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HEALTH, HUMAN CAPITAL, AND AFRICAN AMERICAN MIGRATION BEFORE 1910

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ABSTRACT

This is the first paper to document the effect of health on the migration propensities of African Americans in the American past. Using both IPUMS and the Colored Troops Sample of the Civil War Union Army Data, I estimate the effects of literacy and health on the migration propensities of African Americans from 1870 to 1910. I find that literacy and health shocks were strong predictors of migration and the stock of health was not. There were differential selection propensities based on slave status—former slaves were less likely to migrate given a specific health shock than free blacks. Counterfactuals suggest that as much as 35% of the difference in the mobility patterns of former slaves and free blacks is explained by differences in their human capital, and more than 20% of that difference is due to health alone. Overall, the selection effect of literacy on migration is reduced by one-tenth to one-third once health is controlled for. The low levels of human capital accumulation and rates of mobility for African Americans after the Civil War are partly explained by the poor health status of slaves and their immediate descendants.

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"The evidence that is beginning to accumulate suggests that the attack on the material conditions of the life of blacks after the Civil War was not only more ferocious, but, in certain respects, more cruel than that which preceded it."

-Robert W. Fogel and Stanley Engerman
Time on the Cross (1974)

I. Introduction

Economists have long been interested in the role that the legacy of slavery plays in the current economic condition of African Americans. An important piece to the historical puzzle is the relative lack of accumulation of human capital in the African American population at the turn of the last century. Despite the arguably high levels of skill among the slave population, the decades after the Civil War saw a deterioration in the skill composition of the black labor force (DuBois 1902, Fogel and Engerman 1974, Gutman 1975, Harris 1982, Smith 1984, Jones 1989, Ransom and Sutch 2001). In addition to this decline in skill, the general standard of living for the decedents of slaves grew worse as Reconstruction ended and Jim Crow took hold in the South (Fogel 1975, Margo 1990, Litwack 1998, Ransom and Sutch 2001, Carson 2007). By some measures, only since the modern Civil Rights movement—circa 1945—has there been convergence in the economic lives of whites and blacks (Fogel and Engerman 1974), although convergence between slaves and free blacks was achieved by the early twentieth century (Sacerdote 2005). Many economists credit the Great Migration, begun in 1915, as the starting force that helped close the gaps between whites and blacks (Smith and Welch 1979).

One important and open question is how health affected the propensity of blacks to acquire human capital both through education and migration. Migration out of state was one of the primary means of investing in human capital in the nineteenth and early twentieth centuries. If the shadow of poor health is a long one it may have taken two or more generations to overcome the cumulative negative health effects of slavery and its aftermath, partially explaining

the low mobility rates of African Americans after the Civil War. Given the harsh working conditions of the plantation system and its general level of violence, long migrations may have been physically difficult for large portions of the ex-slave population, even children born near the end of the antebellum era (Steckel 1986a, 1986b, 1986c, 2004). Even more, the poor childhood health of slaves may have affected their ability to accumulate large amounts of human capital after Emancipation and could have long-lived consequences on future generations both through the transmission of low socioeconomic status itself and subsequent poor health for slave descendents (Fogel 1994, Case, Lubotsky and Paxson 2002, Steckel 2004, Costa 2005, Case and Paxson 2006, Costa, Helmchen, and Wislon 2007). New research has shown that blacks were consistently shorter than whites during the antebellum period, and that the heights of blacks actually declined during Reconstruction (Carson 2007), so the potentially negative effects of poor health on slave outcomes may have been even more pronounced for the first generation born outside of chattel slavery. Subsequent generations of African Americans may have been particularly sensitive to the effects of health on the acquisition of human capital.

Until recently, researchers could only use Census records to estimate migration propensities for African Americans during the late nineteenth century. Census estimates confirm that more educated blacks were more likely to migrate than those who were less educated (Woodson 1918, Hamilton 1959, Shryock and Nam 1965, Lieberson 1978, Margo 1988, 1990, Tolnay 1998, Bernstein 1998). I use IPUMS returns and confirm those results— migration and education were positively correlated from 1870 to 1910, and disproportionate shares of black migrants were literate. Using a new data source, the Colored Troops sample of the Union Army Veterans data, I estimate the effects of education and the stock and flow of health on the

migration propensities of African Americans.[1] I find that literacy was a strong predictor of migration for African American Civil War veterans, but that controlling for health shocks experienced during the Civil War significantly reduces the effect. Overall, the effect of literacy on migration decreases by one-tenth to one-third once health factors are controlled for.

Perhaps more intriguing, I find that both the presence and effects of health shocks during the war varied by slave status. Not only were slaves shorter than free blacks (which suggest differences in their health stocks), but even after controlling for height slaves were more likely to experience a health shock (such as illness) during the war and were less likely to be literate afterwards. Health shocks for former slaves had a larger impact on migration propensities than for free blacks. Counterfactuals suggest that as much as 35% of the difference between the mobility patterns of former slaves and free blacks is explained by differences in their human capital, and more than 20% of that difference is due to health alone. The poor health status of African Americans both during and after slavery had a negative impact on the acquisition of human capital and mobility of African Americans. The shadow of slavery and Reconstruction on the economic outcomes of African Americans may be longer than previously thought once the persistent effects of poor health are considered.

II. African American Migration and the Role of Human Capital

A. The Historical Record

I begin by analyzing the mobility of African Americans in Census records. Panel A of Table 1 shows the distribution of the African American population from 1870 to 1910. Even in 1910, on the eve of the Great Migration, only 11% of the African American population lived

[1] Conceptually, this argument is similar to Margo's (1988) claim that schooling and migration cannot be considered independent processes, but rather factors that evolve together. This paper extends that approach to a different set of processes (education and health) at an earlier time period to uncover the impact of education and health on the migration propensities of African Americans after the Civil War and before the Great Migration.

outside of the South. The larger migratory movement of the time was from the rural South to its urban centers, which is shown in Panel B of Table 1. By 1910 more than 25% of the black population in the United States lived in urban areas.[2] A telling feature of black migration is that there was very little movement westward until 1900 or so, and the attempts by some groups of ex-slaves to move to western states such as Kansas were not successful.[3] Despite the large and persistent wage gaps that favored western states, African American migratory patterns did not reach westward until the mid twentieth century.[4] The 500,000 African Americans who did leave the South from 1870 to 1910 represented about 5% of the total African American population, as shown in Panel C of Table 1.

In general, the migration of African Americans before World War I is not as well studied as the migration that took place after 1915.[5] While the migratory flows were not of the same magnitude as those seen after 1915, African American populations in Northern cities did grow substantially before 1910. New York, Philadelphia, and Chicago each saw their African American populations grow by more than thirty percent from 1900 to 1910. Furthermore, of the five cities with more than 80,000 black residents in 1910, only one was in the deep South. The most striking feature of African American migration to 1915 is the increasing urbanization of African Americans, both ex-slave and free. From 1890 to 1910 the proportion of African Americans living in urban areas increased 35% (Meier and Rudwick 1970). According to Costa and Kahn (2006), nearly one third of the black veterans of the Civil War were migrants. IPUMS returns put the proportion of black migrants at approximately 20% of the total black population.

[2] This rural to urban migration has been seen by many to be the first step in the later South to North migration that would follow, but this belies the fact that significant portions of the Great Migration were rural South to urban North (Grossman 1989, Trotter 1991).
[3] See Athearn (1978) and Painter (1986) for the history of the Exodusters, ex-slaves who left the deep South for Kansas in the late 1870s and early 1880s. Their movement was ultimately unsuccessful.
[4] The differences in the directions of black and white migratory flows during this time makes it difficult to use one as a proxy for the other, or to use whites as a counterfactual base.
[5] Henri (1975) is an excellent exception.

In many ways, the Great Migration after 1915 amplified a migratory trend that was already underway (Woodson 1918), but the causes of the migratory flows before 1915 remain an area of conjecture. For example, Ransom and Sutch (1972) see the lack of black mobility as a result of poor institutions in the South after the Civil War.

> The fact that neither a significant out-migration to the North nor a viable manufacturing sector in the South developed during the nineteenth century can only be explained by barriers to the mobility of factors of production. Labor was not attracted to the North no capital to the South. We believe that, once again, the rigidities and racial barriers built into southern economic institutions are to blame. (Ransom and Sutch 2001 p. 195)

As a backdrop to these developments, the general social retrenchment after Reconstruction left African Americans in the South with diminishing political options. Despite the protections offered by the Fourteenth and Fifteenth Amendments and the Civil Rights Act of 1875, the last quarter of the 19th century saw a steady decline in black freedoms in the South. Beginning with the Civil Rights Cases and the Danville Massacre of 1883 and culminating in the "Terrible Nineties," the prospects of full economic and political freedom for African Americans was arguably set back to its antebellum level.[6] Higgs (1982, 1984) and Margo (1984) have shown that property accumulation by blacks was depressed in the last decade of the Nineteenth Century. The relative quality of schooling also declined during this time for blacks, although the Great Migration itself played a role in the reversal of this trend (Margo 1990).

The current economic interpretation of the Great Migration, which sees African American migration as the product of restrictions in European immigration, fails to acknowledge some important issues. First, researchers must uncover how and why African American

[6] The Civil Rights cases, a collection of five separate cases where African Americans sued places of public accommodation for racial discrimination, were decided by the Supreme Court in 1883. The Court held that the antidiscrimination clause of the Civil Rights Act of 1875, which barred discrimination in public accommodations, was unconstitutional. The Danville (VA) Massacre, which left at least 7 dead and 20 wounded, was but one in a series of violent outburst by whites to intimidate black voters and office seekers—similar acts of violent intimidation occurred in the same year in Louisiana and Copiah, MS.

migration before 1915 differed from the migration that followed. Aggregate demand for labor, which Collins (1997) estimated for the Great Migration, is but one part of the story, although it may well be the dominant theme. For example, the movements of African Americans within the South tells us that blacks were migrating, but we are not sure if this movement was due to labor market opportunities, wage differentials, or non-wage, utility enhancing opportunities such as greater personal freedoms.[7] Secondly, not all African Americans would be equally affected by European immigration—skilled African Americans would not be substitutes for unskilled European labor and vice versa. Decomposing aggregate demand could lead to some interesting insights. In this paper, I consider a third possibility, health. For example, even if demand for black labor in the North was as high in 1890 as it was in 1920, the flows of African Americans North may have been dampened by their poor health.

