Estimating the Effect of Education on Mortality in the Presence of Migration: Evidence from the Jim Crow South

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Abstract

There are two indisputable facts of African-American social history over the 20th Century. First, after nearly no progress in educational opportunities for 50 years following the Civil War, beginning in the 1920s there are rapid gains in the level and quality of education for African-Americans. At the same time, these cohorts achieved a second distinction from generations before – they left the Jim Crow South in record numbers. As Smith and Welch (1989) document in their study "Black Economic Progress After Myrdal," rising education and The Great Migration—the early twentieth-century movement of millions of African Americans out of the South to locations with better social and economic opportunities—are understood to be the two principal factors in closing the earnings gap between whites and African Americans in the U.S. over the 20th Century. This paper studies the impact of these two factors on an essential dimension of lifetime wellbeing—longevity. We show that estimating the impact of education on longevity during this historical epoch is complicated. While education raised earnings and plausibly health, education also induced migration. Black et. al (2012) show that migration had an independent negative effects on longevity. In the face of this, a primary objective of our work is to jointly estimate the effects of education and migration on longevity. Since education and migration are both endogenous our study relies on multiple instruments to establish their independent impacts. Two quite separate factors had powerful effects on both education and migration. Aaronson and Mazumder (2012) establish that the Rosenwald Rural School Initiative had powerful effects on educational attainment and migration while Black et. al. (2012) show that proximity of birthplace to early twentieth century railroad lines had a powerful effect on migration; we establish here that it also had effects on educational attainment. Using both sources of variation, we find positive selection into migration and higher levels of education in terms of physical health. While we find no effect of education on longevity in the reduced form, we show that this result is driven by education improving longevity but education also increasing migration which reduced longevity. That is we find that accounting for the effects of migration, education substantially improved longevity while migration itself *reduced* it.

1. Introduction

Two inextricably linked phenomena lie at the heart of African American social history in the twentieth century. The first - after nearly no movement since the Civil War —starting in the 1920s and continuing until the landmark Brown v. Board case in 1954 was a marked increase in the level and quality of schooling of African Americans. The second was the movement of millions of African Americans out of the South to the industrial North known as the Great Migration. According to Smith and Welch (1989), these two factors were the principal reasons for the improvement in earnings of African Americans relative to whites between 1940 and 1980.

Heckman, Donohue and Todd (2002) summarize the improvement in school quality into the period between 1910 and the mid-1930s and then the period between the mid-1930s and 1960. For the cohorts we examine, improvement in education quality during the earlier period is at issue. They identify private philanthropy as the primary driver of increase in African-American school quality in this period. Of particular importance is the Rosenwald School Building Initiative. The Initiative was the result of collaboration between Booker T. Washington, the principal of the Tuskegee Institute in Alabama, and Chicago businessman and philanthropist Julius Rosenwald. The two men developed a matching grant program that, between 1913 and 1931, facilitated the construction of almost 5,000 schoolhouses for Southern rural Black children. Heckman et al (2002) estimates that 29 percent of enrollment of African-American children in the South was in Rosenwald schools.

In addition to making schooling more accessible, the program represented a sea change in the quality of schools. The buildings were constructed based on modern designs that ensured adequate lighting, ventilation and sanitation. Classrooms were required to be fully equipped with books, chairs, desks, blackboards and other materials to ensure an adequate learning environment. One indicator of the higher quality of Rosenwald Schools was that while they comprised 20 percent of school buildings, they comprised 32 percent of the value of school property in the South (see Heckman, et al (2002)). A number of other initiatives -- including minimum teacher salaries, newly built teacher homes, and training programs often in concert with other philanthropic efforts like the Jeannes Fund -- were introduced to recruit and prepare teachers[1].

