Title
Coping in the Cotton South

Author
Lombardi, Paul

Publication Date
2016

Peer reviewed|Thesis/dissertation

UNIVERSITY OF CALIFORNIA,
IRVINE

Coping in the Cotton South

DISSERTATION

submitted in partial satisfaction of the requirements
for the degree of

DOCTOR OF PHILOSOPHY

in Economics

by

Paul Lombardi

Dissertation Committee:
Associate Professor Daniel Bogart, Chair
Assistant Professor Damon Clark
Professor Priya Ranjan

2016

DEDICATION

To

my parents and friends

in recognition of their worth

as no man is an island

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACKNOWLEDGMENTS

I would like to express the deepest appreciation to my committee chair, Professor Daniel Bogart, who has the attitude and the substance of a genius: he continually and convincingly conveyed a spirit of adventure in regard to research and scholarship, and an excitement in regard to teaching. Without his guidance and persistent help this dissertation would not have been possible.

I would like to thank my committee members, Professor Damon Clark and Professor Priya Ranjan, for their support and guidance throughout the dissertation process. Additionally, I thank Professor Yingying Dong for her patience and assistance with my paper writing.

Finally, I would like to thank my family and friends for their support throughout my graduate career. While indirect, their support is invaluable in helping me complete my dissertation.

CURRICULUM VITAE

Paul Lombardi

2009	B.S. in Management Science, University of California, San Diego
2013	M.A. in Economics, University of California, Irvine
2013-16	Teaching Assistant, University of California, Irvine
2016	Ph.D. in Economics, University of California, Irvine

FIELD OF STUDY

Historical Economics, Labor Economics, and Development Economics

ABSTRACT OF THE DISSERTATION

Coping in the Cotton South

By

Paul Lombardi

Doctor of Philosophy in Economics

University of California, Irvine, 2016

Professor Daniel Bogart, Chair

My dissertation examines how rural Southern farmers responded to exogenous changes to household incomes during the early twentieth century. I use a range of statistical approaches: Ordinary and Two Stage Least Squares, Probit, and instrumental variable Probit. Critically, the proxy for household incomes, cotton yields, is predicted using weather fluctuations. In chapter one, I find credit constrained households have lower school attendance rates following negative income shocks. In chapter two, I find the probability of farm wage work is negatively correlated with incomes in credit constrained households. In both chapters, I use black and tenant farmers as proxies for credit constrained households. In the final chapter, I find the probability of a lynching occurring in the local community increases after household incomes fall.

Chapter 1

Introduction

In 1940, black men made fifty percent less in earnings than their white counterparts. Researchers commonly explain the wage gap by pointing to the difference in the two groups' investments in human capital (Carruthers and Wanamaker 2015 and O'Neil 1990). For men born in the Cotton South[1], the mean years of schooling for whites was three and half years higher than that of blacks for children born in 1910[2]. This leads to the question of why did blacks attend school at such lower rates relative to whites?

One explanation for the low attendance rates of black students focuses on the role of the southern cotton industry. Researchers find a negative correlation between cotton production and school attendance. During the early twentieth century, cotton crops tended to be child labor intensive and the primary agricultural product of the southern United States. As cotton production and demand for pickers declined, the opportunity cost of attending school declined resulting in higher attendance rates (Baker 2013).

In this paper, I assess the role played by credit constraints in the schooling decisions of black households during the 1920s and 30s. Based on a model developed by Ranjan (2001), blacks may pull their children from school to work, so they can maintain household consumption following a negative income shock. If households can access credit markets, they borrow against future earning and continue schooling. Due to differences in credit access, the model predicts households will react differently to the same income shock. This hypothesis has been discussed

[1] Throughout the paper the Cotton South (unless specified otherwise) refers to the ten U.S. states that produced around 95% of cotton during the late 19th and early 20th century: Arkansas, Alabama, Georgia, Florida, Louisiana, Mississippi, North and South Carolina, Tennessee, and Texas.
[2] The averages are based on the school obtainment values of individuals born in the Cotton South in 1910. The school obtainment values come from the 1940 Census. The 1910 is used because blacks born in this year should be in educated in graded schools. Earlier cohorts were potentially taught in ungraded school house (Margo 1990).

widely in the development context (Thomas et al. 2004, Jacoby and Skoufias 1997, and Beegle et al. 2006), but not in the Cotton South.

To test this hypothesis, I examine whether the attendance-income relationship is stronger for blacks than whites. I restrict my sample to farming households in the Cotton South during the early twentieth century. I use cotton yields as a proxy for farming household incomes. Since income is potentially endogenous to the attendance decision, I instrument for income. I predict cotton yields with precipitation and temperature measures during the crop cycle.

My results are consistent with the schooling choices of black farming households being affected by credit constraints. I find school attendance by children from black (more constrained) farming households is positively correlated with income. The school attendance of children from less constrained (white) households is unaffected by income fluctuations. The results match the predictions from Ranjan's (2001) model of credit constraints and consumption smoothing. I expand the literature further by observing a similar pattern between tenant and landowning farmers. The school attendance rates for children from tenant farming households decline following negative income shocks. School attendance by children from land owning households is unaffected by income changes.

Modern Economies Literature Review

The literature examining how external shocks effect child labor force participation in developing countries follows two broad branches. One considers how a positive external shock to the economy increases the opportunity cost of attending school. The other focuses on the use of child labor to smooth consumption in response to negative external shocks. Whatever the cause for the increase in child labor, both branches generally find that the increase comes at the expense of school attendance and obtainment.

Several empirical papers find child labor increases in response to improvements or positive external shocks to the macro economy. When Brazil's economy was booming in the late 1990s, Duryea and Arends-Kuenning (2003) found child labor force participation increased significantly in urban areas. Kruger (2007) found a similar response in rural areas of Brazil when the price of coffee beans spiked. The response is not specific to Brazil either. Researchers found a positive correlation between rice prices and child labor hours in rural Vietnam (Beegle et al. 2009 and Edmonds and Pavcnik 2004).

When a positive relationship between child labor force participation and the macro economy is observed, researchers explain the relationship by arguing the opportunity cost of attending school is increasing (Duryea and Arends-Kuenning 2003). As GDP increases, wages tend to increase including those of child workers. Under the assumption that working and earning a wage is the opportunity cost of attending school, as the economy's output increases so does the cost of attending school.

Researchers have also generally found negative external shocks increase child labor force participation. Following a twelve percent decline in Indonesia's GDP, Thomas et al. (2004) observed increases in child labor force participation. In rural Vietnam, child labor hours increased following natural disasters (i.e. flooding, landslides, and etc.)(Beegle et al. 2009). Farming households in India (Jacoby and Skoufias 1997) and Tanzania (Beegle et al. 2006) increased child labor usage in response to crop shocks. Duryea and Arends-Kuenning (2003) did not observe an increase in child labor force participation in Brazil during recessions. However, the authors suggest social insurance programs caused the breakdown in the relationship between child labor and the contracting economy.

Researchers explain the relationship between negative external shocks and increases in child labor by arguing that credit constrained households use child labor to consumption smooth. Ranjan (2001) uses a two period Overlapping Generations model to illustrate this connection. The model sensibly assumes the returns to schooling are higher than the market rate of return. When households are not credit constrained, they always invest in schooling. However, if households are constrained and experience a negative shock, they use child labor to increase household income and consumption.

Empirical evidence supports the theoretical prediction that credit constrained households increase child labor usage following a negative external shock. In Indonesia, poorer households increased child labor usage by more than wealthier ones following the decline of GDP (Thomas et al. 2004). Credit constrained farming households in India (Jacoby and Skoufias 1997) and Tanzania (Beegle et al. 2006) increased child labor usage following crop shocks.

Whatever the cause, researchers consistently find a negative relationship between increases in child labor force participation and schooling outcomes. Using Brazilian data, Cavalieri (2002) finds child labor force participation reduces the probability of completing a grade. For farming households in India, increases in child labor force participation were associated with declines in school attendance (Jacoby and Skoufias 1997). Using household surveys from Vietnam, Beegle et al. (2009) found a negative correlation between school enrollment and child labor hours. The authors also found a similar relationship between education levels and child labor hours.