The educational selection of black migration, both before and during the Great Migration, has been advanced for some time and has received substantial empirical support (Margo 1990, Tonlay 1998, Vigdor 2002). An important drawback is that it has not been possible to see if and how education would be correlated with other factors that might effect the migration decision. The current evidence that we have on educational selection is therefore suggestive, and we are not certain how reliable such estimates are. It is straightforward to see how the correlation of education with other elements of human capital would leave the previous empirical work wanting. Given the large and growing literature on the health gradient, where more educated individuals are shown to be healthier in a number of ways which may be related to health (Case, Lubotsky, and Paxson 2002, Case and Paxson 2006), and the evidence of poor slave health (Steckel 1986a, 1986b, 1986c, 2004, Costa 2005, Costa, Helmchen, and Wilson 2007), it seems

[7] Wade (1964) has established that in the antebellum South cities afforded slaves a greater degree of autonomy. Vigdor (2002) has analyzed migration since 1910 as a function both of education and local labor market conditions.

reasonable to assume that current estimates of educational selection are overstated. Furthermore, the effect of health on the migration propensities of African Americans is important beyond corrected estimates of educational selection. While we have indirect measures of African American health status in the past, little empirical work looks at the broader implications of the poor health of African Americans in the past. The issues addressed here, the immobility and lack of human capital accumulation, are but two factors where health may play a role.

B. Theoretical Considerations

Both literacy and health are types of human capital that would, in theory, have an impact on the migration decision.[8] Treating this idea formally, we can take the standard migration model (Sjaasted 1962, Harris and Todaro 1970, Schwartz 1976, Greenwood 1997) and incorporate the idea of multidimensional human capital. To begin, consider the value of migration, which would be the discounted cumulative difference in expected utility between the new and current location, less the cost of migration.

$$V(0) = \int_0^T \left[E\left[U^n(t)\right] - U^s(t)\right] e^{-rt} dt - C(0) \tag{1}$$

[8] This is not to say that social networks are unimportant in the migration decision, but that human capital may act as both a substitute and complement to social networks in the migration process, such that a person with high levels of human capital may be more likely to migrate with the same social networks as someone with less human capital. This depends, naturally, on the type of human capital. Literacy, for example, could be both a substitute and complement to the social network. If a person could read and write, they would not need to receive as much information from their social network in order to be made aware of opportunities in other locations, and as such literacy is a substitute for the social network. Literacy could also complement a social network if it was used to verify the accuracy of information acquired through the social network. Health, however, is more likely to be a complement to the social network. If one believes himself to be in good health, they may be more likely to migrate if they believe that they stand a good chance of weathering any potential stress brought on by the new location, but knowledge of the nature and extent of these stresses or potential success in the new location would still come from the social network (see Lee 2005).

Where U^n is the utility in the new location and U^s is the utility in the present location (before migration), *r* is the discount rate, *t* is time, and *C* is the cost of migration.[9] I further assume that utility is a function of income (*Y*), human capital (*H*), and other factors (*Z*) and that it is increasing in both income and human capital regardless of location: [10]

$$\begin{aligned} & U = U(Y, Z, H) \\ (2) \qquad & U_Y \rangle 0 \\ & U_H \rangle 0 \end{aligned}$$

Furthermore, consider that human capital has two components, health (*h*), and education (*e*) such that human capital in increasing in both:

$$\begin{aligned} & U = U(Y, Z, H) = U(Y, Z, H(h, e)) \\ (3) \qquad & H_h \rangle 0 \\ & H_e \rangle 0 \end{aligned}$$

The costs of migration depend on three factors, *X*, *Z*, and *H*, such that *C*(-)=*C(X,Z,H(h,e))*.[11] *X* is the mapping of the location chosen, from where one starts, such that places far away have high migration costs ($C_X \rangle 0$). *Z* is any other factors that may affect the cost of migration, but which is unrelated to distance and human capital. I assume that the cost of migrating is invariant or decreasing in human capital ($C_H \leq 0$), this is consistent with the findings in Schwartz (1976).

With these assumptions, the value of migration becomes:

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[9] I move to utility rather than wages since wages may not be the best way to capture African American migration decisions at the time, given large benefits to living in areas that would afford people greater freedoms unrelated to economic activity. Litwack (1979) has shown that economic incentives do not explain the movement of African Americans immediately following the Civil War, and it is not clear when (or if) non-economic factors ceased to dominate African American migration decisions, although some historians have noted the non-economic benefits of migration before and during the Great Migration itself (Grant 1968, Bennett 1993, Saville 1994, Painter 1986, Trotter 1991, Grossmam 1989). In what follows, I drop the expectation on the utility from the new location for better exposition. Naturally, the discounted utility stream includes an expectation over the future utility in the current location as well. I suppress here a discussion of the family migration decision, which can have different implications depending upon the specification (Mincer 1978).

[10] The main conclusions of the model hold if income is a function of human capital as well, where $Y_H > 0, Y_h > 0$ and $Y_e > 0$.

[11] We can further assume that health and education are known and fixed at time t=0.

(4) $$V(0) = \int_0^T \left[U_n(Y_t, Z_t, H_t(h,e)) - U_s(Y_t, Z_t, H_t(h,e))\right] e^{-rt} dt - C(X, H(h,e), Z)$$

It is more difficult to form firm hypotheses about the effects of health on educational attainment. Steckel (2007) has recently argued that slaveholders had strong incentives to keep the health of slaves below optimum because relatively poor health in the growing years would result in more docile slaves. As previously discussed, numerous studies have shown that health and education (and socioeconomic status in general) are positively correlated (Case, Lubotsky and Paxson 2002, Case and Paxson 2006), but the causal relationship is unclear. For example, it could be that better educated persons are better able to adapt to improved health practices, or that those in better health are able to make larger investments in education. Still others have argued that cognitive ability and health evolve together and are functions of the *in utero* environment. Assuming that such a relationship exist, if formal education is a proxy for ability it will be strongly related to health, but if education is weakly correlated with true ability but well correlated with socioeconomic status after the Civil War, its relationship to health could be tenuous.

The question here is which component of human capital matters more in the migration decision, a larger marginal impact on the value of migration.[12] The chain rule and separability give:

(5) $$V_h = \int_0^T \left[\left(U_H^n H_h\right) - \left(U_H^s H_h\right)\right] e^{-rt} dt - \left(C_H H_h\right)$$

and

(6) $$V_e = \int_0^T \left[\left(U_H^n H_e\right) - \left(U_H^s H_e\right)\right] e^{-rt} dt - \left(C_H H_e\right)$$

[12] Note that if $U_H^n \rangle U_H^s$ then $V_H \rangle 0$, and if $U_H^n \langle U_H^s$ then $V_H \langle 0$.

Without further assumptions we cannot say whether the utility with respect to education is higher or lower than the utility with respect to health, and therefore cannot say whether education or health increase the value of migration more. Nor do we have enough information to determine whether the cost of migration with respect to education is higher or lower than the cost with respect to health.

For education to have a stronger effect on migration than health a marginal increase in education should make one more likely to migrate than a marginal increase in health. This implies that the marginal value of migration for education should be larger than the marginal value for health. $V_e \rangle V_h$ implies

$$(7) \qquad V_e - V_h = \left[\int_0^T \left[\left(U_H^n - U_H^s \right) \left(H_e - H_h \right) \right] e^{-rt} dt - \left[C_H \left(H_e - H_h \right) \right] \right] > 0$$

This expression is assured to be greater than zero when:

1. $U_H^n - U_H^s > 0$ and

2. $H_e - H_h > 0$

The first condition implies that the marginal utility of human capital has to be greater in the new location, which is plausible and reasonable to justify on the grounds that increased utility would be the primary reason for migrating from any location. It is the second condition that is more difficult to show. Because both health and education are correlated with one another, it is impossible to identify the effect of education without controlling for the effect of health. Similarly, estimates of the effect of education most likely suffer from omitted variable bias, and if education and health are positively correlated estimates of education's effect are likely to be overstated. As such, the empirical task of this paper serves two purposes—not only does it

estimate the effect of health on African American migration, but it simultaneously produces a bias-corrected estimates of the effect of education on African American migration.[13]

III. Data

A. IPUMS

IPUMS data- Integrated Public Use Microdata – are a random sample of the person records from United States' decennial Censuses. I use IPUMS records from the Censuses of 1870 to 1910 to estimate trends in the educational selection of migration.[14] The IPUMS data contains the age, birthplace, literacy, current location, occupation, labor force status, marital status, and limited information on wealth holdings at the time of Census enumeration. For the analysis here I used IPUMS returns for black men who were above the age of 13 at the time of Census enumeration. For consistency, migration is defined as one who lives in a state different from the state of birth. Using the age of the respondent at the time of enumeration and the place of birth, I create a crude measure of slave status, where a slave is defined as a person born in a slave-holding state before 1865.[15] Although there are numerous problems with this classification, it is congruent with the methodology others have used to disaggregate the African American population by slave status (Sacerdote 2005), and agrees with the fact that far less than 10% of the Southern black population was free (Fogel and Engerman 1974). This measure, however, overestimates the number of slaves and underestimates the number of free blacks. Although occupational codes and wealth can be endogenous (such that the occupations of

[13] If we assume that income (Y) is also a function of human capital, separate from the effect of human capital on utility itself, the condition (1) would be the same except that $U_H = U_H + U_Y Y_H$. Also note that the same result would hold when (1) poor health increases the cost of migration, (2) poor health increases the cost of obtaining new information, or (3) health increases the life expectancy and/or lowers the discount rate.

[14] 1890 data is unavailable. All 1890 values reported are the average of the 1880 and 1900 values.

[15] The American South includes all slave-holding states at the time of the start of the Civil War. States that joined the union after the Civil War are not considered Southern states in this analysis. States to the west of the Confederacy are noted at Western states, and states in the Union at the time of the Civil War are noted as Northern states.

migrants might be different from non-migrants because of their migration, or their migration might be induced by their occupation), I used the occupational codes for the IPUMS to construct a crude measure of a skilled occupation (non-farm, non-manual labor, non-domestic work). When combined with the information on migration status I use this to measure the skill composition of African American migrants from 1870 to 1910.

The net number of migrants from 1870-1910 is close to 200,000 men, close to other estimates when we define migration as living outside of the region one was born in (Collins 1997). IPUMS tabulations confirm that migration in the Census records appears to favor the skilled. Panel A of Table 2 shows that skilled migrants were the vast majority of migrants during this time period. We gain some additional insights into the role of educational selection using simple tabulations from the IPUMS data. Panel B of Table 2 also shows tabulations for the total number of Southern born black men who were skilled, migrants, and skilled-migrants to the North. More than three quarters of all migrants were skilled by this classification. By 1910 more than a quarter of all skilled black men were migrants from the South to the North. Panel B of Table 2 also reports the rural/urban geographic distribution of the Southern born black men by skill and migration status. By 1880, more than half of the migrants were located in urban areas, in sharp contrast to the less than 20% of the total Southern born black population. Skilled migrants were even more likely to be urban than migrants in general. An important fact to take away from the table is that skilled men were far more concentrated in urban areas at all times, and this surely impacted their ability to learn about job opportunities (or opportunities in general) in other locations, and to migrate.

Panel C of Table 2 shows the literacy rates for various segments of Southern born black male population from 1870-1910. It is clear that skilled men had far higher literacy rates than

the general population, and migrants had even higher literacy rates, with skilled migrants having the highest literacy rates at all times. At a time when less than a third of the black population was literate (1870), more than half of migrants from the South could read and write, and more than 60% of skilled migrants could. In contrast, only 40% of the skilled black men in 1870 were literate. Also, the literacy rate of all migrants is very close to the literacy rate of skilled migrants.