A tremendous flow of intellectual energy has been devoted to the task of understanding economic forces surrounding the Great Migration—including efforts to ascertain the forces that led to the Great Migration in the first place. Out migration of blacks from the South likely stem from a combination of factors. This includes poor economic and oppressive social conditions in the South, emphasized in such prominent accounts as Lemann's (1991) *The Promised Land: The Great Black Migration and How It Changed America* and Wilkerson's (2010) *The Warmth of Other Suns: The Epic Story of America's Great Migration.* Other scholars have emphasized an increased demand for black workers in the North. Charles Johnson as early as 1925 suggested that migration was primarily driven by economic forces. He argued that if racial oppression was the driving factor then, African Americans would have moved north in the aftermath of Civil War rather than moving further south. He also analyzed data on lynching and found no evidence that African Americans were disproportionately fleeing these counties. More recent scholars have also highlighted that this increase in demand for African American works in the North corresponds to a sharp decline in the flow of

[1] Heckman, Donohoe and Todd (2002) argue that while private philanthropy greatly improved Black education quality, there were enormous gains in white educational quality as well during this time period. Of particular note was the large increase in the availability of high school education for whites in the South following a national trend. They argue that the net result was that while Black education increased substantially over the period, there was no *relative* increase in Black education until after the mid-1930s. Our study is concerned only with the absolute rise in the amount and quality of Black education.

immigrants from Europe that occurred after the implementation of restrictive post-World War I immigration policies (Collins, 1997).

One cause of the Great Migration that has been poorly is the role of rising education levels and education quality. In modern data it is clear that education is correlated with geographic mobility. On indication of this is that unemployment rates of educated workers have remained relatively similar across regions, which is consistent with migration arbitraging differences in employment prospects across regions; unemployment differences for less educated workers can persist across regions for a great deal of time (Gregg, Machin and Manning, 2004). International comparisons also suggest a link between education and migration. Machin, Pelkonen and Salvanes (2011) report a correlation of 0.78 between the average country level of education and the annual rate of mobility with the US being the most educated and mobile and Portugal the least educated and mobile across the 14 countries investigated. Of course this correlation could stem from many factors but Machin et. al (2011) also present causal evidence of the role of education on migration. Exploiting educational reform on the length of compulsorily schooling in Norway that varied regionally in its timing between 1959 and 1972, they show that this reform increased inter-county migration and increased the odds of working in one of the 9 largest cities in Norway. To our knowledge the only study of the role of the rise in African American education in the Great Migration is Aaronson and Mazumder (2011) who document that access to the Rosenwald Schools increases migration North.

Our work focuses on disentangling the effects of education and migration on one important measure of wellbeing – longevity. There is a vast literature on the effects of education on longevity and a smaller literature on the effects of migration on longevity. Many scholars have suggested that the relationship is likely causal. Cutler and Lleras-Muney (2010) provide evidence on a number of pathways by which education might improve health: highly educated people have higher income and better insurance, higher cognitive ability, and stronger social networks, all of which contribute to better health behaviors. Even so, it has proven difficult to demonstrate a causal relationship between education and mortality. Using an IV strategy based on changes in compulsory schooling laws in the early twentieth century U.S., Lleras-Muney (2005) estimates a large causal impact of education on mortality. However several aspects of this study have been called into question by other authors. The research design rests on the timing of these laws being uncorrelated to state-specific trends in outcomes. Mazumder (2007) shows that estimates of the health effects of education are sensitive to the inclusion of state-specific trends. Black et al. (2005) finds no statistically-significant relationship between compulsory schooling changes and education when standard errors are computed appropriately. Lleras-Muney (2005) also relies on estimates of cohort specific death rates that are extremely noisy; Black, Hsu and Taylor (2013) use a noise reducing strategy that relies heavily on vital statistics data and find virtually all of the variation in state-cohort mortality rates is captured by cohort effects and state effects alone, making it impossible to reliably tease out any additional impact due to changing educational attainment induced by state-level changes in compulsory schooling.

Other studies have used Lleras-Muney's identification strategy in other countries. Albouy and Lequien (2009) use French data to examine two successive reforms in compulsory education laws. Analyses using regression discontinuity (RD) and instrumental variables (IV) lead the authors to conclude that \survival rates at 50 and 80 years old do not seem to be affected by years of schooling. Similarly, Clark and Royer (2012) examine the relationship between education and health in the United Kingdom, using 1947 and 1972 British compulsory school laws reforms. They also find no sizable effect of education on mortality. Finally, Meghir, Palme, and Simeonova's (2012) study of compulsory education reform in Sweden shows that increased education appears to have contributed to limited gains in mortality among women.