The literature on developed economies differs from developing economies as researchers ignore the issue of child labor and try to directly link schooling outcomes and credit constraints. Lochner and Monge-Naranjo(2012) examine three branches of the literature that provide evidence of the effect of credit constraints. The importance of household income in determining college attendance has increased in recent decades (Belley and Lochner 2007 and Lovenhiem 2011). After conditioning on ability and family background, researchers find that household income is an insignificant determinant of college attendance for the National Longitudinal Survey of Youth's 1979 cohort. However, there is a positive significant relationship for individuals in the 1997 cohort (Belley and Lochner 2007). Researchers (Card 1995 and 1999 and Lang 1993) suggest that credit constraints are part of the explanation for the difference in IV and OLS estimates for the returns to schooling. Researchers observe younger households are more credit constrained (Meghis and Weber 1996 and Stephens 2008) and early childhood events have large effects on schooling outcomes (Karloy et al 1998, Duncan et al. 1998, Caucutt and Lochner 2005 and 2012 and Heckman 2010). However, no paper combines these findings.

Black Cotton South Literature Review

One explanation for the wage gap between whites and blacks during the late 19th and early 20th century is blacks attended school at lower rates. Looking at table 1, the reader sees blacks are less likely to be enrolled in school relative to their white counterparts. The paper's empirical results will confirm this fact as well. This paper contributes to the literature that tries to understand why black school attendance lagged whites in the Cotton South by looking at determinants of school attendance. The literature focuses on three factors: school quality, household characteristics, and labor market conditions.

Lower quality schools reduce black school attendance. In several papers, Margo finds a positive relationship between school quality and black schooling outcomes (Margo 1985 & 87). Southern black schools received less funding and lower skilled teachers relative to whites

(Margo1990).[3] The quality discrepancies led to lower attendance and literacy rates among southern blacks (Margo 1985 & 87).

Researchers find household characteristics are important determinants of the probability of children attending school in the Cotton South. Two factors that increase school attendance independent of race are higher levels of parental education and wealth. Using a sample of children from North and South Carolina, Barnhouse Walters and Briggs (1993) find a positive relationship between parent education and school attendance. The researchers use literacy as a proxy for parental education. This result matches previous research by Margo (1985 & 87). Using dwelling ownership as an indicator of household wealth, the researchers observe a positive correlation between school attendance and household wealth.

The local agricultural labor market conditions have also been found to affect black school attendance in the South at the beginning of the twentieth century. Baker (2013) observes child labor force participation declines as Georgia's cotton production declined over the 1920s. The decline in labor force participation was accompanied by a rise in school attendance. The author estimates the relationships with county level datasets on cotton production and school attendance from Georgia. The author instruments for cotton production with rain fall and the arrival of the boll weevil.

The current paper is partially a mix of the previous two branches of the Cotton South literature. Using U.S. Census data, I control for household characteristics including parental

[3] A separate literature examines the reasons for the underfunding of black schools in the Cotton South. Researchers tend to focus on the role of disenfranchisement and school boards decisions (Collins and Margo 2006 and Naidu 2012).

literacy and dwelling ownership[4]. I use weather variables as a source of exogenous variation. I consider the relationship between school attendance and the local labor market.

The current paper extends the literature by being the first to analyze the effect of income shocks on the probability of attending school in the Cotton South. Following a negative income shock, children from black households attend school less frequently. I observe the reverse is true as well (i.e. a positive income shock increases school attendance). Using cotton yields as a proxy for household incomes, I find a positive correlation between school attendance and cotton yields. I continue by showing that the attendance rates of children from tenant farming and farm laborer households have the same positive correlation with cotton yields. My empirical results are consistent with the predictions of a model where child labor is used by credit constrained households to consumption smooth (Ranjan 2001).

The empirical finding of a positive correlation between income and school attendance contradicts the pattern observed by Baker (2013). There are several explanations for the discrepancies between the results: By using county level datasets, Baker (2013) cannot control for variation at the household level (i.e. parental education levels and dwelling ownership). Without house characteristics, the researcher can not restrict the sample to rural farming households. The researcher relies on a panel from a single state as compared to my repeated cross section of the Cotton South. Beyond differences in the datasets, the results could be capturing different effects of cotton production. Theory can predict both a positive and negative correlation between cotton production and school attendance depending on the interpretation of cotton production. Baker (2013) uses cotton output as a proxy for the marginal product of child labor. The current paper uses cotton yields as a proxy for income in farming households.

---

[4] My estimates will match the correlations Barnhouse Walters and Briggs (1993) observe between house income and parent education with school attendance. However, these variables are not the focus of this paper.

Historical Background on Southern Labor and Capital Markets

The conclusion of the Civil War marked the end of slavery in the United States. However, the legacy of slavery was clearly visible in Southern states for decades to come. Rural black[5] farmers had limited access to credit markets in part due to a lack of assets. The combination of the lack of credit market access and federal insurance programs left the farmers susceptible to income fluctuations due to weather shocks to their primary crop—cotton.

Small rural black farmers had few assets following the end of slavery. At the conclusion of the Civil War, there was no general pattern of land redistribution. Most land remained in the hands of the white elite. In Georgia, only one percent of the land was owned by blacks in 1874 and one point six percent by 1880. Across the Cotton Belt, less than ten percent of the farm land was owned by blacks (Ransom and Sutch 2001). Farm land was not the only assets blacks lacked. Within rural counties of Georgia, blacks owned less than three percent of the total taxable assets[6] (Ransom and Sutch 2001). Beyond a lack of assets, black household also accumulated assets at a slower pace than whites (Higgs 1982). However, one physical asset the rural farmer owned that could be used as collateral was his future crop production. From the perspective of a lender, a farmer "'… could give virtually no security for his loans except the forthcoming crop (Anderson 2013).'" While crop liens gave farmers access to the credit market, they severely limited the sources of credit available to them.

The lack of assets besides crop liens limited the credit market for rural black farmers to the local merchant. Following the defeat of the Confederate Army, much of the South's formal

[5] Poor farmers faced similar credit constraints regardless of their race (Wright 1986 and Ransom and Sutch 2001). Tenant farmers and farm laborers did not own land and had few assets to secure a loan besides crop liens. Credit could be secured only through the local merchant. Government laws on child labor and social programs were the same for all farmers.

[6] Taxable assets includes land, city and town property, money and liquid assets, kitchen and household furniture, mules, horses, hogs, and etc., planation and mechanical tools, and all other property.

banking system collapsed. In 1860, there were forty-nine state charter banks in Georgia and South Carolina. Only three of these banks survived the Civil War (Ransom and Sutch 2001). Even following the Reconstruction Era, the South's banking system lagged relative to other parts of the country. Of the nearly three thousand national banks in the United States in 1890, less than four hundred of them were located in the twelve southern states[7] (Ransom and Sutch 2001). Beyond this general tightness of credit markets in the South, the lack of land ownership ensured most rural black farmers were cut off from traditional sources of credit. To fill this void, local merchants offered credit to rural farmers by taking crop liens as collateral. Merchants' reliance on personal knowledge of individuals to judge their credit worthiness limited the threat of competition from outsiders. While landowners' wealth and familiarity with locals represented a potential threat, merchants and landowners often worked together or simply were the same individual. Therefore, merchants were able to exercise a "territorial monopoly" (Ransom and Sutch 2001). The strength of the merchant's monopoly can be seen in the level of interest charged for credit. Based on data from 1880s Georgian merchants, Ransom and Sutch (2001) estimate that the average markup for corn purchased on credit was thirty-five percentage points higher than cash purchases. From the differences in price markups, they estimate an implicit annual interest rate of 59.4%. Merchants' monopoly power can also be observed in how the crop liens were written.

Merchants' control of the credit market led to crop liens requiring farmers to grow just cotton. From the perspective of the merchant, cotton had several benefits over other crops. The market for cotton was large and well established. Cotton can be easily stored without fear of spoilage. By forcing the farmers to grow just cotton, the merchant reinforced the farmer's

---

[7] The South in this case refers to Arkansas, Alabama, Georgia, Florida, Louisiana, Mississippi, North and South Carolina, Tennessee, Texas, Virginia, and West Virginia.

dependence as the farmer had to buy food and animal feed on credit. Indebted farmers knew the importance of growing cotton: "…cotton is the only crop that will bring money… cotton brings the money, and money pays debts…" (Wright 1986). Besides cementing the farmer's reliance on the merchant, cotton yields declined due to this practice. Southern farmers were not able to apply scientific farming techniques used by northern farmers to increases yields--crop rotation and fallow fields. While the local merchant's monopoly over credit developed organically, other features of the southern farming economy grew from the white elites' desire to limit the economic advancement of former slaves.