Census returns leave us with two questions in regards to the impact of education/literacy on migration. The first is how the effect of literacy changes once additional features of human capital are included. The second is how these additional influences, when taken with the effect of literacy on migration, influence migration propensities. For example, including health measures may diminish the effect of literacy on migration, and then when measured with a feature of health the (potentially positive) effect of literacy may be smaller than the (potentially negative) effect of health. In order to gauge the extent of both I use a unique data source that allows us to measure the stock and flow of health, literacy status, and migration of black men in the mid and late twentieth century.

B. The Colored Troops Sample of the Union Army Veterans Data

The Union Army data offers a unique opportunity to analyze the lives of African American families in the years after the Civil War and before the Great Migration. I use the Colored Troops Sample of the Union Army data to investigate how literacy and health fare as predictors and correlates of migration later in life for African American Union Army Veterans. The Colored Troops sample (CTS) contains information on more than 5,600 black troops from more than 50 infantry companies.[16] The sample was chosen by randomizing over the Colored Troop companies in the United States military, and the sample represents approximately 2.5% of

[16] Data on every troop in every selected company is gathered.

the black troops who served in the Civil War (more than 180,000 black men served in the Union Army by the end of the Civil War, about 10% of the Union Army). Because of the time period under study, this sample of men, who all reached the age of adulthood near the time of the Civil War, would be likely to be under the social pressures and economic realities described earlier.

The data used in this paper comes from a unique panel data set created from the combined military, census, and pension records of black Civil War veterans.[17] This data allows us to measure heath shocks experienced during the war, the stock of health at the time of enlistment, and later migration. The military records include information known at enlistment (including age, year of enlistment, place of enlistment, physical condition, etc.) as well as information on the troops well being during the war (illness, injuries, death reported in military files) until the time of discharge from military service. The military records also contain information on the stock of health, as measured by height at enlistment. As Steckel (1995) and others have shown, height is a measure of net nutrition during childhood, and this is related to later life morbidity and mortality (Fogel 1994).

The Census records from 1900 and 1910 are linked to the individual veterans, and contain the same information as in IPUMS. Here we can measure the veterans current location (at the time of enumeration), occupation, literacy, and other measures of socioeconomic status. Two strengths of this data should be noted. First, the records in the pension and military files contain information that can be checked against the Census linkages—allowing one source to act as a check on the other. Second, the health shocks that are measured in the military records are quite specific— this allows us to look at the effects of specific health shocks that would be applicable to the general black population (such as respiratory infections, high fever, malaria,

[17] This data is part of the larger Early Indicators Project at the University of Chicago's Center for Population Economics.

and smallpox) and those that would be more likely related to the war itself (such as a gunshot wound or amputation). This specificity also allows us to look at the relationship between individual troop and company characteristics, specific health shocks, and later migration since health events are measured pre-migration.[18] This does not imply, however, that the health measures in the CTS are complete. For example, diseases such underlying causes are likely to be misdiagnosed, and we usually have measures of their symptoms.

There are certain differences between the CTS and Census returns. Relative to the entire black population, the CTS is more Northern (roughly one-half of the Colored Troops are free blacks, while less than a tenth of the black population was free in 1860), urban, and has a higher occupational status, although some of these differences are not very large. While only 8% of the general black population was professional, more than 11% of the CTS were. Similarly, more than 20% of the CTS lived in very large cities in 1900, while only 10% of the general black population did. Even veterans who remained in the South were more likely to live in urban areas. For this reason, the CTS has a higher percentage of migrants than in the IPUMS data. Also, the experiences of black veterans were not representative of the general African American population in many respects. The recruitment of black men into the Union Army was not a random process in either the North or South (see Litwack 1979). Similarly, the death rate for black troops was particularly high, perhaps driven by high rates of malarial infections. As Costa and Kahn (2006) have shown, enlistment exposed troops, particularly former slaves, to new environments, people, and experiences that may have had long lasting effects. Even with these differences, the purpose here is to see how much of the positive selection on education observed in the CTS can be attributed to health, and then seeing how those estimates would lower the

[18] Since the randomization is on company, every troop in a given company will have the same "exposure" measures to such war related activity as battles.

educational selection seen in Census data. An advantage here is that the CTS is a mobile group—if they were less mobile than black population in general it would be difficult to draw inferences from their mobility patterns and migration selectivity to the general black population.

V. Empirical Results

A. Evidence from IPUMS

Looking at the IPUMS data in more detail, we can estimate the size of educational selection by analyzing the probability of migrating with a host of covariates including literacy, with the general specification

$$\Pr(Migrant = 1 \mid X = x) = \Phi(x'\beta) \tag{8}$$

Table 3 reports the results from a probit regression of migrant status on literacy and other socioeconomic factors.[19] In the IPUMS data we find that the effect of literacy on migration is large. At baseline, being literate increases the probability of being a migrant by more than 10% for all black men, and by more than 20% for free blacks, but close to 8% for former slaves. For North/South migration literacy increases the probability of migrating by nearly 9% overall, and by more than 10% for former slaves.

Once the socioeconomic variables are added to the regression specification literacy increases the probability of migrating to a different state than the one born in by less than 4%. The correlation that literacy has with factors such as occupation, socioeconomic status, urban location, and wealth reduces the explanatory power of literacy alone.[20] In fact, controlling for these factors actually causes literacy's effect on migration to be negative for free blacks for both

[19] All probit results here show the marginal effects on the probability of migration.
[20] The occupational score is a measure based on the predicted income in a given occupation. The Duncan Socioeconomic Index weighs the income, average education, and prestige of a given occupation (see Ruggles and Sobek (1997) for further details).

interstate and North/South migrations. These factors play a much smaller role for slaves—the effect of literacy on migration probabilities for former slaves are lower (8% versus 5% for interstate migration), and the effect of literacy on the North/South migration of former slaves is slightly different (11% versus 8%). The addition of the socioeconomic controls show that literacy's correlation with other socioeconomic factors varies by slave status.

As mentioned earlier, there are limits to interpreting this evidence as being educational selection. For example, some of the socioeconomic controls, such as wealth, are likely endogenous. The question we should ask is how much of this effect that we attribute to educational selection should be attributed to factors that are well correlated with education? Indeed, we see that other socioeconomic controls reduce the effect of education on migration substantially, particularly for free blacks. To answer that question we should look at measures of not only migration, but also the stock and flow of health more generally. Below, I consider the estimates of educational selection with the CTS data, which allow us to estimate the effects of literacy on migration while controlling for health.

B. Evidence from the Colored Troops Sample of Union Army Veterans

1. Slave Status and Human Capital

The Colored Troops sample of the Union Army veterans' data gives us a unique opportunity to measure both the stock and flow of health as well as educational selection in migration. While neither the IPUMS or CTS data contain an explicit slave indicator, the CTS allows us to define slave status in a more nuanced way. Since interstate migrations were a non-negligible part of slave mobility, and a number of those born in slave states did obtain freedom later and fought in the Union Army (particularly those enlisting in border states), I use a measure

of slave status that ties to probable slave status at the time of enlistment. I define men as slaves if they enlisted in a slave holding state and if their place of residence at the time of enlistment was a slave holding state. While birthplace measures of slave status likely overstate the number of slaves, this construction of slave status most likely underestimates the number of blacks exposed to slave status at any point in their lives. Fugitive slaves and manumitted ex-slaves living in Northern states will be counted as free blacks here. Also, this measure of slave status ties more closely to the time period of interest—when looking at migration by slave status we would like to know the effects for those who were likely to be slaves or free blacks at the time of the Civil War, not the time of their birth. As such, this is an "intensive" measure of slave status since it captures those who are most likely to have lived their lives up to the time of enlistment in slavery. Birthplace constructions, by the same token, are "extensive" measures, they tell us which men are likely to have ever lived under slavery at any time.[21]

Before looking at the effect of health on migration, we should look more closely at the underlying relationships. There are a series of necessary preliminary questions that must be answered before we turn to the effects of health on the migration propensities of African Americans. The first question is how slave status affects the propensity to be ill during the war—namely, does slave status affect the stock of health, and does that difference in the stock of health relate to susceptibility to illness during the war? This issue is tackled in Table 4. To the extent that slaves had poorer nutritional outcomes as children this would result in lower height for slaves, and worse outcomes as adults (Steckel 1986b, 2004, 2007). As height reflects net nutritional status in childhood, and given that slave children were particularly small, we would expect a slight negative effect of being a slave on height, although slave children did experience

[21] This is similar to the analogous use of the term in labor economics, where the extensive margin is participation in the labor force and the intensive margin is the number of hours worked.

remarkable catch-up growth. Indeed, slaves are shorter that free black troops by more than one tenth of an inch on average when using the intensive measure of slave status, and nearly two tenths of an inch shorter when using the extensive definition of slave, consistent with what we would expect given this construction. This would imply that slaves had slightly lower levels of physiological capital than free blacks, consistent with the previous literature.[22]

The second question is whether this difference in the stock of health had an effect on the probability of experiencing a health shock, controlling for the stock of health itself (height). Even with catch up growth (which would result in similar heights for both slave and free blacks), slaves would be more prone to illness because of environmental and nutritional detriments early in childhood (Steckel 1986b). To look at this effect I regressed an indicator for illness during the war on height, height squared, and slave status in columns II and VII of Table 4. The slave status indicator was statistically significant—being a slave increases the probability of experiencing a negative health shock during the war by more than 3% with the intensive (time of war) measure, but the extensive (birthplace) measure of slave status is not related to illness. This shows that intensive slave status itself, separate from the height measure, does play a role in the probability of experiencing a health shock. As a check of this result, when one does the same type of specification for wounds, the effect of being a slave is statistically insignificant, and height was positively related to the probability of being wounded.[23] Slaves not only had a lower stock of health, but also greater susceptibility to illness.

This susceptibility to illness could have had large negative impacts on their propensity to migrate and accumulate human capital after the war. The third question is exactly this—the

[22] Lee (2006) finds that slaves had higher rates of morbidity and mortality during the war and later in life.
[23] This is likely because height increases the chances of gunshot wounds and other war related wounds.

effect of this difference in susceptibility on literacy.[24] Did illness during the war decrease the chances that one would be literate, independent of slave status and controlling for the stock of health? In probit regressions of literacy on height, squared height, illness, wound, and slave status I find that slave status and illness are negatively related to literacy, but that wounds were not related to literacy. An ill slave was more than 6% less likely to be literate with the intensive (time of war) measure, and more than 25% less likely with the extensive (birthplace) measure. The cumulative effects of slavery and illness, and their relationship to each other, appears to be large with either definition of slave status.

2. Health, Human Capital, and Migration among Black Civil War Veterans

An advantage of the CTS data is that migration can be measured in a number of ways, allowing us to measure the effect of health on migration with several constructed measures. Table 5 shows results for the primary migration measure used here—the state of residence for a veteran in the 1900 Census and the state of enlistment when he enrolled in the Union Army. The table shows probit models of migration for the CTS similar to those in Table 3 for three different types of migrations-- interstate, inter-region, and South-North.[25] There are several interesting facts to note. First, the control for height, which is taken as a measure of the stock of health (as suggested by Steckel 1995 and others), does not play a statistically significant role in the propensity to migrate either overall of by slave status. Overall, being ill during the war, has a statistically significant effect in most of the regressions, and has an effect on all types of

[24] See Cornish (1952) and Blassingame (1965) for the role of the Union Army in educating blacks during and after the Civil War.

