-\sigma)(1+\delta\alpha\varepsilon\upsilon)}{\delta\alpha\varepsilon\upsilon\left[\tau_{bt}-s_{bt}+(\alpha+\sigma)(1-\tau_{bt})\right]}$$

Substituting this into () as well as for $\frac{\partial\theta_{bt}}{\partial\tau_{bt}}$ produces:

$$\left\{(1+\delta)(1-\alpha-\sigma)+\frac{(\tau_{bt}-s_{bt})(1-\alpha-\sigma)(1+\delta\alpha\varepsilon\upsilon)}{\left[\tau_{bt}-s_{bt}+(\alpha+\sigma)(1-\tau_{bt})\right]}\right\}\frac{1}{\kappa(1+\delta\varepsilon\nu)}=\frac{(1-\alpha-\sigma)(1+\delta\alpha\varepsilon\upsilon)(1-\tau_{bt})}{\left[\tau_{bt}-s_{bt}+(\alpha+\sigma)(1-\tau_{bt})\right]}$$

After some algebra, we can write:

$$\begin{aligned}\tau_{bt} &= P+Qs_{bt} \\ P &= \frac{\kappa(1+\delta\varepsilon\nu)(1+\delta\alpha\varepsilon\upsilon)-(\alpha+\sigma)(1+\delta)}{(1+\delta)(1-\alpha-\sigma)+(1+\delta\alpha\varepsilon\upsilon)\left[1+\kappa(1+\delta\varepsilon\nu)\right]} \\ Q &= \frac{(1+\delta\alpha\varepsilon\upsilon)+(1+\delta)}{(1+\delta)(1-\alpha-\sigma)+(1+\delta\alpha\varepsilon\upsilon)\left[1+\kappa(1+\delta\varepsilon\nu)\right]}\end{aligned}$$

Substituting for $\left\{\frac{(1+\delta)(1-\alpha-\sigma)}{\theta_{bt}}+\frac{\delta\alpha\varepsilon\upsilon}{X_t}N_{bt}w_{bt}(\tau_{bt}-s_{bt})\right\}$ using the Euler equation for the black tax rate, the Euler equation for black teacher hires can be simplified to:

$$\frac{(1+\delta\alpha\varepsilon\upsilon)\left[\delta\varepsilon\nu(1-\tau_{bt})-s_{bt}\right]}{\left[\tau_{bt}-s_{bt}+(\alpha+\sigma)(1-\tau_{bt})\right]}-\frac{s_{bt}}{1-s_{bt}}+\frac{\delta\varepsilon\nu\left[1+\kappa(1+\delta\varepsilon\nu)-\left[1-\delta(1-2\varepsilon)\nu\right]\right]}{\left[1+\kappa(1+\delta\varepsilon\nu)\right]}=0$$

Now replacing for τ_{bt} from above and further simplification produces:

$$\begin{aligned} & s_{bt}\left\{\begin{array}{c} \frac{\delta\varepsilon\nu[2+\delta+\delta\alpha\varepsilon\upsilon]+1+\delta(1-\alpha-\sigma)+(1+\delta\alpha\varepsilon\upsilon)[1+\kappa(1+\delta\varepsilon\nu)]+\kappa(1+\delta\varepsilon\nu)}{\kappa(1+\delta\varepsilon\nu)+\alpha+\sigma} \\ +\frac{\delta\varepsilon\nu[\kappa(1+\delta\varepsilon\nu)-[1-\delta(1-2\varepsilon)\nu]]}{\kappa(1+\delta\varepsilon\nu)} \end{array}\right\} \\ = & \frac{\delta\varepsilon\nu\left[1+\delta+1+\delta\alpha\varepsilon\upsilon\right]}{\kappa\left(1+\delta\varepsilon\nu\right)+\alpha+\sigma}+\frac{\delta\varepsilon\nu\left[\kappa\left(1+\delta\varepsilon\nu\right)-\left[1-\delta\left(1-2\varepsilon\right)\nu\right]\right]}{\kappa\left(1+\delta\varepsilon\nu\right)} \end{aligned}$$

Once $(\tau_t, \tau_{bt}, s_{bt})$ are known w_{bt} can be solved by setting the marginal product of black sharecroppers equal to the wage, where θ_{bt} is a function of $(\tau_t, \tau_{bt}, s_{bt})$ and the equilibrium wage w_{bt}.

E. BLACK YEOMAN MIGRATION PROBABILITY

If a black yeoman in a discriminatory district stays she receives the following utility

$$\ln\left[h_{bt}\left(1-\tau_{bt}\right)\right]+\delta\ln\left[Ah_{bt}\left(\frac{X_{bt}}{g_b h_T}\right)^{\varepsilon\nu}R_t^{(1-\varepsilon)\nu}\right]$$

where $R_t = \frac{\overline{h}_t}{h_{bt}}$. Equating utilities of staying and leaving produces the following result:

$$\ln\left[1-\tau_{bt}\right]+\delta\varepsilon\nu\ln X_{bt}-\ln\left[\frac{1}{1+\delta\varepsilon\nu}\right]-\delta\varepsilon\nu\ln\left[\frac{\delta\varepsilon\nu}{1+\delta\varepsilon\nu}\right]-\delta\varepsilon\nu\ln h_{bt}+f=\kappa\left(1+\delta\varepsilon\nu\right)\ln\theta_{bt}$$