During the first half of the twentieth century, Southern congressmen voted to eliminate or limit federal programs meant to insure individuals against idiosyncratic shocks. Research by Alston and Ferrie (1999) details the strategies used by southern congressmen to exclude farmers from federal welfare programs. When the U.S. Congress passed the Social Security Act, farmers were excluded from both the unemployment and old age provisions. Southern congressman also succeeded in having farmers excluded from the Fair Labor Standards Act. By eliminating farmers, children were still able to work on farms. In the case of the Farm Security Administration, the southern congressmen were initially able to defund the program and later have the act that established it abolished. The act would have provided grants to farmers following natural disasters. (The administration also threatened merchant control by establishing co-operatives of farmers) (Alston and Ferrie 1999). While the motivation of Southern congressmen is not critical for the current paper, their success in affecting policy is. Farmers were not insured against weather shocks. And farming was one area of the labor market in which children could still participate.

Table 1 provides the reader with descriptive statistics on workforce participation[8], school enrollment[9], and idleness by race, age, and gender for children from farming households in the rural Cotton South. (Idle identifies children who are neither enrolled in school nor participating in the workforce). Even in the youngest age group, over eight percent of boys work. By the middle group, more than half of them are in the workforce. Black children work more and attend school less frequently than their white counterparts. Nearly fifty percent of black children and forty percent of white children aged five to nine are idle. By the ages ten to fourteen, idleness declines to twelve percent or less.

Theoretical Model

To generate predictions about the relationship between cotton yields and schooling choices, I rely on a general equilibrium model with overlapping generations. The model comes directly from Ranjan's (2001) household production model with credit constraints. The steady state equilibrium[10] features child labor despite parents having altruistic utility functions and the returns to schooling being higher than those for capital. The lack of access to credit is critical to achieving a steady state with child labor. If parents could borrow against futures, the model would not have child labor as every parent would send the child to school.

Households feature one parent and one child. Each individual lives for two periods: one as a child and then one as a parent. The parent's value function is altruistic in nature. The function is composed of the utility of consumption in the current period and the value function in

---

[8] Per the 1910 Census' Instructions to Enumerators, children on farms who helped their parent's farm or worked off the farm were identified as "Farm Laborer." Children who performed chores or general household work were not given an occupation. Without an occupation, children were not considered a labor force participant (Haines).

[9]Per the 1910 Census' Instructions to Enumerators, individuals who attended school anytime between September 1, 1909 and their enumeration date were counted as having attended school. Individuals aged between 5 and 21 who did not attend school were counted as "No." The question is left blank for individuals over 21 and those who did not attend school (Haines).

[10]I only present the steady state equilibrium of interest. Ranjan (2001) discusses the two trivial equilibria where all households send the child to school and not.

the next. The latter half of the function means the parent considers not just the child's utility, but the child's child's utility and so forth.

$$V_t = U(C_t) + \beta V_{t+1} \tag{1}$$

Parents discount the value of future generations by β where $0 < \beta < 1$. To maximize the value function, the parent selects to have the child attend school in the current period or not. If the child does not attend school, he earns a fraction of the adult unskilled wage ($w_c = \theta w_u$, where $0 < \theta < 1$) in period t and the unskilled wage in $t + 1$. Children who attend school receive no wage in period t and the individual's talent level multiplied by the skilled wage ($\sigma_i w_s$ where $\sigma_i \in [\underline{\sigma}, \bar{\sigma}]$) in $t + 1$. Talent represents the amount of human capital individuals gain from attending school. The budget constraint is the sum of the parent's income plus the child's (i.e. $b_t + W_c$ or b_t). Therefore, the parent's maximization problem takes the form:

$$V_t(b_{t,}\sigma_i) = \max(U(b_t + w_c) + \beta V_{\boldsymbol{t+1}}(w_u, \sigma_i), U(b_t) + \beta V_{\boldsymbol{t+1}}(\sigma_i w_s, \sigma_i)), \tag{2}$$

For a given σ_i there exists a threshold level of parental income $b^*(\sigma_i)$ such that parents with a $b_t > b^*(\sigma_i)$ send the child to school. In terms of the maximization problem, $b^*(\sigma_i)$ is the level of income conditional the on σ_i such that the parent is indifferent between sending the child to school or not (i.e. $(\sigma_i w_s) = (1 - \beta)[U(b_t + w_c) - U(b_t)] + \beta U(w_u + w_c)$). In the case of a logarithmic utility function, $b^*(\sigma_i)$ is given by:

$$b^*(\sigma_i) = \frac{(w_u + w_c)^{\frac{\beta}{1-\beta}}}{(\sigma_i w_s)^{\frac{\beta}{1-\beta}} - (w_u + w_c)^{\frac{\beta}{1-\beta}}} \tag{3}$$

Based on the equilibrium, we can consider how the model fits the observed patterns of school attendance for children from rural farms. For a given talent level, school attendance is an increasing function of parental income. On average, white households were wealthier and attend school more frequently than black households. I observe a similar pattern in my dataset when looking at home owners versus renters. The odds of attending school are also an increasing function of σ_i (i.e. the human capital gained from attending school). The historical literature shows that black schools were of a lower quality than white ones (Margo1990). Assuming lower quality schools lead to less human capital gains, the observed lower attendance rate by blacks fits the model's prediction.

Using comparative statics, the reader can observe how the model can predict both a positive and negative relationship between cotton production and school attendance. If cotton yield is used as a proxy for parental income, an increase in cotton yields increases school attendance. This mechanism is the basis of the current paper. Baker's (2013) paper finds a negative relationship between the marginal product of child labor and school attendance. My theoretical model has a similar prediction: a decline in θ (the fraction of the adult unskilled wage the child receives based on their margin product) leads to an increase in school attendance. Using cotton production as a proxy for the marginal product of child labor, Baker (2013) finds a negative correlation between cotton production and school attendance. Therefore depending on what cotton production is a proxy for, the model is capable of predicting either a positive or negative relationship with school attendance.[11]

Data

The weather data used to measure crop shocks comes from the nClimDiv dataset from the National Oceanic and Atmospheric Administration. The dataset is based at the Climate Division

[11] Baker (2013) uses a modified version of Baland and Robinson's (2000) one-sided altruism model. The model can generate the same predictions as the current paper's. The model predicts an increase in schooling following an increase in parental incomes.

level. Each state is composed of half dozen or more divisions. The divisions themselves are composed of several counties. Figure one shows a map of the United States broken down into Climate Divisions. From the map, we can see the nClimDiv database provides weather data across the entire contiguous United States at a level in-between the state and county levels.

From the nClimDiv dataset, I use measures of rainfall and temperature. The one month Standardized Precipitation Index is normalized using the division's historical rainfall patterns over the period 1901 to 2001. A measure of zero represents the median value. Negative values are associated with dry periods and positives with wet periods. The greater the magnitude of the measure the more severe the weather conditions are. Figures two and three provide the reader with a visual representation of the variation in division's rainfall. From the average monthly temperature measures, I generate a variable for division's average temperature across the crop cycle. The variation within a climate division's two weather measures is critical to my instrumental variable strategy.

Cotton output and acreage comes from the U.S. Agricultural Census. I collect the 1920 Agricultural Censuses data from the Inter-university Consortium for Political and Social Research's Historical, Demographic, Economic, and Social Data: The United States, 1790-2002 series. For 1930, I transcribed the values from digital copies of the U.S. Agricultural Census (Ruggles). The output and acreage variables are measured at the county level. Using these values, I calculate the cotton yield per acre by dividing the county's total cotton output by the total acres of cotton.

Individual level data come from the Integrated Public Use Microdata Series' one percent sample from the 1920 and the five percent sample from the 1930 U.S. Census. The key variable of interest is school attendance by individuals. The Census asked individuals if they attended school during the school year leading up to the census (i.e. the 1919-1920 and 1929-1930 school years). From this variable, I generate a dummy variable equal to one if an individual attended school during the academic year beginning in 1919 (or 1929) and zero otherwise.

By combining Census information on whether individuals live in urban or rural areas with farm status, I restrict my sample to rural farming households. I further restrict my sample to individuals from the Cotton South[12]. These restrictions reduce my sample to two hundred-forty thousand individuals (I also restrict the sample to individuals between the ages five and eighteen.). (In terms of the Climate Divisions, the sample has seventy-three divisions.)

The Censuses also provides demographic controls: age, race, gender, and number of siblings. Previous research into child labor shows that children's age, gender, and number of siblings are all important factors in the household's decision to use child labor. I control for gender by including a dummy variable equal to one for females and zero for males. Individuals' values for age and number of siblings are included directly in the estimation equations. Unlike previous studies, controlling for individuals' race is critical for my results. I find that blacks and whites responded differently to the same shocks. These finding are not surprising given the legacy of slavery.