[25] I define inter-regional migration as a migration that crosses a Census subdivision. For example, the South region of the United States contains three sub-divisions; the West South Central (AR, OK, TX), the East South Central (AL, KY, MS, TN) and the South Atlantic (DE, FL, GA, MD, NC, SC, VA, WV).

migrations.[26] As would be expected, the presence of these negative health shocks decreases the likelihood that a veteran would migrate. In general, the marginal effect of literacy on education declines by about one-fifth in all of the specifications where health is included.

Furthermore, there are large differences in the effects of education and health on migration by slave status.[27] Ex-slaves were much more likely to migrate if literate, when compared to free blacks. Somewhat surprisingly, however, the effect of particular negative health shocks have different effects on the probability that one would migrate. For example, having a severe fever during the war would decrease the probability of migrating by 6% for a former slave, while a respiratory infection reduces the probability of migrating by more than 10% for free blacks. These differences carry over to other types of migrations. Measles, for example, has a negative but statistically insignificant effect on the inter-regional migration of ex-slaves but a positive effect on free blacks. Not only is illness related to migration, but different illnesses have different effects on different migrations, and they differ dramatically by slave status. Part of this difference could be due to the fact that ex-slaves were more likely to serve in Southern locations (Litwack 1979), which could have exposed them to different disease environments that free blacks.[28]

The results of Tables 4 and 5 can be used to construct a counterfactual for the role of health and literacy in explaining the mobility differences between ex-slaves and free blacks. Former slaves would be less likely to migrate by $\beta_{Literacy}\gamma_{Literacy|Slave}$ due to illiteracy, where β comes from the pooled regressions in Table 5 and γ comes from the effect of slave status on

[26] Due to military definitions, the illness recorded here is an illness or injury that prevented the troop from serving with their regiment. As such, illness from the military records can be taken as a severe health shock during the Civil War.

[27] Given the smaller marginal effects when using the intensive measure of slave status, I use the intensive measures of slave status in the migration specifications as plausible lower-bound effects by slave status.

[28] Litwack (1979) notes that ex-slaves were believed to be naturally inoculated against infections such as malaria, making them ideal troops in Southern locations.

literacy in Table 4. Similarly, former slaves would be less likely to migrate by $\beta_{Health}\gamma_{Health|Slave}$ due to health. Combining both gives the total effect. To see how much of the mobility difference is explained by the combined effect we can calculate

(9) $$\left[\beta_{Literacy}\gamma_{Literacy|Slave} + \beta_{Health}\gamma_{Health|Slave}\right] / \left|M_{Free} - M_{Slave}\right|$$

where *M* is the mobility rate. To estimate the proportion of the mobility gap due to health alone we can calculate

(10) $$\beta_{Health}\gamma_{Health|Slave} / \left[\beta_{Literacy}\gamma_{Literacy|Slave} + \beta_{Health}\gamma_{Health|Slave}\right]$$

In instances where slaves were more mobile than free black such a calculation would tell us how much more mobile slaves would have been if they had similar levels of human capital as free blacks, and in instances where free blacks were more mobile it would tell us how much the mobility gap would close with similar human capital levels.

Taking smallpox as the measure of illness reveals that the interregional mobility gap between blacks and whites would have decreased by 30% if ex-slaves and free blacks had similar levels of human capital, and the North-South mobility gap would have been 35% larger. Health plays a significant role in explaining each gap—it accounts for roughly one-third of both gaps.[29] If one takes respiratory infections as the measure of illness, the interstate mobility gap would narrow by 20%, the interregional gap would narrow by 30%, and the North-South gap would increase by 30% with similar levels of human capital. As with the smallpox measure, the respiratory health measure explains anywhere from 20% (for North-South) to 30% (for interstate) of the mobility gap between free blacks and former slaves. In general, human capital

[29] Using the free black estimates for β (as opposed to the pooled estimates) the gap would be 15% larger, and health would explain 30% of that gap.

differences explain 30% of the mobility differences between slaves and free blacks, and 20% of that gap is due to health.

To gauge the robustness of the results with respect to migration, I check in three ways. The first is to use a measure of migration similar to the measure used in Table 5. In Table 6, the measure of migration is the 1900 state of residence and the state of residence given at the time of enlistment into the Union Army. This will obviously be highly correlated with the state of enlistment (see Litwack 1979 and Costa and Kahn 2006), although not perfectly so. State of residence at the time of enlistment is actually asked for at the time of pension application. As such, it may be more prone to error than the state of enlistment measure. In general, this construction results in lower probabilities of migration than the enlistment-based measure.[30] What we find are results very similar to the results in Table 5. Furthermore, the inclusion of illness again leads to declines in the effect of education on migration. As with the previous estimates, controlling for health shocks seriously diminishes the effect of education on migration. The effect of literacy on North-South migration, for example, declines by almost one-third once health is added to the specification.

Consistent with the results of Table 5, Table 6 shows that ex-slaves and free blacks did have different baseline migration propensities, and that slaves were more likely to be migrants if literate than free blacks. For both groups, the addition of health and other factors reduces the educational selection effect, in some cases by nearly a half for free blacks. For example, severe fever had a large effect for slaves but a negligible effect for free blacks. Interestingly, however,

[30] The mean of migration based on state of enlistment is .443, the mean based on birthplace is .428, the mean based on discharge is .453, and the mean based on state of residence at enlistment is .226.

typhoid has a strong negative effect on the inter-regional migration of slaves, suggesting that the effects of particular health shocks are difficult to predict.[31]

Going further, we can use another measure of migration that will not be as strongly correlated as the first two. Table 7 shows migration as measured by the state of residence in 1900 with the state of discharge from military service. Since the discharge state will always be well correlated with the enlistment state, and is exogenous to the troop himself, this robustness test serves two purposes. The first is to see if place of discharge alters the marginal effect of literacy on the propensity to migrate, as Lee (2005) found for white veterans, and also to see if the inclusion of health shocks lowers that probability in the same manner as in Tables 5 and 6. The results confirm the findings of Tables 5 and 6 on both counts. While literacy had almost no effect on interstate migration (perhaps largely because troops would be prone to move to their home state after discharge—unless the state of discharge was his state of residence, returning home would be noted as a migration here), literacy does have an effect on inter-regional and South-North migrations when defined in this manner.

Also, as with the previous estimates, Table 7 shows that the effect of literacy on migration decreases substantially once the other covariates are included. In the case of interstate and inter-regional migration, the effect of literacy is actually negative once the health shocks are included. While smallpox, typhoid, and respiratory infections led to lower migration propensities, fever led to increased likelihood of remaining in the state of discharge. As with previous estimates, the effects of these health shocks are large. For example, having smallpox is one-third the size of the educational selection for a slave, and respiratory infections had a larger

[31] To test for the presence of a single underlying health factor that could be used I performed principal component (factor) analysis on the health measures. Unfortunately, the principle factor had an Eigen value of only .36, next highest value was .072. Such low Eigen values suggest that there is not a principal component. The lack of a principal component is consistent with the results, where different health shocks have different effects on different types of migrations.

negative effect than literacy's positive effect on interstate migration. Table 7 shows that the pattern holds by slave status as well and is similar to the effects in Table 6, where education had a negative effect on migration propensities for free blacks, while ex-slaves were still positively selected.

Lastly, we can measure migration in a continuous way, using the actual distance (in miles) between the state of enlistment and the 1900 location of the veteran.[32] I estimate the regression

$$(11) \qquad Dist_i = \beta_0 + \beta_1 LIT_i + \beta_2 INJURED_i + \sum_k \beta_k ILL_{ki} + \sum_j \beta_j WAR_{ji} + + X'\theta + \varepsilon_i$$

where the distance of migration is regressed on literacy, whether the veteran had been injured during the war, illness by type during the war, and war characteristics such as the fraction of the veteran's regiment that dies in the war and whether the regiment was a fighting regiment or not.[33] Table 8 presents the results. This result allows us to measure the effect of specific war illnesses on the migration distance itself. The results show that cholera, malaria, and typhoid each had significant effects of migration distance, but not all in the same direction. Having malaria during the war increased the distance of migration, while cholera and typhoid each decreased the distance migrated. In addition, being a member of a fighting regiment (a regiment that sustained heavy battle-related casualties) increased the distance migrated, which could be due to the fact that fighting regiments were likely to travel to distant locations while in active duty. Fractions of the company free and light skinned had a negative effect on the distance migrated. Lastly, and most simply, age at death is positively related to migration distance—those who did migrate lived longer. This is the confirmatory evidence that health and migration

[32] Distance is measured from the center of the county of enlistment to the center of the county of present location. See Schwartz (1973) for the classic reference dealing with distance and migration.
[33] Fighting regiment is one that sustained heavy losses due to combat in the war. See Costa and Kahn (2006) for a description.

were positively related in the late nineteenth century for African Americans, and that part of what has been observed as educational selection is actually health-related.

VI. Conclusion

The story of educational selection in African American migration has neglected the potential confounder of health. In this paper I have shown that controlling for health shocks experienced pre-migration, the effect of literacy on migration is decreased substantially. As much as one-third of what we would term "educational selection" actually reflects the influence of other factors, many of which had their beginnings in the antebellum era. While educational selection is still present, and much more pronounced for slaves than for free blacks, the degree and magnitude of the decrease due to the inclusion of health shocks, and suggest that health status should begin to play a more prominent role in the discussion.

The findings presented here have shown that the effects of slavery did have an impact on the ability of blacks to accumulate human capital. In fact, the evidence we now have available suggest that the estimates drawn from the CTS may be understatements of the effect. African Americans born immediately after Emancipation had even lower living standards than those born in the late antebellum era. Carson (2007), for example, presents the first evidence yet of the biological living standard for blacks born after the Civil War. Even allowing for problems with the data and the considering the fact that his sample is drawn from prison records, he finds that biological measures such as height actually *declined* substantially for blacks and whites in the Reconstruction era, which is consistent with the argument made by Fogel and Engerman (1974). This trend does not begin to reverse itself until the Reconstruction era is over. If we take and extend the results we obtain from the CTS to those of lower heights who were born later, the

effects of poor health on mobility and economic outcomes would probably be larger since the general African American population was probably in poorer health than the troops.

Remarkably, the generation born after 1890, when the heights reported by Carson begin to rise, would have been the prime age movers during the Great Migration that began 25 years later. While this conclusion is highly speculative, to the extent that the generation born immediately after Emancipation was in poorer health than the generation that preceded it, we should expect relatively low levels of human capital accumulation and of migration for African Americans far after the end of chattel bondage. As the general health of the African American population recovered after 1890, mobility and the accumulation of human capital would coincide as children born in that era came of age. The results presented here suggest that the effects of slavery on subsequent African American health and economic outcomes may have taken several generations to run their course, and may be a key determinant in the convergence of black and white economic outcomes in the early and mid twentieth century.