The hypothesized effect of education on mortality may vary considerably both across populations and across the education distribution. As .Cutler and Lleras-Muney (2010) discuss there are many mechanisms through which education may operate. If education operates through income then the historical time period could matter a great deal. In general medical access and healthy behaviors rise with income but during some historical periods income healthy choices (such as a positive correlation between income and smoking in the 1940s, 1950s and 1960s). In addition, education may increase cognition and this may increase the ability to understand the benefits of medical interventions; however it is not clear that this mechanism is affected by compulsorily school laws which raise education within the secondary school years.

Finally, a pathway we emphasize here is that education may affect migration, especially rural to urban migration; and migration may affect health differently during various historical epochs. There is much evidence that migration to cities during the Industrial Revolution lowered health and raised mortality (CITE). The presumed mechanisms include increased exposure to virulent pathogens at least partly caused by poor sanitation and urban crowding (CITE). In addition there is some evidence of long-term impacts of pollutants on mortality (Taylor 2013). While historians have emphasized the link between cities and health before the germ theory of disease and the development of public health, there is more modern evidence that this link may have extended well into the 20th century. In work closely related to our work, Black et. al (2013) shows that this migration increased mortality of African Americans born in the early twentieth century. This inference comes from an analysis that uses proximity of birthplace to early twentieth century railroad lines as an instrument for migration. The paper shows that the likely causes of increase mortality were likely quite different than in early historical epoch. The work makes the case that behavioral differences, especially the increased use of tobacco and alcohol in cities during this period was a major contributing factor.

This work draws heavily on Aaronson and Mazumder (2011) and Black et. al (2013). Aronson and Mazumder (2011) use various data sources to establish the effects of the Rosenwald School Building initiative on educational attainment and other measures of human capital development. They also establish the first evidence that access to these schools increased migration out of the South. However their data sources do not measure health outcomes or mortality. Black et. al. (2013) establishes that these same cohorts of African Americans had higher mortality caused by migration. But their work does not have direct measures of educational attainment at the micro level. This work develops a new data source which contains all of the outcomes necessary to trace out the effects of education on mortality in the face of migration. The key to our work is extending the National Longitudinal Mortality Study (NLMS) to include the "town or county" of birth for the nearly 4 million individuals in the study. This allows us to place each respondent geographically to likely access to Rosenwald Schools early in life and allows us to understand access to railroad which independently raised the chances of leaving the South.

Our paper proceeds as follows. In section 2 we establish several facts about African-American education in the South and about migratory patterns. We establish that education was typically complete by the late teen years and thereafter migration to the North escalated rapidly with age until the mid 30s. We briefly discuss the Rosenwald School building program and its spatial and time series variation. Section 3 describes the main dataset we use , the NLMS and how we obtain fine grain geography on place of birth. Section 4 contains our main empirical results. We show that while access to a Rosenwald School increased education there appears to be no effects on mortality. However, we show that this is caused by two offsetting effects – the direct effect of education was to decrease mortality substantially but this was offset by an increase in migration North which increase mortality. Using cause of death information from the NLMS we also show that specific diseases were reduced by additional education but increased by migration. Section 5 is a conclusion.

2. Patterns of Education, Education Access and Migration

3. Data

As we have noted, our ability to study the impact of the Great Migration on mortality hinges on access to a unique data source, the Duke SSA/Medicare Dataset. We also use additional data sources, described below.