The final set of individual level variables I gather from the Censuses are those for parental controls and household assets. The education level of parents is strongly correlated with their children's levels. The 1920 and 30 Censuses do not have a direct measure of individual's educational obtainment. Instead, I use literacy as a measure of individual's educational level. The Census defines literacy as the ability to read and write. Based on this definition, seventy percent

[12] I use the same group of states as Davis et al. (2009): Arkansas, Alabama, Georgia, Florida, Louisiana, Mississippi, North and South Carolina, Tennessee, and Texas. These states produced around 95% of cotton during the late 19th and early 20th century

of my sample is literate. From the literacy variable, I generate a variable equal to one when at least one of a child's parents is literate. (In households where only grandparents are present, I use their literacy in place of the parents'.) I control for household assets by including information on if the household owns or rents their dwelling. I create a dummy variable equal to one whether the household owns their dwelling and zero otherwise.[13] I combine information on ownership status and parent occupation to create a dummy variable for tenant farmers. If the household head is a farmer and the farm is rented, the tenant farmer dummy variable equals one. The variable equals zero if households own their dwelling or are headed by farm laborers.

Table two provides the reader with the differences in means of child school attendance rates based on several household characteristics. My sample of rural farming households from the Cotton South matches patterns previously observed by researchers. Children from black households attend school at lower rates than their white counterparts. The attendance rates of children with a literate parent are almost twenty percentage points higher than households with illiterate parents. This difference is even larger than the gap between landowners and renters—12.8. Female children attend school at slightly higher rates than males. Children from tenant farming households attend school in lower rates than other groups.[14]

The key assumption of the current paper is fluctuations in cotton yields (a proxy for household income) affect household schooling choices. Tables three and four provide support for this belief. Table three looks at how weather shocks influence attendance rates. Table four directly examines the effect of cotton yields on the attend rates of children from rural farming households from the Cotton South.

[13] In addition to the dummy for owning the household dwelling, I tried to include a dummy variable for owning the dwelling out right, but the variable is dropped due to multicollinearity.
[14] The difference between tenant farming and non-tenant farming households is misleading. The non-tenant farming category is composed of landowners and farm laborers.

Table three gives the differences in means of school attendance rates of household types conditioned on severe dry and wet Mays. Dry Mays tend to raise cotton yields while wet ones reduce yields. Therefore, cotton farmers' incomes likely fall following wet periods and rise after dry periods. From the table, the reader can observe school attendance rates are higher following a dry May for children from black, white, and tenant farming household. Only land owning households were unaffected. Following a wet May, the school attendance rates are lower across all households. However, the magnitudes of the differences are smaller than following a dry period except for landowners.

Table four compares the attendance rates of households in counties with high and low cotton yields. Counties in the high sample have yields in the top ten percent and counties in the low sample have yields in the bottom ten percent. Similar to the dry period portion of table three, the reader observes that children from black, white, and tenant farming households attend school with higher probabilities in high yield counties versus low yield counties. However, the differences are smaller than those based on dry periods. The difference is likely due to weather shocks capturing the fluctuations in incomes while the yields corresponds more to income levels. I fail to find a statistical difference between the attendance rates of children from land owning households from counties with high and low cotton yields.

In addition to individual controls, the U.S. Decennial Census provides county level controls. The county level controls come from the Inter-university Consortium for Political and Social Research's Historical, Demographic, Economic, and Social Data: The United States, 1790-2002 series. The controls include information on the county's area, population, and farms. The county's area is given in terms of square miles. Population variables include the county's totals for the following groups: total, rural, white males, black males, individuals over the age of nine, illiterate individuals over the age of nine, and individuals between six and twenty enrolled in school. For farms, I include the total number of farms, farms owned by native whites, and tenant farms. Within the category of tenant farms, I include the total acreage and value of farmland and implements.

The final set of controls measures school accessibility. I use the school quality dataset from Carruthers and Wanamaker 2015. The authors use annual education reports from southern states between 1910 and 1940 to generate a county level dataset. I include the total number of teachers at black and white schools, total number of black and white schools, and total expenditure per student.

Empirical Methods

Examining the features of the ideal model to test the relationship between income shocks and school attendance in credit constrained households guides the paper's model decisions. The sample population would experience the same exogenous shock to their incomes. The shock would only affect the schooling choice through the income channel. We would have data on household, school, and community characteristics.

For the current paper, the ideal linear model could have the following form:

$$School\ Attendance\ Rate_c = \alpha + \beta_{1i}\Delta Y_i + \beta_{2i}(CC_i * \Delta Y_i) + \boldsymbol{\beta}_{ni}\boldsymbol{X}_i + \boldsymbol{\beta}_{mc}\boldsymbol{X}_c$$

where ΔY_i is the exogenous change in household i's income from the previous period. CC_i is a measure of household i's level of credit constraint. X_i and X_c are household and community controls respectively. We expect β_{2i} to be positive and significant if households are credit constrained and using child labor to consumption smooth. If households can borrow against future earnings, they will not change schooling choices following a change in household income and β_{2i} will be insignificant.

One adjustment to the ideal model I make is to the income variable—ΔY_i. There are no datasets with individual level income data from the early twentieth century with individual characteristics. Therefore, I replace individual income with a proxy variable. As previous researchers have done (Baker 2013), I use a measure of cotton production as proxy for the incomes of farmers in the Cotton South. Yields times price provides a good approximation of farming incomes. Due to the accessibility of data and variation at the county level, I use cottons yields over cotton prices as a proxy for incomes in rural farming households in the Cotton South.

I also use a proxy variable in place of a direct measure of household's level of credit constraint. My proxy variable for being credit constrained is black.[15] Based on the historical evidence, freed slaves tended to not have land or other tangible assets that banks would accept as collateral. Liens on future crop production were the only assets many freedmen owned and the local merchant was the only individual willing to accept these as collateral. Therefore, we expect the average black farmer to be more credit constrained than his white counterpart.

After incorporating the two proxy variables, I estimate the following linear model:

$$\begin{aligned} School\ Attendance\ Rate_{rtc} &= \alpha + \beta_{1c} Cotton\ Yield_{ct} + \beta_{2c}(Black * Cotton\ Yield_{ct}) + \boldsymbol{\beta}_{mrc}\boldsymbol{X}_{rtc} \\ &+ \phi_r + \delta_t + \gamma_c \end{aligned}$$

$\boldsymbol{X}_{rtc}$ is a matrix of county controls by race and year. $Black$ is a dummy variable equal to one for black observations and zero otherwise. $Cotton\ Yield$ is a continuous variable equal to a county's cotton yield in a given year. The unit is five hundred pound cotton bales per acre. The model includes race ϕ_r, year, δ_t, and county, γ_c, fixed effects. The model's errors are clustered at the county level.

[15]As a robustness check, I replace black with tenant farmer and farm laborer as proxies for being credit constrained in some regressions.

The model's key variable of interest is the interaction term between cotton yield and Black. If the consumption smoothing explanation for child labor is correct, we expect the coefficient on the interaction term, β_{2c}, to be significant. A significant β_{2c} means the credit constrained group reacts differently to income fluctuations relative to the reference group—whites.

To control for household characteristics, I add household controls that are aggregate to the county level by race and year. The controls include parental literacy, age, number of sibling, and dummy variables for dwelling ownership and female. After aggregation, the parental literacy variable represents the percentage of households with a literate parent in a county by race and year. Previous child labor research shows that all of these characteristics are significant factors in household's education decisions. The household's assets affect their access to credit markets. To control for this access, I include a dummy variable equal to one if the household's dwelling is owned.

County controls include two other categories of variables researchers commonly have in child labor models: measures of school accessibility and local characteristics. For school accessibility, I include county level measures of the supply of schooling. The variables include the total number of black and white schools, total number of teachers at black and white schools, and total expenditures per student. For local characteristics, I add information on the county's population and farming community.

To address the possibility of cotton yields being endogenous, I implement an instrumental variable strategy. I use May values of the one month Standardized Precipitation Index and average temperature across the crop cycle as instruments. The instruments allow me to extract the exogenous portion of cotton yields. May rain and average temperature are correlated with cotton yields and unlikely to affect school attendance.