References

Athearn, Robert (1978) *In Search of Canaan: Black Migration to Kansas, 1879-1880*. Lawrence, KS: The Regents Press of Kansas.

Bennett, Lerone (1993) *Before the Mayflower: A History of Black America*. New York: Penguin.

Berlin, Ira, et. al., eds. (1982) *Freedom: A Documentary History of Emancipation, 1861-1867*. Cambridge: Cambridge University Press.

_____. (1998) *Freedom's Soldiers: The Black Military Experience in the Civil War*. Cambridge: Cambridge University Press.

Bernstein, David E. (1998) "The Law and Economics of Post-Civil War Restrictions on Interstate Migration by African Americans." *Texas Law Review* 76: 781-847.

Blassingame, John (1965) "The Union Army as an Educational Institution for Negroes, 1862-1865." *Journal of Negro Education* 34: 152-159.

Carson, Scott A. (2007) "African-American and White Inequality in the Nineteenth Century American South: A Biological Comparison." Forthcoming, *Journal of Population Economics*.

Case, Anne, Darren Lubotsky and Christina Paxson (2002) "Economic Status and Health in Childhood: The Origins of the Gradient." *American Economic Review* 92: 1308-1334.

Case, Anne and Christina Paxson (2006) "Stature and Status: Height, Ability, and Labor Market Outcomes." NBER Working Paper No. 12466.

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

Cornish, Dudley (1952) "The Union Army as a School for Negroes." *Journal of Negro History* 37: 368-382.

Costa, Dora L. (2004) "Race and Pregnancy Outcomes in the Twentieth Century: A Long Term Comparison" *Journal of Economic History* 64: 1056-1086.

_____. (2005) "Race and Older Age Mortality: Evidence from Union Army Veterans" NBER Working Paper No. 10902.

Costa, Dora L. and Matthew E. Kahn (2006) "Forging a New Identity: The Costs and Benefits of Diversity in Civil War Combat Units for Black Slaves and Freemen." *Journal of Economic History* 66: 936-962.

Costa, Dora L., Lorens Helmchen, and Sven Wilson (2007) "Race, Infection, and Arteriosclerosis in the Past" *Proceedings of the National Academy of Sciences* 104: 13219-13224.

DuBois, W.E.B. (1902) *The Negro Artisan: A Social Study.* Atlanta, Georgia: Atlanta University Press.

Fogel, Robert William. (1975) "Three Phases of Cliometric Research on Slavery and its Aftermath." *American Economic Review* 65: 37-46.

_____. (1994) "Economic Growth, Population Theory, and Physiology: The Bearing of Long Term Processes on the Making of Economic Policy." *American Economic Review* 84: 369-395.

Fogel, Robert William and Stanley L. Engerman (1974) *Time of the Cross: The Economics of American Negro Slavery*. Boston: Little, Brown and Company.

Grant, Joanne, ed. (1968) *Black Protest: History, Documents, and Analyses 1619 to the Present*. Fawcett Premier.

Greenwood, Michael, J. (1997) "Internal Migration in Developed Countries" in Mark. Rosenzweig and Oded Stark, eds., *Handbook of Population and Family Economics.* Amsterdam: Elsevier.
Grossman, James R. (1989). *Land of Hope*. Chicago: The University of Chicago Press.
Gutman, Herbert G. (1975) *Slavery and the Numbers Game: A Critique of Time on the Cross*. Urbana, Illinois: University of Illinois Press.
Hamilton, C. Horace (1959) "Educational Selectivity of Net Migration from the South" *Social Forces* 38: 33-42.
Harris J. and M. Todaro (1970). "Migration, Unemployment & Development: A Two-Sector Analysis." *American Economic Review* 60: 126-42.
Harris, William H. (1982) *The Harder We Run: Black Workers Since the Civil War*. New York: Oxford University Press.
Henri, Florette (1975) *Black Migration: Movement North 1900-1920.* New York: Anchor Press.
Higgs, Robert (1982) "Accumulation of Property by Southern Blacks before World War I" *American Economic Review* 72: 725-737.
_____. (1984). "Accumulation of Property by Southern Blacks before World War I: Reply" *American Economic Review* 74: 777-781.
Jones, Jacqueline (1989). *Labor of Love, Labor of Sorrow*. New York: Vintage.
Lee, Chulhee (2005) "Health, Information, and Migration: Geographic Mobility of Union Army Veterans, 1860-1880" NBER Working Paper No. 11207.
_____. (2006). "Socioeconomic Differences in Wartime Mobility and Mortality of Black Union Army Soldiers." Unpublished manuscript, Seoul National University.
Leiberson, Stanley (1978) "Selective Black Migration from the South: A Historical View." in Frank Bean and W. Packer Fresbie, eds., *The Demography of Racial and Ethnic Groups*. New York: Academic Press.
Litwack, Leon F. (1979) *Been in the Storm so Long: The Aftermath of Slavery*. New York: Knopf.
_____. (1998) *Trouble in Mind: Black Southerners in the Age of Jim Crow*. New York: Knopf.
Margo, Robert A. (1984). "Accumulation of Property by Southern Blacks before World War I: Comment" *American Economic Review* 74: 768-776.
_____. (1988) "Schooling and the Great Migration." NBER Working Paper No. 2679.
_____. (1990). *Race and Schooling in the South, 1880-1950*. Chicago: The University of Chicago Press.
Meier, A. and Rudwick, E. (1970) *From Plantation to Ghetto*: *Revised Edition*. New York: Hill and Wang.
Mincer, Jacob (1978) "Family Migration Decisions" *Journal of Political Economy* 86: 749-773.
Painter, Nell I. (1986) *Exodusters: Black Migration to Kansas after Reconstruction*. New York: W.W. Norton.
Ransom, Roger L. and Richard Sutch. (2001) *One Kind of Freedom: The Economic Consequences of Emancipation.* London: Cambridge University Press.
Ruud, Paul (2000) *An Introduction to Classical Econometric Theory* New York: Oxford University Press.
Ruggles, Steven and Matther Sobek, et. al. (1997) *Integrated Public Use Microdata Series: Version 2.0* Minneapolis: Historical Census Projects, University of Minnesota.
Sacerdote, Bruce (2005). "Slavery and the Intergenerational Transmission of Human Capital." *Review of Economics and Statistics* 87: 217-234.

Saville, Julie. (1994) *The Work of Reconstruction: From Slave to Wage Laborer in South Carolina, 1860-1870*. New York: Cambridge University Press.
Schwatrz, Aba (1973) "Interpreting the Effect of Distance on Migration." *Journal of Political Economy* 81: 1153-1169.
_____. (1976) "Migration, Age, and Education." *Journal of Political Economy* 84: 701-720.
Shaffer, Donald (2004) *After the Glory: The Struggles of Black Civil War Veterans*. University of Kansas Press.
Shryock, Henry S. and Charles Nam (1965) "Educational Selectivity in Interregional Migration" *Social Forces* 43: 299-310.
Sjaastad, Larry A. (1962) "The Costs and Returns of Human Migration." *Journal of Political Economy* 70: 80–93
Smith, James P. (1984) "Race and Human Capital." *American Economic Review* 74: 685-698.
_____ and Finis Welch (1979) "Race Differences in Earnings: A Survey and New Evidence." In M. Straszheim and P. Mieszkowski, eds., *Current Issues in Urban Economics*. Baltimore, MD: Johns Hopkins University Press.
Steckel, Richard H. (1986a) "Birth Weights and Infant Mortality Among American Slaves." *Explorations in Economic History* 23: 173-198.
_____. (1986b) "A Peculiar Population: The Nutrition, Health, and Mortality of American Slaves from Childhood to Maturity." *Journal of Economic History* 46: 57-77.
_____. (1986c) "A Dreadful Childhood: The Excess Mortality of American Slaves." *Social Science History* 10: 427-465.
_____. (1995) "Stature and the Standard of Living." *Journal of Economic Literature* 33: 1903-1940.
_____. (2004) "Fluctuations in a Dreadful Childhood: Synthetic Longitudinal Height Data, Relative Prices and Weather in the Short-Term Health of American Slaves." NBER Working Paper No. 10993.
_____. (2007) "A Pernicious Side of Capitalism: The Care and Feeding of Slave Children." Unpublished manuscript, The Ohio State University.
Tolnay, Stewart E. (1998) "Educational Selection in the Migration of Southern Blacks, 1880-1990." *Social Forces* 77: 487-514.
Trotter, Joe William, ed. (1991) *The Great Migration in Historical Perspective*. Indiana University Press.
U.S. Bureau of the Census. (1968). *Negro Population 1790-1915*. New York: Arno Press and the New York Times.
Vigdor, Jacob (2002) "The Pursuit of Opportunity: Explaining Selective Black Migration." *Journal of Urban Economics* 51: 391-417.
Wade, Richard C. (1964) *Slavery in the Cities: The South 1820-1860*. New York: Oxford University Press.
Woodson, Carter G. (1918) *A Century of Negro Migration*. New York: AMS Press.

Appendix

The data also allows for us to check the robustness of the result in a different way—where would *not* expect to see educational (or any other type) of selection. In Appendix Table 1 migration is measured as the state of residence in 1900 and the state of residence in 1910. Migrations at this time, when veterans of the Civil War were aged, are not likely to be prone to educational selection. The regression is

$$Mig_i = \beta_0 + \beta_1 LIT_i + \sum_k \beta_k HEALTH_{ki} + X'\theta + \varepsilon_i \quad \text{(A1)}$$

The results of Appendix Table 1 confirm that there was little educational selection at older ages for migration, and illness during the war had very small effects on the probability of migration. When disaggregating by slave status the result remains, neither ex-slaves nor free blacks exhibited much in the way of educational selection in migration at this late stage of life, and the effects of health shocks are less than .5% in almost every case.

Appendix Table 2 reports the full specification of the distance regression reported in Table 8. To give readers some indication of the baseline measures of literacy and health on migration propensities, Appendix Table 3 shows estimates similar to those in Table 6 by slave status.

Table 1
Summary Measures of African American Migration 1870-1920

Panel A
Percentage Distribution of the African American Population, 1870-1910

Year	The South	The North	The West
1870	90.6	9.3	0.1
1880	90.5	9.3	0.2
1890	90.3	9.4	0.4
1900	89.7	10	0.3
1910	89.0	10.5	0.5

* Data from U.S. Bureau of the Census, *Negro Population 1790-1915* , 1968, (p.33)

Panel B
Urban and Rural African American Population, 1890-1910

Year	Urban Pop.	Percentage	Rural Pop.	Percentage
1890	1,481,142	19.8	6,007,534	80.2
1900	2,005,972	22.7	6,828,022	77.3
1910	2,689,229	27.4	7,138,534	72.6

*Data from U.S. Bureau of the Census, *Negro Population 1790-1915* , 1968 (p. 88)

Panel C
African American Migration 1870-1920

	Black Migration From South	Net Migration			
		South	Northeast	North Central	West
1870-1880	68,000	-68,000	26,000	42,000	-
1880-1890	88,000	-88,000	61,000	28,000	-
1890-1900	185,000	-185,000	136,000	49,000	-
1900-1910	194,000	-194,000	109,000	63,000	22,000
1910-1920	555,000	-555,000	242,000	281,000	32,000

*Data from William Collins "When the Tide Turned: Immigration and the Delay of the Great Balck Migration" *Journal of Economic History* , Vol. 57, No.3, 1997, (pp. 608, 610).