3.1. The National Longitudinal Mortality Survey (NLMS)

Our primary data source is the NLMS. The database was developed for the purpose of studying the effects of demographic and socio-economic characteristics on differentials in U.S. mortality rates. The NLMS is a unique research database in that it is based on a random sample of the non-institutionalized population of the United States. The NLMS currently consists of March Supplement of the Current Population from 1973 to 2008, as well as CPS files for February 1978, April 1980, August 1980, December 1980, and September 1985, and one 1980 Census cohort, 36 cohorts in all. Mortality information is obtained from death certificates available for deceased persons through the National Center for Health Statistics through 2010. Important variables available for analyses are standard demographic and socio-economic variables such as, education, income and employment as well as information collected from death certificates, including cause of death. The study currently consists of approximately 3.6 million records with 500,000 identified mortality cases.

A key variable not currently in the NLMS is fine grain geography on place of birth. While it is true that the state of birth is available from the CPS, sub-state measures such as town of birth is not. Our project requires that we locate subjects relative to Rosenwald School and railroad stop locations. Fortunately, the NLMS can be linked to the NUMIDENT File from the Social Security Administration (SSA). In addition to exact date of birth, the NUMIDENT File provides a 12-character text field for the place of birth as well as a two-character abbreviation for the State of birth. In our previous work we developed an algorithm that matches this object to place names recorded in the U.S. Geological Service's Geographic Names Information System (GNIS). The GNIS is the master list of all place names in the U.S. both current and historic, and includes geographic features including the longitude and latitude of each place. Our algorithm essentially classifies places according to the strength of their match between the write-in place of birth on the SSA NUMIDENT file and the GNIS list. We are able to match 85% of individuals with this algorithm; hand matching increases this rate to higher than 95% and eliminates most error.

3.2. The Duke Medicare/SSA

We will also use the Duke Medicare/SSA dataset. This records every individual who qualifies for Medicare (age 65) in the US and is also linked to the SSA NUMIDENT file. The file contains only place of birth, age at death, location at age 65 and a small number of demographic data. However the high density of the data is useful for this project. This data seem to have quite high coverage rates (typically 0.80 or above) for the 1916-1932 cohorts, but coverage rates are much lower for earlier cohorts. Thus we restrict attention to only the 1916-1932 cohorts.

4. Empirical Results

4.1 Results from the Duke Medicare/SSA dataset

Since the Rosenwald School exposure and proximity to a railroad line will both be important to our study, we begin our data exploration by studying how these two are related. Table 3 gives the fraction of individuals in our Duke Medicare/SSA dataset that were born on railroad lines by the percentile distribution of Rosenwald School exposure. For example, for individuals in counties in the lowest 10% of Rosenwald School exposure, 61.8% of residents of these counties were born on a railroad line. While there is some correlation between Rosenwald Exposure and the fraction of residents born on a railroad line, it is also clear that with counties of any level of exposure there are residents born both on and off of the line. It is possible that within counties, towns on the railroad line also were more likely to have Rosenwald Schools. While there is no comprehensive list of the exact location of Rosenwald Schools nationally, we were able to determine the location of 5XX of the 6XX Rosenwald Schools in North Carolina. When we correlate the presence of a Rosenwald School in a town with the town being on a Railroad line we find a correlation of X.XX.

The Duke Medicare/SSA data has the advantage of being very large. This allows us to investigate the effect of migration on mortality controlling for access to Rosenwald Schools. What is missing in this analysis is data on the actual level of education attained. For this reason we instrument migration north with proximity to the railroad line but enter the Rosenwald exposure variable just as a control. Our dependent variable of interest is the probability of living to age 75 (given that you lived to age 65). Column (1) of Table 4 replicates the finding from Black et al (2013). Controlling for Rosenwald exposure does effect the finding that migrating North substantially decreases the probability of living to age 75. As we described above, the reason for this is that exposure to Rosenwald schools is not especially correlated with living in a town on the railroad line. In fact the correlation is only 0.045. This low correlation stems from Rosenwald exposure varying at the county level while railroad proximity varies within county; that is regardless of the Rosenwald exposure, there are both towns on and off the railroad line within each county. Column (1) also suggests that there appears to be no effect of exposure on mortality. The coefficient on exposure is numerically very small and is estimated with a good amount of precision. Column (2) presents the first stage from the regression. What is clear is that both Rosenwald School exposure and proximity to a railroad line raises the probability of moving to the North.