My instrumental variable strategy must address the issue that by interacting cotton yields with Black I generate a second potentially endogenous variable. I use an approach discussed by Wooldridge (2010) to handle the concern. I interact my two instrumental variables with Black to generate two additional instruments. Therefore, my two first stage equations take the forms:

$$\begin{aligned} &Cotton\ Yield_{dt} \\ &\quad = \alpha + \beta_1 May\ Rain_{dt} + \beta_2 May\ Rain\ X\ Black_{dt} + \beta_3 Avg\ Temperature_{dt} \\ &\quad + \beta_4 Avg\ Temperature\ X\ Black_{dt} + \boldsymbol{\beta X}_{dt} + \phi_r + \delta_t + \gamma_d \end{aligned}$$

$$\begin{aligned} &Cotton\ Yield\ X\ Black_{dt} \\ &\quad = \alpha + \beta_1 May\ Rain_{dt} + \beta_2 May\ Rain\ X\ Black_{dt} + \beta_3 Avg\ Temperature_{dt} \\ &\quad + \beta_4 Avg\ Temperature\ X\ Black_{dt} + \boldsymbol{\beta X}_{rtd} + \phi_r + \delta_t + \gamma_d \end{aligned}$$

where $May\ Rain_{dt}$ is the May value of one month Standardized Precipitation Index and $Avg\ Temperature_{dt}$ is average temperature across the crop cycle at the climate division level—d. The model includes race, year, and division fixed effects. The other portion of the equation is variables from the second stage. My second stage equation now has the following form:

$$\begin{aligned} Attendance\ Rate_{rtd} &= \alpha + \beta_1 \widehat{Cotton\ Yield}_{dt} + \beta_2 \widehat{Cotton\ Yield\ X}\ Black_{dt} + \boldsymbol{\beta X}_{rtd} + \phi_r \\ &+ \delta_t + \gamma_d \end{aligned}$$

The estimated cotton yield and interaction term replace the true values. I make several adjustments due to the instruments being measured at the climate division level. I cluster the errors and include fixed effects at the climate division level. I aggregate all of the variables to the climate division level.

Two potential threats to the excludability of the instrumental variable involve the weather directly affecting school attendance. Rainy weather could physically prevent children from attending school due to unpassable roads and water damage. This could explain a correlation between wet periods and declines in school attendance. However, the timing does not fit my model. Farmers begin to plant their cotton crop in April. The crops experience the weather shocks in May. Attendance data come from the school year that begins around September, which is just before the time cotton crops are picked—October. The four month gap between the occurrence of the weather shock and the start of school makes it unlikely that the weather directly causes changes in attendance rates. May storms could be severe enough that schools are damaged and unable to reopen in time for the new school year several months later. To address this threat, I add school access variables from the previous school year to my model (i.e. for 1930 I include the school access variables from the school years 1928-1929 and 1929-30). If the weather is closing schools, the closures will show up as decreases in the number of schools between the two school years.

Weather shocks could reduce household incomes and consumption. Under this explanation school is simply a normal good which the households consumes less of following a decline in incomes. However, this mechanism does not fit as public primary and secondary schools were free during the early twentieth century.[16]

Results

The theoretical model provides several testable predictions. If black rural farming households are credit constrained, we expect to observe school attendance rates of black children

[16] The estimates do not match the normal good explanation. The households uniformly experience income losses. However, the school attendance rates of children from credit constrained households respond differently to the income losses.

to vary with fluctuations in household incomes. Using cotton yields as a proxy for household incomes, the model predicts attendance rates will be positively correlated with cotton yields. Due to being less credit constrained, the model predicts white attendance rates will not vary with cotton yields.

Table five presents my baseline estimates based on Ordinary Least Squares. The statistically significant result that black children attended school less frequently than white children matches previous research into the schooling choices of rural farming households in the Cotton South. We see the parameter on the interaction term, Cotton Yield X Black, is positive and significant at five percent level in all four specifications. The result matches the predictions generated from my theoretical model. The schooling choices of the credit constrained group (black households) are positively correlated with income fluctuations (cotton yield). The model also predicts the less credit constrained group (white households) will not change their schooling choices with income fluctuations. The reader can observe the empirical results confirm this theoretical prediction as the coefficient on Cotton Yield is insignificant after the inclusion of controls beyond fixed effects. (The coefficient on Cotton Yield represents the response of white households to income fluctuations as they are the reference group.)

A few technical notes regarding table five: I aggregate the data to the county level to match the level observation for cotton yields. The four regressions include year and county fixed effects. I cluster the errors at the county level. The addition of School Access controls from Carruthers and Wanamaker (2015) reduce the number of counties from nine hundred-thirty to four hundred-fifty-one.

A potential issue with the results in table five is the endogeneity of cotton yields. If true, my baseline model will have two endogenous covariates—Cotton Yield and Cotton Yield X

Black. I address the issue by using the May value of the one month Standardized Precipitation Index and average temperature across the crop cycle to extract the exogenous portion of the cotton yield's variation. For Cotton Yield X Black, I interact the two instruments with the black dummy variable. Table six presents the F-statistics for the two first stages. The combined Kleibergen Paap F-statistic ranges from 6.25 to 11.00. Using the critical values for models with two endogenous variables and four instruments (Stock and Yogo 2005), the second stage estimates in the first two columns have a potential bias of less than 10% and 20% in the last two.[17]

I provide the two stage least squares estimates in table seven. The data is now aggregated to the climate division to match the level of observation for my instrumental variables. The estimates are similar to the results based on OLS. Children from black farming households attend school at lower levels than their white counterparts. After adding controls for local characteristics, the coefficient on Cotton Yield X Black is positive and significant at the five percent level or higher. However, the magnitudes are four to five times larger than the OLS estimates. The difference could be due to the OLS estimates capturing the average effect of changes in cotton yields across the population. The 2SLS estimates capture the effect of households responding to short run fluctuations in yields due to weather conditions. There is marginal evidence that white households reduce school attendance as cotton yields increase. We see the coefficient is negative and close to being statistically significant in columns 2 through 4. The result suggests some white households are responding to increasing wages by pulling children from school. The pattern is consistent with a rising opportunity cost of attending school.

[17] I repeat the estimation using Limited Information Maximum Likelihood in place of 2SLS. The second stage estimates are nearly identical to those presented in table eight. While LIML requires more assumptions, the estimates are no longer biased based on the critical values from Stock and Yogo (2005).

The results in tables five and seven show that income fluctuations due to changes in cotton yields was a significant factor in the schooling choices made by credit constrained farming households in the Cotton South. Using black as a proxy for being credit constrained, I find children from credit constrained households attend school more frequently after a rise in cotton yields and less when cotton yields fall. While black school attendance rates show a positive correlation with cotton yields, white attendance rates are unaffected. The result matches the prediction of the theoretical model as white households were less credit constrained.

Extensions

To further test my results, I estimate several models: I estimate my baseline equations with individual outcomes. I run a less restrictive model with no interaction term on different subpopulations: white and black farmers, urban blacks, and rural non-farming blacks. I replace black with tenant farmer and farm laborer as my proxy for being credit constrained.

Tables eight and nine show the results from estimating the baseline equations with individual outcomes. The individual results match those based on outcomes aggregated to the county and climate division levels. The coefficient on Black is negative and significant in six out eight of the specifications. The parameter of interest on Cotton Yield X Black is positive and significant at the five percent level after controlling local characteristics and measures of school access. Similar to the OLS estimates in table five, the coefficient on Cotton Yield is significant in the first two columns. However, the coefficient is insignificant after the addition of controls for school access and household characteristics.

In table ten, I estimate a less restrictive 2SLS with no interaction term—Cotton X Black. I restrict the sample to just white or black farmers. Therefore, the coefficients are not jointly determined like the baseline model. Before, the coefficient on the number of black schools represented the effect of black schools on the attendance rates of both white and black farmers. Now, I allow the coefficients to vary by race. I obverse a similar pattern as baseline estimates. The schooling choices of white farming households are unaffected by changes in incomes as the coefficient on Cotton Yield is insignificant. However, we see the coefficient is positive and significant for black farmers. Therefore, the attendance rates of children from black farming households are increasing in response to increasing incomes. A negative consequence of restricting my sample to subpopulations is the weak instrument issue is exacerbated. Therefore, I only present estimates with not weak instruments.

As a falsification test, I replace my sample of rural black farming households from the Cotton South with two groups whose attendance rates should be unaffected by cotton yields. A significant result would suggest my main empirical results are capturing a different mechanism than my theoretical model predicts. To show the my results are specific to black farming households, I show the estimates of regressing the attendance rates of children from urban black and rural non-farming black households on cotton yields in table ten. The results are insignificant in both cases. For the rural non-farming black households, the children likely attend the same schools as the children in my main sample. Therefore, my main results cannot be caused by changes in the supply of schools.