Table 2
Census Tabulations of Skill, Migration and Literacy 1870-1910

Panel A
Change in the Number of Skilled Migrants, Skilled Men and Migrants by Census Year

Year	Skilled Migrant	Skilled	Migrant	SM/M*	SM/S*
1870-1880	68,500	467,750	83,250	82.28%	14.64%
1880-1890	25,158	181,573	33,366	75.40%	13.86%
1890-1900	25,158	181,573	33,366	75.40%	13.86%
1900-1910	71,832	242,082	77,013	93.27%	29.67%

* S= Skilled, SM= Skilled Migrant

Panel B
Geographic Distribution of African American Men by Skill and Migration Status

	Total		Skilled Men		Migrants		Skilled Migrants	
Year	% Rural	% Urban	% Rural	% Urban	% Rural	% Urban	% Rural	% Urban
1870	91.01%	8.99%	76.31%	23.69%	60.37%	39.63%	41.04%	58.96%
1880	84.06%	15.94%	66.60%	33.40%	47.59%	52.41%	31.28%	68.72%
1890^	81.04%	18.96%	60.46%	39.54%	38.71%	61.29%	26.12%	73.88%
1900	77.46%	22.54%	55.96%	44.04%	31.90%	68.10%	22.76%	77.24%
1910	71.25%	28.75%	41.80%	58.20%	28.52%	71.48%	19.77%	80.23%

^ Note that 1890 data is the average of the 1880 and 1900 data

Panel C
Literacy Rate of Southern Born African American Men by Skill and Migrant Status

Year	Total	Skilled	Migrant	Skilled Migrant
1870	27.62%	39.20%	57.70%	62.26%
1880	38.51%	46.37%	62.35%	63.37%
1890^	46.50%	57.76%	71.29%	72.40%
1900	55.97%	66.11%	78.14%	78.23%
1910	65.39%	75.99%	87.97%	89.53%

^ Note that 1890 data is the average of the 1880 and 1900 data

Note: Thes tabulations use the person weights in the IPUMS data so that the percentages are representative of the African American population at the time of enumeration.

Table 3
Census Estimates of Migration, Selected Coefficients, 1870-1910

	Interstate Migration						North-South Migration					
	All		Free Blacks		Former Slaves		All		Free Blacks		Former Slaves	
	I	II	III	IV	V	VI	I	II	III	IV	V	VI
Literate	0.107***	0.0333***	0.225***	-0.0379**	0.0805***	0.0543***	0.0897***	0.0586***	0.0484***	-0.0623***	0.116***	0.0815***
	[0.0054]	[0.0071]	[0.011]	[0.019]	[0.0071]	[0.0085]	[0.0036]	[0.0035]	[0.0060]	[0.011]	[0.0050]	[0.0048]
Occ Score		-0.00345***		-0.00533***		-0.00319**		0.00166***		-0.00265***		0.00140***
		[0.00095]		[0.0019]		[0.0014]		[0.00040]		[0.00090]		[0.00053]
SEI Index		0.00366***		0.00574***		0.00410***		-0.00134***		0.00225***		-0.00150***
		[0.00065]		[0.0013]		[0.00083]		[0.00024]		[0.00057]		[0.00026]
Urban		0.133***		0.153***		0.0978***		0.101***		-0.00624		0.130***
		[0.014]		[0.028]		[0.019]		[0.0094]		[0.011]		[0.013]
Large City		0.134***		0.00684		0.196***		0.0126*		-0.00722		0.0170*
		[0.022]		[0.031]		[0.032]		[0.0074]		[0.014]		[0.0093]
Year is 1880	-0.0402***	-0.0659***	-0.0240***	-0.135***	0.0521***	-0.0335*	-0.0011	-0.0143**	-0.00845**	-0.0501***	0.0148***	-0.00838
	[0.0029]	[0.013]	[0.0042]	[0.017]	[0.0051]	[0.020]	[0.0017]	[0.0058]	[0.0022]	[0.0034]	[0.0028]	[0.0076]
Year is 1900	-0.0653***	-0.141***	0.0212***	-0.264***	0.0833***	-0.0876***	-0.00327**	-0.00896*	-0.00533**	-0.177***	0.0267***	0.0221**
	[0.0029]	[0.011]	[0.0042]	[0.028]	[0.0068]	[0.022]	[0.0017]	[0.0054]	[0.0022]	[0.020]	[0.0040]	[0.011]
Year is 1910	-0.0764***	-0.131***	0.0358***	-0.203***	0.0536***	-0.0915**	-0.00621**	-0.00202	-0.00584**	-0.101***	0.0332***	0.0176
	[0.0037]	[0.013]	[0.0055]	[0.021]	[0.013]	[0.036]	[0.0023]	[0.0072]	[0.0026]	[0.0090]	[0.0083]	[0.019]
Observations	143108	86041	79941	32553	63167	53488	143108	86041	79941	32553	63167	53488
Pseuso R-squared	0.02	0.09	0.08	0.12	0.01	0.07	0.06	0.17	0.07	0.17	0.07	0.21

Standard errors in brackets * significant at 10% level; ** significant at 5% level; ** significant at 1% level
Source: Author's calculation from IPUMS sample of African American males over the age of 13 at time of Census enumeration.
Mean of dependent variable = .185 (.085 North/South) for whole sample, .272 (.109) for former slaves, and .121 (.067) for free Blacks.
The coefficients are the marginal effects of a probit regression. For continuous variables (such as Occ Score) the effect is evaluated at the mean.
For dichotomous variables (such as literacy) the effects calculate the change in probability from moving from 0 to 1.
Odd numbered columns include literacy-year intereactions. Even numbered colums include mulatto, age, age squared, labor force status, and literacy-, occupation score-, SEI-, Urban-, Large City-, mulatto-, age-, age squared-, and laborforce status- year interactions.
Large City is defined as a location with more than 10,000 residents at time of Census enumeration.

Table 4
Slave Status and Health/Literacy Outcomes

	Dependent Variable:									
	Height	Illness	Wounded	Literate	Literate	Height	Illness	Wounded	Literate	Literate
	I	II	III	IV	V	VI	VII	VIII	IX	X
Slave	-0.113	0.0316**	0.00578	-0.0420***	-0.0702***					
	[0.069]	[0.013]	[0.0051]	[0.012]	[0.019]					
Height		0.0516	0.0698*	0.0125	0.00906		0.0521	0.0690*	0.0298	0.0319
		[0.072]	[0.037]	[0.070]	[0.070]		[0.072]	[0.037]	[0.071]	[0.071]
Height^2		-0.000332	-0.000514*	-0.000107	-0.00008		-0.000337	-0.000508*	-0.000241	-0.000255
		[0.00054]	[0.00028]	[0.00052]	[0.00052]		[0.00054]	[0.00028]	[0.00053]	[0.00053]
Illness				-0.0222*	-0.0458***				-0.0272**	0.0755**
				[0.013]	[0.018]				[0.013]	[0.030]
Wounded				-0.039	-0.0397				-0.0344	-0.0327
				[0.031]	[0.030]				[0.031]	[0.031]
Slave * Illness					0.0490*					
					[0.025]					
Alternative Slave definition:										
Slave						-0.188**	-0.0159	0.00574	-0.240***	-0.160***
						[0.094]	[0.017]	[0.0066]	[0.017]	[0.028]
Slave * Illness										-0.124***
										[0.033]
Observations	4675	4675	4675	4675	4675	4675	4675	4675	4675	4675
R-squared	0.001					0.001				
Pseudo R-squared		0.002	0.003	0.002	0.003		0.006	0.003	0.037	0.038

Standard errors in brackets * significant at 10% level; ** significant at 5% level; *** significant at 1% level
Slave status in the top panel is defined as those residing in and enlisting in a slave holding state at the time of enlistment (48.1% of sample)
Slave status in the bottom panel is defined as those born in a slave holding state (80.7% of sample).
Columns I and VI are OLS regressions, all others are probit regressions. For probits models the coefficients are the marginal effects of a probit regression. For continuous variables (such as height) the effect is evaluated at the mean. For dichotomous variables (such as health shocks) the effects calculate the change in probability from moving from 0 to 1.

Table 5

Migration and Selection from the Colored Troops Sample by Migration Type and Slave Status, Selected Coefficients

Does Veteran in 1900 Live in a State Different From the State of Enlistment?

	Interstate				Inter-regional				North-South			
		All	Slave	Free		All	Slave	Free		All	Slave	Free
	I	II	III	IV	I	II	III	IV	I	II	III	IV
Height	-0.897	-1.086	0.0546	-1.865	-0.617	-0.545	1.552	-1.712	0.874	0.804	0.93	1.332
	[0.95]	[0.97]	[1.59]	[1.46]	[0.88]	[0.88]	[1.69]	[1.25]	[0.80]	[0.73]	[1.00]	[1.15]
Height^2	0.0134	0.0166	0.000235	0.0278	0.00936	0.00843	-0.0221	0.0254	-0.0132	-0.0124	-0.0147	-0.0194
	[0.014]	[0.014]	[0.024]	[0.022]	[0.013]	[0.013]	[0.025]	[0.019]	[0.012]	[0.011]	[0.015]	[0.017]
Literate	0.115***	0.128***	0.192***	0.0650***	0.182***	0.171***	0.220***	0.113***	0.155***	0.0990***	0.187***	0.0188
	[0.014]	[0.014]	[0.021]	[0.021]	[0.013]	[0.014]	[0.020]	[0.020]	[0.012]	[0.011]	[0.017]	[0.014]
Wounded		0.0102	0.0354	-0.0182		-0.00569	0.0198	-0.0346		-0.0158	0.0138	-0.0497***
		[0.021]	[0.029]	[0.031]		[0.020]	[0.027]	[0.029]		[0.014]	[0.021]	[0.018]
Smallpox		0.0115	-0.0341	0.0322		-0.0715**	-0.0551	-0.0876*		-0.0592**	-0.0454	-0.0621**
		[0.041]	[0.065]	[0.052]		[0.036]	[0.057]	[0.047]		[0.025]	[0.042]	[0.031]
Malaria		-0.0384	-0.00651	-0.0753		-0.102**	-0.086	-0.122*		-0.0126	0.0362	-0.0676
		[0.056]	[0.075]	[0.086]		[0.048]	[0.063]	[0.073]		[0.041]	[0.063]	[0.046]
Measles		-0.0801	-0.0171	-0.123		-0.131***	-0.142**	-0.0749		-0.0034	-0.0189	0.0459
		[0.057]	[0.077]	[0.087]		[0.048]	[0.058]	[0.085]		[0.044]	[0.055]	[0.081]
Typhoid		-0.0333	0.0145	-0.081		-0.0217	-0.0343	0.00595		-0.0235	-0.0191	-0.0153
		[0.037]	[0.050]	[0.054]		[0.034]	[0.045]	[0.053]		[0.025]	[0.035]	[0.037]
Severe Fever		-0.0236	-0.0640**	0.0129		-0.024	-0.0803***	0.0363		-0.0543***	-0.0626***	-0.0481***
		[0.018]	[0.025]	[0.027]		[0.017]	[0.022]	[0.026]		[0.012]	[0.016]	[0.017]
Respiratory Infect.		-0.0724***	-0.0339	-0.104***		-0.0544***	0.00176	-0.105***		-0.0267**	-0.0251	-0.0255
		[0.019]	[0.028]	[0.028]		[0.018]	[0.026]	[0.025]		[0.013]	[0.019]	[0.019]
Observations	4675	4675	2317	2268	4675	4675	2317	2268	4675	4675	2317	2268
Pseudo R-squared	0.01	0.04	0.07	0.04	0.03	0.05	0.07	0.05	0.04	0.11	0.14	0.11