Column (3) and (4) present the main equation and the first stage equation with additional controls. In the main equation we include a measure of whether the count was rural or urban and the interaction of these variables with Rosenwald School exposure. We do this as urban areas had alternatives to Rosenwald Schools where rural areas did not. One indication of the importance of Rosenwald Schools in rural areas is that the Black-White attendance gap narrowed from 21 percentage points to 9 percentage points in rural areas between 1910 and 1930; in urban areas the gap narrowed a more modest amount – from 13 percentage points to 7 percentage points. Column (3) suggests that while on average access to Rosenwald Schools did not promote longevity, it appears that in rural areas there was a modest effect on longevity raising the probability of living to age 75 by 1 percentage point; there does not appear to be any effect of Rosenwald School exposure in urban areas.

Column (4) presents the first stage regression. What is clear is that the effect of Rosenwald School exposure on migration is complicated. It appears that exposure to Rosenwald Schools had a powerful positive effect on migration in rural counties but a negative effect on migration in urban areas. We estimate that the effect of going from no exposure to complete exposure in rural areas raised migration by almost 7 percentage points; in urban areas it reduced migration by 1.2 percentage points (NOTE: WE NEED TO EXPLAIN THE WAY URBAN AND RURAL IS SET UP).

Columns (5) – (8) repeat these regressions on different subsamples. Columns (5) and (6) restrict the sample to the 11 confederate states; that is they eliminate Maryland, Oklahoma and Kentucky from the analysis. Columns (7) and (8) further eliminate the three states that border the Union states; that is they eliminate Virginia, Tennessee and Arkansas. In general, the results we see for the sample of the 14 States with Rosenwald Schools are similar to the analysis on various subsamples of these States.

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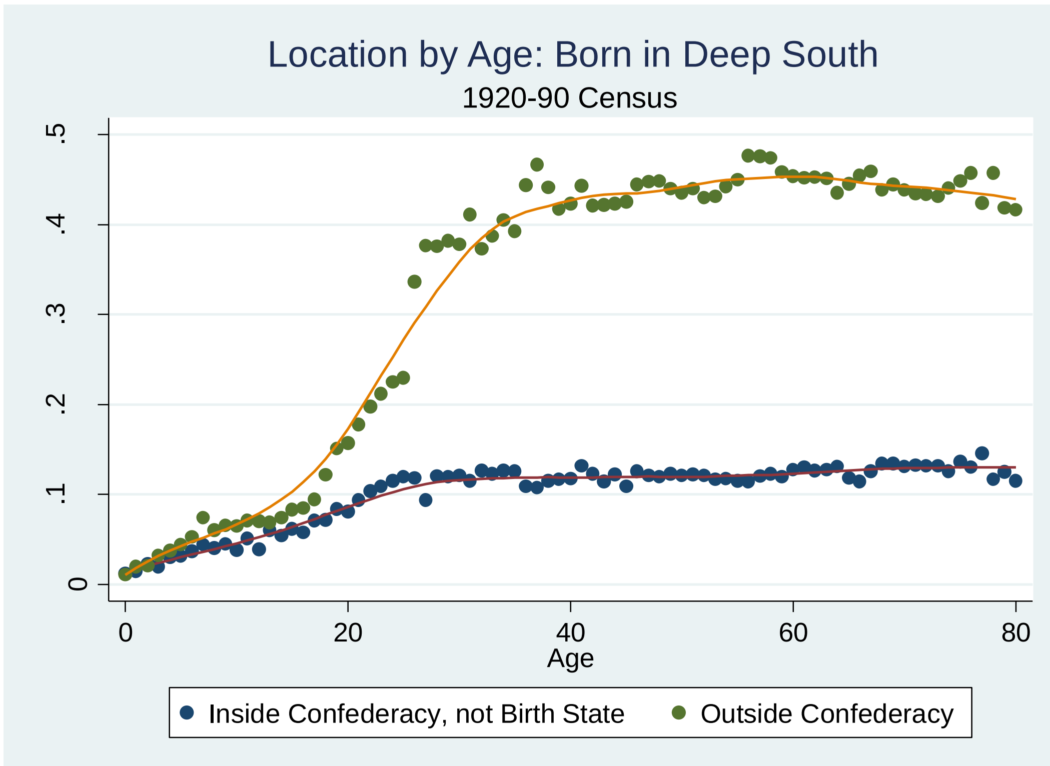
Figure 1. Migration within the South and to the North for African Americans Born 1916-1932