Simplifying produces:

$$\theta_{bt}=\left\{(1-\tau_{bt})^{\frac{1}{1+\delta\varepsilon\nu}}\,h_{bt}^{-\frac{\delta\varepsilon\nu}{1+\delta\varepsilon\nu}}\,X_{bt}^{\frac{\delta\varepsilon\nu}{1+\delta\varepsilon\nu}}(1+\delta\varepsilon\nu)(\delta\varepsilon\nu)^{\frac{-\delta\varepsilon\nu}{1+\delta\varepsilon\nu}}e^{\frac{f}{1+\delta\varepsilon\nu}}\right\}^{\frac{1}{\kappa}}$$

A white yeoman only cares about the amount that she can extract from black yeoman remaining in her district. Thus for any given revenue per black yeoman, the discriminating white yeoman wishes to maximize the proportion that stays. Therefore the discriminating district chooses to hire the best teachers for black children as well.

The three Euler equations determining optimal choice of tax rates for whites and blacks and the level of spending on black children are:

$$\begin{aligned} \frac{1}{1-\tau_t^y} &= \frac{\delta\varepsilon\nu h_t^y}{X_t^y} \\ \frac{\delta\varepsilon\nu N_{bt}^y\theta_{bt}h_{bt}^y}{X_t^y}+\frac{\delta\varepsilon\nu}{X_t^y}\left\{N_{bt}^y h_{bt}^y\tau_{bt}^y-X_{bt}^y N_{bt}^y\right\}\frac{\partial\theta_{bt}}{\partial\tau_{bt}^y} &= 0 \\ -\frac{\delta\varepsilon\nu N_{bt}^y\theta_{bt}}{X_t^y}+\frac{\delta\varepsilon\nu}{X_t^y}\left\{N_{bt}^y h_{bt}^y\tau_{bt}^y-X_{bt}^y N_{bt}^y\right\}\frac{\partial\theta_{bt}}{\partial X_{bt}^y} &= 0 \end{aligned}$$

Rearranging the first Euler equation yields:

$$X_t^y=\delta\varepsilon\nu h_t^y\left(1-\tau_t^y\right)$$

Observe the functional form of θ_{bt} implies:

$$\begin{aligned}\frac{\partial \theta_{bt}}{\partial \tau_{bt}^{y}} &= -\frac{\theta_{bt}}{(1-\tau_{bt})\,\kappa\,(1+\delta\varepsilon\nu)} \\ \frac{\partial \theta_{bt}}{\partial X_{bt}^{y}} &= \frac{\theta_{bt}\delta\varepsilon\nu}{X_{bt}\kappa\,(1+\delta\varepsilon\nu)}\end{aligned}$$

Rearranging and taking the ratio of the second and third Euler equations produces:

$$X_{bt}^{y} = \delta\varepsilon\nu h_{bt}^{y}\,(1-\tau_{bt}^{y})$$

Replacing this result into the third Euler equation and using the definition of θ_{bt} produces:

$$\tau_{bt}^{y} = \frac{(1+\delta\varepsilon\nu)\,\kappa+\delta\varepsilon\nu}{(1+\kappa)\,(1+\delta\varepsilon\nu)}$$

Thus education expenditures per black adult is given by:

$$X_{bt}^{y} = \frac{\delta\varepsilon\nu}{(1+\kappa)\,(1+\delta\varepsilon\nu)}h_{bt}^{y}$$

Using these results for τ_{bt}^{y} and X_{bt}^{y} and substituting into the definition of θ_{bt} produces:

$$\begin{aligned}\theta_{bt} &= \left\{(1-\tau_{bt})^{\frac{1}{1+\delta\varepsilon\nu}}\,h_{bt}^{-\frac{\delta\varepsilon\nu}{1+\delta\varepsilon\nu}}\,(\delta\varepsilon\nu h_{bt}\,(1-\tau_{bt}))^{\frac{\delta\varepsilon\nu}{1+\delta\varepsilon\nu}}\,(1+\delta\varepsilon\nu)(\delta\varepsilon\nu)^{\frac{-\delta\varepsilon\nu}{1+\delta\varepsilon\nu}}\,e^{\frac{f}{1+\delta\varepsilon\nu}}\right\}^{\frac{1}{\kappa}} \\ &= \left(\frac{1}{1+\kappa}\right)^{\frac{1}{\kappa}} e^{\frac{f}{\kappa(1+\delta\varepsilon\nu)}}\end{aligned}$$

Finally using the budget constraint for white yeomen, and the previous results allows us to calculate:

$$\tau_{t}^{y} = \max\left\{0, \frac{\delta\varepsilon\nu}{1+\delta\varepsilon\nu} - \frac{N_{bt}h_{bt}^{y}}{h_{t}^{y}\,(1+\delta\varepsilon\nu)}\left(\frac{\kappa}{1+\kappa}\right)\left(\frac{1}{1+\kappa}\right)^{\frac{1}{\kappa}} e^{\frac{f}{\kappa(1+\delta\varepsilon\nu)}}\right\}$$