I replace Black as my proxy for credit constrained households with two other measures—tenant farmer and farm laborer. Black households had similar credit characteristics as tenant farming households: The households lacked tangible assets to be used as collateral for traditional loans. They relied on crop liens with the merchant to buy supplies. Government unemployment insurance did not cover farmers. Insurance against crop failures did not exist. Farm laborer access to credit was further limited by the lack of a crop or good reputation to borrow against.

However, the incomes of farm laborers did not vary with cotton yields. Therefore, the predicted coefficient pattern for tenant farmers is the same as black households: positive coefficient on the interaction term (i.e. Tenant Farmer X Cotton Yield). Cotton yields should not affect the school attendance of children from households headed by farm laborers.

I present my baseline estimates for tenant farming and farm laborer households in tables eleven and twelve. The omitted category in both tables is land owning farmers. The model includes year and division fixed effects and controls for household, county, and school access characteristics. The results match the patterns predicted by the theoretical model and empirical results for black farming households. Following a positive income shock, the school attendance rates rise for children from tenant farming households (i.e., the coefficient on Cotton Yield X Tenant Farmer is positive and statistically significant at the five percent level in all four specifications). After controlling for local characteristics, I find the school attendance rates of children from farm laborer households did not respond to changes in cotton yields. The result is consistent with historical evidence that laborers' wages were low but did not vary with yields (Ransom and Sutch 2001). I provide the estimates based on the less restrictive model in table thirteen. The signs and significance match the results from tables eleven and twelve.

Conclusion

Previous research into the effect of exogenous shocks to household incomes shows schooling outcomes of children from credit constrained households improve after a positive income shock and decline after a negative shock. Researchers base their studies on data sets from modern developing countries. I extend the literature by being the first to observe the same pattern in the U.S. Cotton South[18] during the early twentieth century.

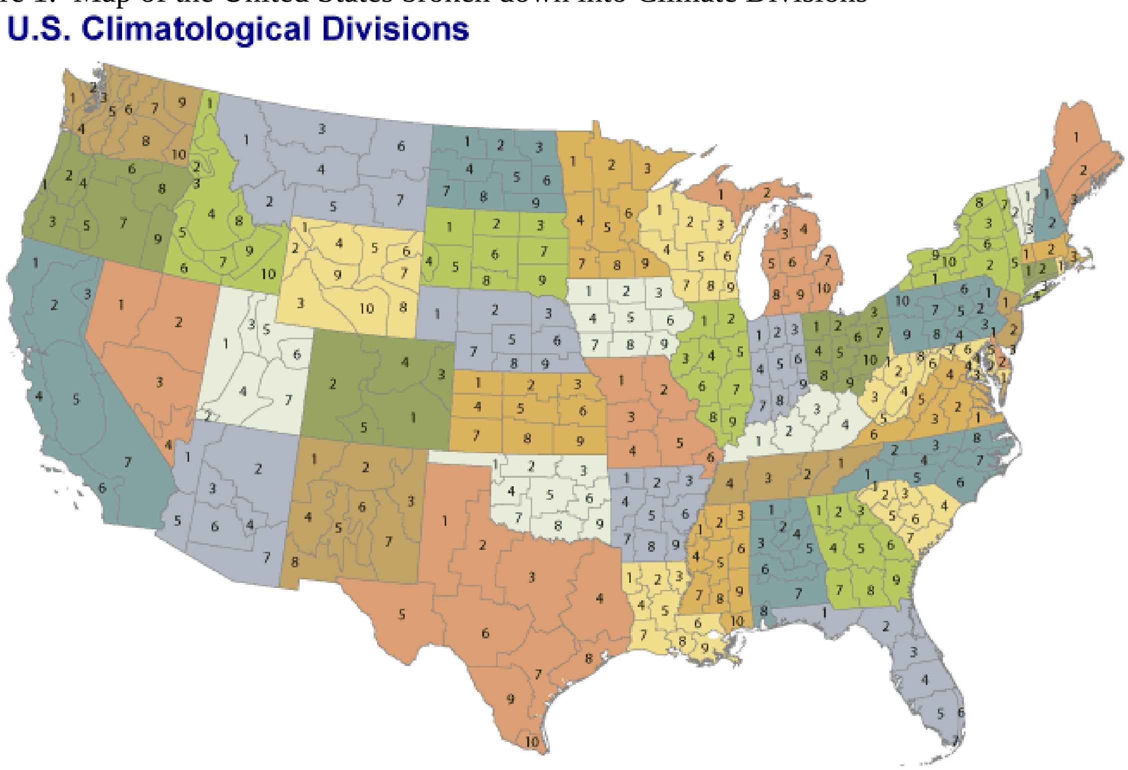
Using cotton yields as a proxy for incomes, I find a positive correlation between the probability of black children attending school and positive exogenous shocks to household incomes. I restrict my sample to rural farming households in the U.S. Cotton South. Using historical evidence, I show black rural farming households tended to be credit constrained due to their lack of assets or access to credit markets. In my main specification, I regress school attendance rates on cotton yields and controls for county, household, and school access characteristics. The model includes year and county fixed effects. To control for the endogeneity of cotton yields, I use May value of one month Standardized Precipitation Index and average temperature as instrumental variables. Based on the first stage estimates, I regress the climate division school attendance rates on the predicted cotton yields. I consistently find a positive correlation between cotton yields and the school attendance rates of black child.

Finding a correlation between income shocks and school attendance in the U.S. Cotton South during the early twentieth century leads to two research questions. First, what is the long term effect of income fluctuation on educational attainment? The current paper only considers the year following an income shock. Do children who did not attend school following a year with a negative income simply return the next year and eventually obtain the same level of educational attainment as they would have done without the shock? Or do negative shocks lead to permanent reductions in schooling levels? Second, what U.S. policies were effective in mitigating the side effects of negative income shocks on farming households? Finding answers

[18] I use the same group of states as Davis et al. (2009): Arkansas, Alabama, Georgia, Florida, Louisiana, Mississippi, North and South Carolina, Tennessee, and Texas. These states produced around 95% of cotton during the late 19th and early 20th century

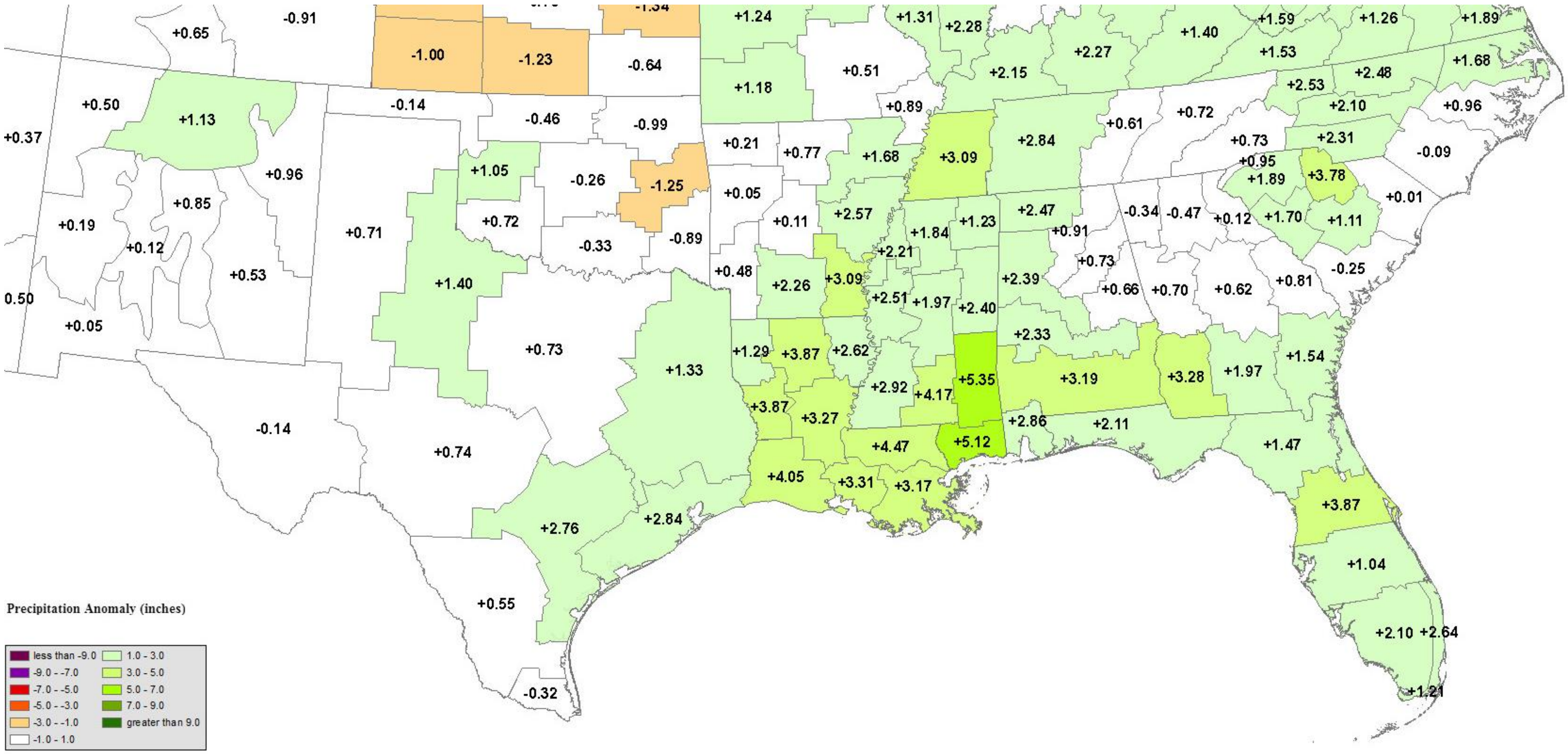
to this question could help modern developing countries reduce child labor and increase schooling.