Source: Authors' calculations for blacks in the 1920-1990 Decennial Census born in the Deep South, 1916-1932.

Table 1. State of Residence in 1970, African Americans Born in the Deep South, 1916-1932

Born in South Carolina	Proportion
Reside in South Carolina	0.43
Reside in rest of South	0.11
Reside in North	0.47
Conditional on residing in North, proportion residing in:	
New York	0.34
Pennsylvania	0.17
District of Columbia	0.10
New Jersey	0.10
Maryland	0.10

Born in Georgia	Proportion
Reside in Georgia	0.49
Reside in rest of South	0.16
Reside in North	0.35
Conditional on residing in North, proportion residing in:	
New York	0.21
Michigan	0.15
Ohio	0.15
Pennsylvania	0.11
New Jersey	0.11

Born in Alabama	Proportion
Reside in Alabama	0.44
Reside in rest of South	0.10
Reside in North	0.47
Conditional on residing in North, proportion residing in:	
Ohio	0.23
Michigan	0.21
Illinois	0.12
New York	0.12

Born in Mississippi	Proportion
Reside in Mississippi	0.38
Reside in rest of South	0.14
Reside in North	0.49
Conditional on residing in North, proportion residing in:	
Illinois	0.39
Michigan	0.13
California	0.11

Born in Louisiana	Proportion
Reside in Louisiana	0.57
Reside in rest of South	0.12
Reside in North	0.32
Conditional on residing in North, proportion residing in:	
California	0.53
Illinois	0.10

Source: Authors' calculations, 1970 PUMS, state sample, black individuals aged 37 to 53 inclusive. We list destination States that have a proportion 0.10 or higher.

Table 2. Place of Residence in Old Age, African Americans Born in the Deep South, 1916-1932

Born in South Carolina	Proportion
Reside in South Carolina	0.42
Reside in rest of South	0.15
Reside in North	0.43
Conditional on residing in North, proportion residing in:	
New York City	0.41
Washington	0.19
Philadelphia	0.17
Non-metro area	0.0095

Born in Georgia	Proportion
Reside in Georgia	0.46
Reside in rest of South	0.19
Reside in North	0.35
Conditional on residing in North, proportion residing in:	
New York City	0.23
Detroit	0.15
Philadelphia	0.11
Non-metro area	0.014

Born in Alabama	Proportion
Reside in Alabama	0.42
Reside in rest of South	0.13
Reside in North	0.45
Conditional on residing in North, proportion residing in:	
Detroit	0.19
Chicago	0.14
Cleveland	0.12
Non-metro area	0.018

Born in Mississippi	Proportion
Reside in Mississippi	0.32
Reside in rest of South	0.15
Reside in North	0.53
Conditional on residing in North, proportion residing in:	
Chicago	0.36
Detroit	0.11
St. Louis	0.10
Non-metro area	0.025

Born in Louisiana	Proportion
Reside in Louisiana	0.53
Reside in rest of South	0.15
Reside in North	0.32
Conditional residing in North, proportion residing in:	
Los Angeles	0.30
San Francisco	0.19
Chicago	0.11
Non-metro area	0.016

Source: Authors' calculations, Duke-SSA data, birth cohorts, 1916 to 1932. We list destination cities that have a proportion of 0.10 or more.