Standard errors in brackets * significant at 10% level; ** significant at 5% level; ** significant at 1% level

Note: Mean of Dependent Variable (All, Slave, Free) = .443, .423, .462 (interstate), .323, .307, .338 (regional), .180, .189, .172 (North/South)

The coefficients are the marginal effects of a probit regression. For continuous variables (such as height) the effect is evaluated at the mean. For dichotomous variables (such as literacy and health shocks) the effects calculate the change in probability from moving from 0 to 1.

All regressions include height cubed, marital status, employment status, wealth in 1900, farmer status, tuberculosis, pneumonia, dysentery and rheumetism. Wounded includes fractures, gunshot wounds, and all other wounds recorded in military records. Respiratory infections includes bronchitis.

Table 6

Migration and Selection from the Colored Troops Sample by Migration Type and Slave Status, Selected Coefficients

Does Veteran in 1900 Live in a State Different From the State of Residence at Enlistment as Given in Pension Application?

	Interstate				Inter-regional				North-South			
		All	Slave	Free		All	Slave	Free		All	Slave	Free
	I	II	III	IV	I	II	III	IV	I	II	III	IV
Height	-0.537	-0.45	-0.239	-0.341	-0.0775	0.0693	0.332	-0.0224	-0.184	-0.0979	0.109	-0.186
	[0.73]	[0.73]	[1.18]	[1.09]	[0.73]	[0.73]	[1.14]	[0.97]	[0.53]	[0.48]	[0.82]	[0.58]
Height^2	0.00728	0.00592	0.00204	0.00495	0.00108	-0.00114	-0.0052	0.000379	0.0024	0.000968	-0.00212	0.00236
	[0.011]	[0.011]	[0.018]	[0.016]	[0.011]	[0.011]	[0.017]	[0.014]	[0.0078]	[0.0071]	[0.012]	[0.0085]
Literate	0.0480***	0.0346***	0.0444**	0.0275	0.0561***	0.0418***	0.0613***	0.0275*	0.0525***	0.0321***	0.0566***	0.0157
	[0.012]	[0.012]	[0.018]	[0.017]	[0.011]	[0.011]	[0.016]	[0.015]	[0.0089]	[0.0084]	[0.013]	[0.011]
Wounded		0.121***	0.134***	0.102***		0.0835***	0.0756***	0.0889***		0.0465***	0.0504**	0.0355**
		[0.019]	[0.027]	[0.028]		[0.017]	[0.024]	[0.025]		[0.013]	[0.020]	[0.018]
Smallpox		-0.0629**	-0.0599	-0.0676*		-0.0471*	-0.0732*	-0.0289		-0.0195	-0.0625**	0.00652
		[0.031]	[0.051]	[0.038]		[0.026]	[0.041]	[0.033]		[0.021]	[0.028]	[0.028]
Malaria		0.0704	0.0884	0.0447		0.0629	0.0631	0.0586		0.116**	0.122*	0.101
		[0.052]	[0.072]	[0.075]		[0.047]	[0.066]	[0.068]		[0.047]	[0.067]	[0.064]
Measles		-0.0125	-0.051	0.0565		-0.0142	-0.0171	-0.00041		0.0117	-0.0081	0.05
		[0.049]	[0.060]	[0.082]		[0.042]	[0.057]	[0.066]		[0.037]	[0.046]	[0.066]
Typhoid		-0.0491*	-0.054	-0.0429		-0.0650***	-0.0975***	-0.0249		-0.0252	-0.0420*	-0.00787
		[0.028]	[0.038]	[0.043]		[0.022]	[0.027]	[0.036]		[0.018]	[0.024]	[0.027]
Severe Fever		0.0472***	0.0296	0.0655***		0.00674	-0.00364	0.0158		-0.0231**	-0.0299**	-0.0189
		[0.016]	[0.022]	[0.023]		[0.013]	[0.019]	[0.019]		[0.0095]	[0.014]	[0.012]
Respiratory Infect.		-0.00693	-0.00909	-0.00736		-0.0102	0.0027	-0.0245		-0.00983	-0.00734	-0.0157
		[0.016]	[0.023]	[0.023]		[0.014]	[0.021]	[0.018]		[0.011]	[0.017]	[0.013]
Observations	4675	4675	2317	2268	4675	4675	2317	2268	4675	4675	2317	2268
Pseudo R-squared	0.01	0.05	0.05	0.06	0.01	0.04	0.04	0.05	0.01	0.06	0.06	0.07

Standard errors in brackets * significant at 10% level; ** significant at 5% level; ** significant at 1% level

Note: Mean of Dependent Variable (All, Slave, Free) = .226, .236, .217 (interstate), .164, .182, .149 (regional), .101, .120, .085 (North/South)

The coefficients are the marginal effects of a probit regression. For continuous variables (such as height) the effect is evaluated at the mean. For dichotomous variables (such as literacy and health shocks) the effects calculate the change in probability from moving from 0 to 1.

All regressions include height cubed, marital status, employment status, wealth in 1900, farmer status, tuberculosis, pneumonia, dysentery and rheumetism. Wounded includes fractures, gunshot wounds, and all other wounds recorded in military records. Respiratory infections includes bronchitis.

Table 7

Migration and Selection from the Colored Troops Sample by Migration Type and Slave Status, Selected Coefficients

Does Veteran in 1900 Live in a State Different From the State of Discharge?

	Interstate				Inter-regional				North-South			
		All	Slave	Free		All	Slave	Free		All	Slave	Free
	I	II	III	IV	I	II	III	IV	I	II	III	IV
Height	-0.669	-0.514	0.303	-0.605	-1.428	-1.099	-1.213	-0.875	0.509	0.684	1.514	0.077
	[0.92]	[0.94]	[1.45]	[1.21]	[0.94]	[0.95]	[1.62]	[1.15]	[0.79]	[0.73]	[1.13]	[1.01]
Height^2	0.010	0.008	-0.004	0.009	0.022	0.016	0.019	0.012	-0.008	-0.011	-0.023	-0.001
	[0.014]	[0.014]	[0.022]	[0.018]	[0.014]	[0.014]	[0.024]	[0.017]	[0.012]	[0.011]	[0.017]	[0.015]
Literate	0.016	-0.019	0.0375*	-0.0630***	0.0388***	-0.009	0.0633***	-0.0699***	0.120***	0.0729***	0.100***	0.0531***
	[0.014]	[0.015]	[0.021]	[0.021]	[0.013]	[0.014]	[0.020]	[0.019]	[0.011]	[0.011]	[0.016]	[0.015]
Wounded		0.0546***	0.0861***	0.020		0.020	0.015	0.025		-0.014	-0.007	-0.026
		[0.021]	[0.029]	[0.031]		[0.020]	[0.028]	[0.030]		[0.014]	[0.019]	[0.019]
Smallpox		-0.157***	-0.252***	-0.111**		-0.169***	-0.244***	-0.123***		-0.0713***	-0.140***	-0.029
		[0.039]	[0.058]	[0.051]		[0.034]	[0.049]	[0.045]		[0.023]	[0.016]	[0.035]
Malaria		-0.077	-0.114	-0.004		-0.068	-0.095	-0.015		0.004	0.022	-0.020
		[0.057]	[0.077]	[0.088]		[0.053]	[0.073]	[0.081]		[0.041]	[0.059]	[0.053]
Measles		0.029	-0.095	0.156*		0.053	-0.108	0.226**		0.113**	-0.068	0.389***
		[0.059]	[0.077]	[0.089]		[0.059]	[0.072]	[0.091]		[0.053]	[0.043]	[0.093]
Typhoid		-0.240***	-0.269***	-0.214***		-0.195***	-0.260***	-0.118**		-0.0720***	-0.0950***	-0.041
		[0.032]	[0.042]	[0.048]		[0.029]	[0.035]	[0.047]		[0.020]	[0.023]	[0.033]
Severe Fever		0.117***	0.0916***	0.147***		0.106***	0.0794***	0.134***		0.018	0.006	0.021
		[0.018]	[0.026]	[0.026]		[0.018]	[0.026]	[0.026]		[0.014]	[0.018]	[0.020]
Respiratory Infect.		-0.0778***	-0.0903***	-0.0842***		-0.0410**	-0.041	-0.0562**		-0.008	-0.026	0.008
		[0.019]	[0.028]	[0.027]		[0.019]	[0.027]	[0.026]		[0.014]	[0.018]	[0.020]
Observations	4675	4675	2317	2268	4675	4675	2317	2268	4675	4675	2317	2268
R-squared	0.00	0.05	0.08	0.05	0.00	0.05	0.08	0.05	0.02	0.09	0.11	0.10

Standard errors in brackets * significant at 10% level; ** significant at 5% level; ** significant at 1% level

Note: Mean of Dependent Variable (All, Slave, Free) = .453, .478, .431 (interstate), .363, .395, .335 (regional), .172, .181, .164 (North/South)

The coefficients are the marginal effects of a probit regression. For continuous variables (such as height) the effect is evaluated at the mean. For dichotomous variables (such as literacy and health shocks) the effects calculate the change in probability from moving from 0 to 1.

All regressions include height cubed, marital status, employment status, wealth in 1900, farmer status, tuberculosis, pneumonia, dysentery and rheumetism. Wounded includes fractures, gunshot wounds, and all other wounds recorded in military records. Respiratory infections includes bronchitis.