Figure 1: Map of the United States broken down into Climate Divisions



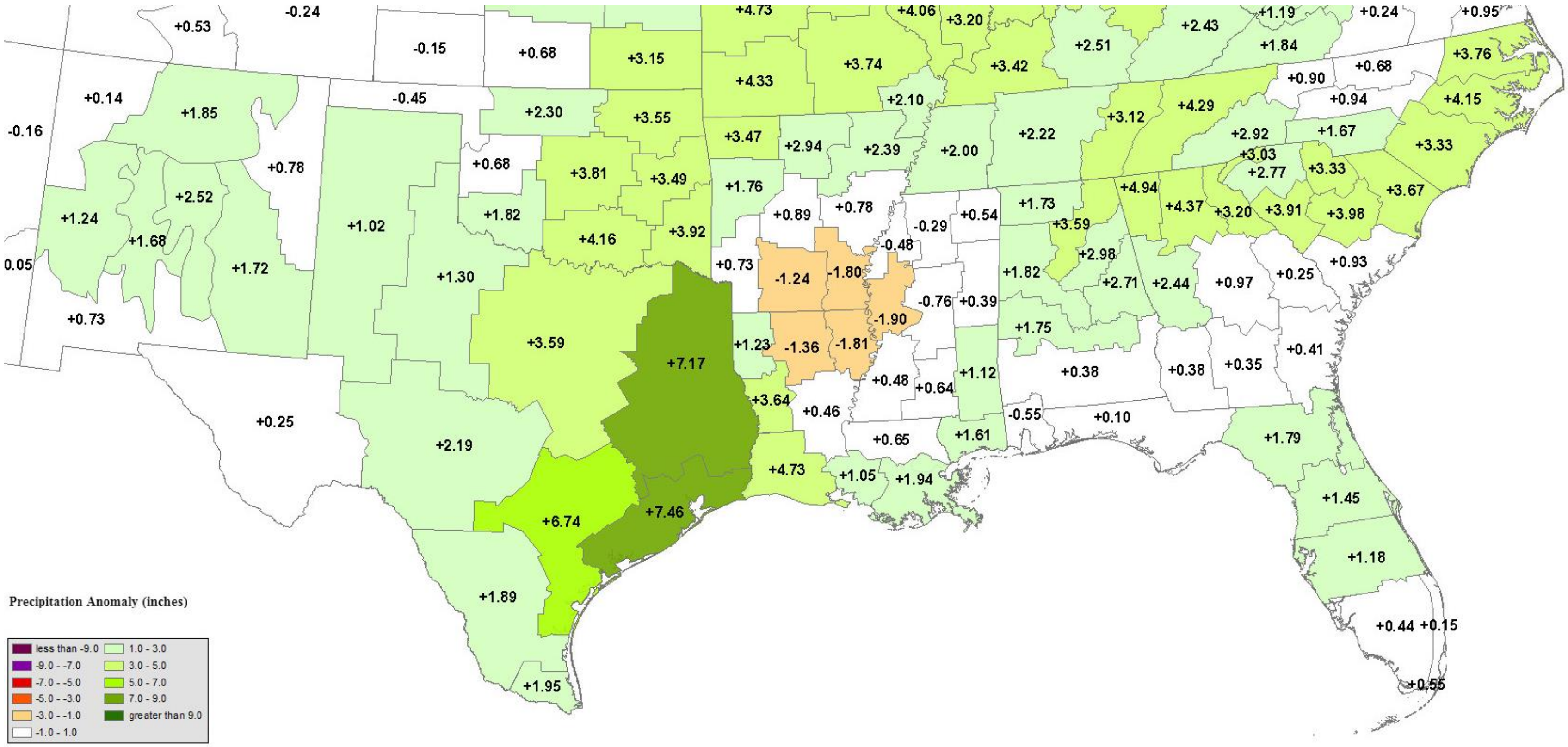
Source: National Oceanic and Atmospheric Administration/ National Weather Service Prediction Center

Figure 2: Map of the southern United States with Climate Divisional Precipitation Anomalies in May 1919



Source: National Oceanic and Atmospheric Administration/ National Weather Service Prediction Center

Figure 3: Map of the southern United States with Climate Divisional Precipitation Anomalies in May 1929



Source: National Oceanic and Atmospheric Administration/ National Weather Service Prediction Center

Table 1: Percentage of Farm Household Children Enrolled in School, Participating in the Workforce, and Idle by Race, Sex, and Age

	Male			*Female*		
	Ages 5-9	Ages 10-14	Ages 15-19	Ages 5-9	Ages 10-14	Ages 15-19
Black Children:						
In School	45.6	67.1	45.3	48.2	75.4	59.0
In Workforce	8.3	61.1	80.9	7.1	50.2	65.7
Idle	51.0	11.6	9.1	49.5	11.3	13.5
Observations	3,425	3,263	1,542	3,573	3,173	1,549
White Children:						
In School	59.1	87.3	72.4	60.7	88.3	73.6
In Workforce	8.3	52.8	73.4	4.2	24.8	28.6
Idle	39.5	5.4	5.6	38.5	8.0	17.3
Observations	5,121	4,790	2,605	5,132	4,349	2,294

Notes: Idle identifies children that are neither in school or the workforce. Observations come from the IPUMS 1% sample of the 1910 US Decennial Census.

Table 2: Probability of Attending School Based on Household Characteristics Pooled Sample from the 1920 and 1930 Censuses

	Status			
	Yes	No	Difference	P-Value
Household Characteristic:				
Literate Household Head	72.4	54.0	18.4	0.00
Male	69.1	71.8	-2.7	0.00
Black	65.9	73.0	-7.1	0.00
Tenant Farmer	67.4	74.2	-6.8	0.00
Landowner	78.6	65.8	12.8	0.00

Note: The observations come from the IPUMS 1% sample of the 1920 and 5% sample of the 1930 US Decennial Census.

Table 3: Probability of Attending Schooling Following a Weather Shock in 1919 or 1929

	Dry Period			
	Yes	No	Difference	P-Value
Household Type:				
Black	73.7	65.9	7.8	0.01
White	81.0	73.0	8.0	0.00
Tenant Farmer	77.7	67.3	10.4	0.00
Landowner	79.2	78.6	0.6	0.76
	Wet Period			
	Yes	No	Difference	P-Value
Household Type:				
Black	63.8	68.7	-4.9	0.00
White	72.2	74.0	-1.8	0.00
Tenant Farmer	65.8	69.3	-3.5	0.00
Landowner	77.5	80.1	-2.6	0.00

Note: The observations come from the IPUMS 1% sample of the 1920 and 5% sample of the 1930 US Decennial Census.

Table 4: Probability of Attending School in 1920 or 1930 Conditioned on Cotton Yield

	Cotton Yield			
	High	Low	Difference	P-Value
Household Type:				
Black	70.1	64.4	5.7	0.00
White	73.0	67.4	5.6	0.00
Tenant Farmer	69.8	62.5	7.3	0.00
Landowner	77.2	77.4	-0.2	0.73

Notes: The observations come from the IPUMS 1% sample of the 1920 and 5% sample of the 1930 US Decennial Census. High corresponds to counties with yields in the highest decile and low to the lowest decile.