Table 3:
Fraction of Population on Railroad Lines by Mean Rosenwald School Exposure

Pecentile	Mean Exposure	Fraction of Population on Railroad
10th	0.00	61.8
15th	0.02	69.0
20th	0.06	55.7
25th	0.09	57.6
30th	0.12	64.4
35th	0.14	57.6
40th	0.18	56.4
45th	0.21	59.5
50th	0.25	67.8
55th	0.28	64.1
60th	0.31	58.4
65th	0.35	59.9
70th	0.40	61.7
75th	0.46	57.4
80th	0.52	61.7
85th	0.60	63.5
90th	0.74	71.3
95th	0.89	61.5
Max	1.00	72.2
Mean	0.33	62.3

Table 4:
First and Second Stage Regressions, Railroad as an Instrument for Migration North

VARIABLES	(1) Live to 75	(2) North	(3) Live to 75	(4) North	(5) Live to 75	(6) North	(7) Live to 75	(8) North
North	-0.145***		-0.106***		-0.0937***		-0.0815***	
	(0.0179)		(0.0247)		(0.0227)		(0.0253)	
railroad		0.0561***		0.0400***		0.0446***		0.0402***
		(0.00104)		(0.00143)		(0.00151)		(0.00163)
Rosenwald Exposure (RE)	0.00325	0.0434***	0.00111	0.0269***	0.00125	0.0307***	0.000970	0.0281***
	(0.00211)	(0.00199)	(0.00270)	(0.00271)	(0.00289)	(0.00299)	(0.00310)	(0.00320)
On Railroad X Urban County				-0.0296***		-0.0313***		-0.0234***
				(0.00236)		(0.00248)		(0.00270)
On Railroad X Rural County				0.0638***		0.0760***		0.0828***
				(0.00411)		(0.00453)		(0.00489)
Rural County			-0.00101	-0.0348***	-0.000361	-0.0331***	0.000715	-0.0460***
			(0.00219)	(0.00216)	(0.00216)	(0.00228)	(0.00247)	(0.00247)
Urban County			-0.00440	0.0104**	-0.00431	0.00910**	-0.00558	0.0181***
			(0.00278)	(0.00415)	(0.00286)	(0.00451)	(0.00341)	(0.00489)
RE X Rural County			0.0103**	0.0428***	0.00924*	0.0395***	0.00913*	0.0445***
			(0.00481)	(0.00488)	(0.00501)	(0.00525)	(0.00550)	(0.00573)
RE X Urban County			-0.000882	-0.0392***	-0.00107	-0.0499***	0.00432	-0.0572***
			(0.00407)	(0.00409)	(0.00435)	(0.00450)	(0.00511)	(0.00521)
Constant	0.700***	0.428***	0.684***	0.436***	0.677***	0.431***	0.670***	0.435***
	(0.00878)	(0.00304)	(0.0118)	(0.00323)	(0.0109)	(0.00341)	(0.0121)	(0.00364)
Observations	912,929	912,929	912,929	912,929	856,608	856,608	711,916	711,916
R-squared	0.002	0.100	0.012	0.105	0.014	0.047	0.017	0.039

Notes: Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Column (1) -(4) for 14 States with Rosenwald Schools Present; Col (5)-(6) for 11 Confederate States (14 States - MD, OK, KY). Col (7)-(8) are Confederate States minus VA, TN, AR (states on border). Other controls incude sex X cohort fixed effects and State of Birth.

Appendix Table. Coverage Rates of Medicare Part B for African Americans Born in the Deep South, 1906 to 1932

Birth Cohort	Coverage Rate	Birth Cohort	Coverage Rate
1906	0.24	1920	0.83
1907	0.26	1921	0.83
1908	0.25	1922	0.82
1909	0.28	1923	0.90
1910	0.27	1924	0.77
1911	0.35	1925	0.85
1912	0.44	1926	0.84
1913	0.50	1927	0.86
1914	0.57	1928	0.85
1915	0.69	1929	0.79
1916	0.84	1930	0.87
1917	0.78	1931	0.86
1918	0.79	1932	0.90
1919	0.76		

Sources: Authors' calculations from the Duke SSA/Medicare data, and the 1980, 1990, and 2000 Public Use Micro Samples of the Decennial Censuses.