Table 8
The Distance Between 1900 Residence and State of Enlistment
Selected Coefficients

Constant	175.644	233.038	-23.514
	(15.78)**	(2.69)**	(0.11)
Light Skinned	-14.41	-19.555	19.836
	(0.55)	(0.73)	(0.74)
War Injury	-25.866	-23.559	-16.476
	(1.60)	(1.39)	(0.96)
War Illness	-15.374	-0.893	
	(1.19)	(0.07)	
Literate	63.017	56.034	64.728
	(3.54)**	(3.03)**	(3.01)**
Age at Death		1.193	1.473
		(3.82)**	(4.49)**
Fract. Of Co. Died in War			115.561
			(1.27)
Fract. Of Co. Ill/Wounded			-69.39
			(0.16)
Fract. Of Co. Farmers			23.429
			(1.02)
Fract. of Co. Free			-123.787
			(3.13)**
Fract. of Co. Light Skinned			-257.835
			(2.66)**
Fract. of Co. Southern			27.395
			(0.73)
Fract. of Co. Literate			37.921
			(0.37)
Fighting Regiment			59.786
			(2.37)*
Height			0.455
			(0.44)
Chills			-57.904
			(1.49)
Cholera			-130.191
			(3.39)**
Malaria			104.502
			(2.17)*
Typhoid			-56.678
			(2.58)**
Observations	2166	2011	1477
R-squared	0.01	0.02	0.1

Robust t-statistics in parentheses
* significant at 5% level; ** significant at 1% level
Dependent Variable is Distance from 1900 location to place of enlistment (mean = 172.45)
Note: Author's Calculations based on Colored Troops Sample.
Company frangmentation defined in Costa and Kahn (2006)

Appendix Table 1
Migration and Selection from the Colored Troops Sample by Migration Type and Slave Status, Selected Coefficients
Does Veteran in 1900 Live in a State Different From State of Residence in 1910?

	Interstate				Inter-regional				North-South			
	All		Slave	Free	All		Slave	Free	All		Slave	Free
	I	II	III	IV	I	II	III	IV	I	II	III	IV
Constant	7.313	6.25	6.836	2.181	0.942	0.74	1.975	-0.184	0.47	0.21	1.738	-0.814
	(1.78)	(1.51)	(0.68)	(0.87)	(0.77)	(0.62)	(1.01)	(0.11)	(0.47)	(0.22)	(0.98)	(0.72)
Height	-0.341	-0.289	-0.323	-0.097	-0.045	-0.035	-0.094	0.008	-0.02	-0.008	-0.079	0.04
	(1.79)	(1.51)	(0.70)	(0.86)	(0.83)	(0.66)	(1.09)	(0.11)	(0.46)	(0.19)	(1.02)	(0.77)
Height^2	0.005	0.004	0.005	0.001	0.001	0.001	0.001	0	0	0	0.001	-0.001
	(1.79)	(1.51)	(0.71)	(0.86)	(0.89)	(0.72)	(1.17)	(0.10)	(0.45)	(0.16)	(1.06)	(0.81)
Literate	-0.004	-0.008	-0.016	0.002	0.004	0.004	0.006	0.002	0.002	0.001	0.002	0
	(1.15)	(2.26)*	(2.79)**	(0.50)	(1.94)	(1.80)	(1.95)	(0.60)	(1.18)	(0.61)	(0.78)	(0.06)
Wounded		0.002	0	0.004		0	0.001	-0.002		0.001	0.003	-0.002
		(0.44)	(0.05)	(0.68)		(0.07)	(0.29)	(0.52)		(0.24)	(0.71)	(2.29)*
Smallpox		-0.011	-0.012	-0.009		-0.004	-0.003	-0.005		-0.002	-0.002	-0.002
		(5.87)**	(2.96)**	(4.41)**		(4.39)**	(2.35)*	(3.42)**		(3.22)**	(2.20)*	(2.04)*
Malaria		0.014	0.041	-0.008		-0.005	-0.004	-0.005		-0.002	-0.002	-0.001
		(0.70)	(1.15)	(2.83)**		(3.37)**	(2.05)*	(2.38)*		(2.24)*	(1.89)	(1.06)
Measles		-0.002	0.001	-0.006		-0.003	-0.004	-0.004		-0.002	-0.003	0
		(0.16)	(0.05)	(2.79)**		(3.71)**	(2.37)*	(1.98)*		(2.52)*	(2.02)*	(0.40)
Typhoid		0.021	0.033	0.004		0.007	0.007	0.007		0.004	-0.002	0.01
		(1.56)	(1.49)	(0.34)		(0.93)	(0.72)	(0.60)		(0.71)	(2.30)*	(0.91)
Severe Fever		0.008	0.015	0.001		0.002	0.001	0.002		-0.001	0	-0.002
		(1.64)	(1.72)	(0.22)		(0.63)	(0.22)	(0.55)		(0.79)	(0.18)	(2.31)*
Respiratory Infect.		-0.006	-0.004	-0.007		-0.004	-0.005	-0.003		-0.003	-0.003	-0.002
		(1.41)	(0.48)	(2.09)*		(2.29)*	(3.33)**	(0.93)		(3.55)**	(2.72)**	(2.36)*
Observations	4675	4675	2317	2268	4675	4675	2317	2268	4675	4675	2317	2268
R-squared	0.001	0.02	0.05	0.001	0.001	0.001	0.01	0.001	0.001	0.001	0.01	0.01

Robust t-statistics in parentheses * significant at 5% level; ** significant at 1% level

Note: Mean of Dependent Variable (All, Slave, Free) = .015, .020, .010 (interstate), .005, .004, .005 (regional), .002, .003, .002 (North/South)
All regressions include height cubed, marital status, employment status, wealth in 1900, farmer status, tuberculosis, pneumonia, dysentery and rheumetism. Wounded includes fractures, gunshot wounds, and all other wounds recorded in military records. Respiratory infections includes bronchitis.

Appendix Table 2
The Distance Between 1900 Residence and State of Enlistment

Constant	175.644	233.038	-23.514
	(15.78)**	(2.69)**	(0.11)
Light Skinned	-14.41	-19.555	19.836
	(0.55)	(0.73)	(0.74)
War Injury	-25.866	-23.559	-16.476
	(1.60)	(1.39)	(0.96)
War Illness	-15.374	-0.893	
	(1.19)	(0.07)	
Literate	63.017	56.034	64.728
	(3.54)**	(3.03)**	(3.01)**
Co. Fragmentation Index		-191.409	-74.829
		(1.71)	(0.49)
Age at Death		1.193	1.473
		(3.82)**	(4.49)**
Fract. Of Co. Died in War			115.561
			(1.27)
Fract. Of Co. Ill/Wounded			-69.39
			(0.16)
Fract. Of Co. Farmers			23.429
			(1.02)
Fract. of Co. Free			-123.787
			(3.13)**
Fract. of Co. Light Skinned			-257.835
			(2.66)**
Fract. of Co. Southern			27.395
			(0.73)
Fract. of Co. Literate			37.921
			(0.37)
Fighting Regiment			59.786
			(2.37)*
Height			0.455
			(0.44)
Chills			-57.904
			(1.49)
Cholera			-130.191
			(3.39)**
Cold			48.941
			(1.26)
Diarrhea			-25.607
			(1.47)
Fever			28.724
			(1.35)
Heart Problems			53.177
			(1.08)
Hepatitis			-71.774
			(1.50)
Lung Problems			139.666
			(1.27)

Malaria			104.502
			(2.17)*
Measles			47.599
			(1.37)
Smallpox			58.713
			(0.98)
Respitory Problems			10.407
			(0.46)
Scurvey			19.08
			(0.62)
Stomach Problems			-25.587
			(0.61)
Syphilis			119.082
			(0.84)
TB			-23.715
			(0.50)
Typhoid			-56.678
			(2.58)**
Observations	2166	2011	1477
R-squared	0.01	0.02	0.1

Robust t-statistics in parentheses
* significant at 5% level; ** significant at 1% level
Dependent Variable is Distance from 1900 location to place of enlistment (mean = 172.45)
Note: Author's Calculations based on Colored Troops Sample.

Appendix Table 3
Migration and Selection from the Colored Troops Sample by Migration Type and Slave Status
Does Veteran in 1900 Live in a State Different From the State of Residence at Enlistment as Given in Pension Application?

	Former Slaves						Free Blacks					
	Interstate		Interregional		North-South		Interstate		Interregional		North-South	
	I	II	III	IV	V	VI	I	II	III	IV	V	VI
Constant	8.187	2.187	-3.417	-8.49	2.424	-3.646	9.71	6.399	5.039	1.501	2.264	2.294
	(0.3)	(0.08)	(0.18)	(0.45)	(0.15)	(0.23)	(0.56)	(0.37)	(0.42)	(0.12)	(0.21)	(0.21)
Height	-0.247	0.025	0.186	0.413	-0.076	0.206	-0.437	-0.275	-0.237	-0.066	-0.084	-0.073
	(0.2)	(0.02)	(0.21)	(0.48)	(0.1)	(0.28)	(0.55)	(0.35)	(0.44)	(0.12)	(0.17)	(0.14)
Height^2	0.002	-0.002	-0.003	-0.007	0.001	-0.004	0.006	0.004	0.004	0.001	0.001	0.001
	(0.1)	(0.11)	(0.24)	(0.51)	(0.06)	(0.33)	(0.54)	(0.32)	(0.45)	(0.12)	(0.13)	(0.08)
Height^3	0	0	0	0	0	0	0	0	0	0	0	0
	(0.01)	(0.22)	(0.28)	(0.53)	(0.01)	(0.38)	(0.51)	(0.29)	(0.45)	(0.11)	(0.08)	(0.01)
Literate	0.054	0.045	0.072	0.064	0.076	0.063	0.042	0.024	0.043	0.027	0.034	0.017
	(3.09)**	(2.61)**	(4.48)**	(4.01)**	(5.37)**	(4.43)**	(2.58)*	(1.39)	(3.02)**	(1.79)	(3.01)**	(1.4)
Farmer		-0.101		-0.068		-0.091		-0.068		-0.052		-0.049
		(5.54)**		(4.16)**		(7.53)**		(3.99)**		(3.53)**		(4.57)**
Married		0.017		-0.01		0.035		0.001		-0.027		0.021
		(0.88)		(0.52)		(2.34)*		(0.06)		(1.63)		(1.75)
Ill/Injured in War		0.01		-0.021		-0.037		0.02		-0.002		-0.006
		(0.64)		(1.47)		(2.98)**		(1.3)		(0.12)		(0.54)
Unemployed		-0.076		-0.047		-0.012		-0.028		-0.028		0.021
		(4.45)**		(2.97)**		(0.93)		(1.73)		(1.97)*		(1.91)
Wealth in 1900		0.241		0.18		0.112		0.419		0.312		0.202
		(6.67)**		(5.23)**		(3.71)**		(10.45)**		(7.59)**		(5.55)**
Observations	2317	2317	2317	2317	2317	2317	2268	2268	2268	2268	2268	2268
R-squared	0.01	0.04	0.01	0.03	0.01	0.04	0.01	0.06	0.01	0.05	0.01	0.04

The results are from a linear probability model where the dependent variable is migration away from state of enlistment.
Robust t-statistics in parentheses
* significant at 5% level; ** significant at 1% level
Note: Author's Calculations based on Colored Troops Sample.
Mean of Dependent Variable (Slave) = .236 (interstate), .182 (inter-regional), .120 (North-South)
Mean of Dependent Variable (Free) = .217 (interstate), .149 (inter-regional), .085 (North-South)