Table 5: County School Attendance Rate Regressed on Cotton Yield, Black, and Cotton Yield X Black Using OLS

	(1)	(2)	(3)	(4)
Black	-0.100***	-0.098***	-0.112***	-0.056***
	(0.008)	(0.007)	(0.011)	(0.014)
Cotton Yield X Black	0.035**	0.029**	0.046**	0.039**
	(0.016)	(0.013)	(0.020)	(0.017)
Cotton Yield	0.050*	0.015	0.009	0.011
	(0.028)	(0.023)	(0.034)	(0.030)
Controls:				
County	No	Yes	Yes	Yes
School Access	No	No	Yes	Yes
Individual	No	No	No	Yes
No. of Counties	930	930	451	451

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Errors are clustered at the county level. All regressions include year and county fixed effects.

Table 6: F-Statistics from Two First Stages: Cotton Yield and Cotton Yield X Black

	(1)	(2)	(3)	(4)
Cotton Yield	8.66	6.90	6.21	5.03
Cotton Yield X Black	15.69	17.43	10.68	10.26
Controls:				
County	No	Yes	Yes	Yes
School Access	No	No	Yes	Yes
Household	No	No	No	Yes

Table 7: Climate Division School Attendance Rate Regressed on Cotton Yield, Black, and Cotton Yield X Black Using 2SLS

	(1)	(2)	(3)	(4)
Black	-0.249***	-0.257***	-0.263***	-0.182***
	(0.195)	(0.177)	(0.028)	(0.150)
Cotton Yield X Black	0.319	0.297**	0.330***	0.246**
	(0.200)	(0.117)	(0.123)	(0.123)
Cotton Yield	0.029	-0.182	-0.237*	-0.141
	(0.123)	(0.129)	(0.130)	(0.119)
Controls:				
County	No	Yes	Yes	Yes
School Access	No	No	Yes	Yes
Household	No	No	No	Yes
No. of Divisions	73	73	70	70
No. of Observations	269	269	248	248

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Errors are clustered at the climate division level. All regressions include year and division fixed effects.

Table 8: Probability of Individuals Attending School Regressed on Cotton Yield, Black, and Cotton Yield X Black Using Probit

	(1)	(2)	(3)	(4)
Black	-0.279***	-0.270***	-0.325***	-0.224***
	(0.024)	(0.023)	(0.033)	(0.032)
Cotton Yield X Black	0.073	0.051	0.148**	0.157**
	(0.045)	(0.042)	(0.067)	(0.064)
Cotton Yield	0.149**	0.076*	-0.033	-0.036
	(0.064)	(0.046)	(0.059)	(0.051)
Controls:				
County	No	Yes	Yes	Yes
School Access	No	No	Yes	Yes
Individual	No	No	No	Yes
No. of Counties	930	930	691	691

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Errors are clustered at the county level. All regressions include year and county fixed effects.

Table 9: Probability of Individuals Attending School Regressed on Black, Cotton Yield, and Cotton Yield X Black Using IV Probit

	(1)	(2)	(3)	(4)
Black	-0.196	-0.218	-0.631***	-0.470***
	(0.195)	(0.177)	(0.028)	(0.150)
Cotton Yield X Black	-0.144	-0.109	0.818**	0.686**
	(0.460)	(0.414)	(0.363)	(0.319)
Cotton Yield	0.655*	0.527	0.173	0.210
	(0.347)	(0.336)	(0.495)	(0.486)
Controls:				
County	No	Yes	Yes	Yes
School Access	No	No	Yes	Yes
Individual	No	No	No	Yes
No. of Divisions	73	73	70	70
No. of Observations	269	269	248	248

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Errors are clustered at the climate division level. All regressions include year and division fixed effects.

Table 10: Climate Division School Attendance Rate Regressed on Cotton Yield Using 2SLS

	Black Farmers		***White Farmers***	
	(1)	(2)	(1)	(2)
Cotton Yield	0.403***	0.431**	-0.023	-0.169
	(0.146)	(0.207)	(0.069)	(0.107)
Controls:				
County	No	Yes	No	Yes
School Access	No	No	No	No
Individual	No	No	No	No
	Urban Blacks		***Rural Non Farming Blacks***	
	(1)	(2)	(1)	(2)
Cotton Yield	0.126	0.022	-0.023	-0.473
	(0.150)	(0.163)	(0.298)	(0.358)
Controls:				
County	No	Yes	No	Yes
School Access	No	No	No	No
Individual	No	No	No	No

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Errors are clustered at the climate division level. All regressions include year and division fixed effects.

Table 11: Climate Division School Attendance Rate Regressed on Tenant Farmer, Cotton Yield and Cotton Yield X Tenant Farmer Using 2SLS

	(1)	(2)	(3)	(4)
Tenant Farmer	-0.217***	-0.157***	-0.144***	-0.093***
	(0.040)	(0.032)	(0.029)	(0.025)
Cotton Yield X	0.271***	0.168**	0.134**	0.113**
Tenant Farmer	(0.091)	(0.067)	(0.059)	(0.057)
Cotton Yield	0.155	-0.118	-0.147	-0.090
	(0.099)	(0.139)	(0.138)	(0.122)
Controls:				
County	No	Yes	Yes	Yes
School Access	No	No	Yes	Yes
Individual	No	No	No	Yes
No. of Divisions	73	73	70	70
No. of Observations	269	269	248	248

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Errors are clustered at the climate division level. All regressions include year and division fixed effects.

Table 12: Climate Division School Attendance Rate Regressed on Farm Laborer, Cotton Yield, and Cotton Yield X Farm Laborer Using 2SLS

	(1)	(2)	(3)	(4)
Farm Laborer	-0.327***	-0.201***	-0.126***	-0.109*
	(0.059)	(0.059)	(0.057)	(0.060)
Cotton Yield X	0.393**	0.201	0.031	0.044
Farm Laborer	(0.154)	(0.138)	(0.126)	(0.120)
Cotton Yield	0.093	-0.237	-0.293	-0.143
	(0.172)	(0.195)	(0.205)	(0.149)
Controls:				
County	No	Yes	Yes	Yes
School Access	No	No	Yes	Yes
Individual	No	No	No	Yes
No. of Divisions	73	73	70	70
No. of Observations	269	269	248	248

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Errors are clustered at the climate division level. All regressions include year and division fixed effects.

Table 13: Climate Division School Attendance Rate Regressed on Cotton Yield Using 2SLS

	Tenant Farmers		*Farm Laborers*	
	(1)	-	(1)	(2)
Cotton Yield	0.457**	-	0.437	-0.259
	(0.181)	-	(0.362)	(0.376)
Controls:				
County	No	Yes	No	Yes
School Access	No	No	No	No
Individual	No	No	No	No

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Errors are clustered at the climate division level. All regressions include year and division fixed effects.

Chapter 2

Introduction

The neoclassical model of labor supply predicts hours worked increase as wages increase, but do conditions exist where this relationship reverses? The model argues labor supply is based on individuals balancing the marginal utility of consumption and leisure. Consumption goods are purchased with wages earned from working. Therefore, labor supply rises with wages. The theoretical result fits our general intuition and observed patterns. However, under the right conditions, development economists observe labor supply increase even as wages decline.

Farmers from modern developing economies and the U.S. Cotton South during the early twentieth century face similar conditions that researchers find can generate a negative relationship between wages and labor supply. Farming households' incomes are inherently volatile as crop yields are a function of a variable input—weather. Without unemployment and crop insurance, farmers lack governmental safety nets against idiosyncratic crop shocks.[19]

[19] U.S. farmers were ineligible for unemployment insurance during my period of observation.

Limited access to credit prevents farmers from borrowing against future earnings. Lacking these remedies, farmers are forced to seek other coping mechanisms following declines in household incomes due to low crop yields including wage work in low wage periods.

The current paper examines if rural farming households in U.S. Cotton South used wage work off the family farm to cope with declines in household incomes. Based on a model developed by Cameron and Worswick (2003), households may take wage work off the family farm to maintain household consumption following a negative income shock (e.g. reduction in crop yields). If households can access credit markets, they will borrow against future earnings to make up for income losses. Therefore, the model makes a testable prediction that household responses to the same income shock will vary by household levels of credit access. A second testable prediction from the model is the probability of seeking wage work is higher following a larger negative income shock.

To test the two hypotheses, I examine the relationship between wage work and cotton yields. I restrict my sample to rural farming households in the U.S. Cotton South during the early twentieth century. The restriction of time and location permits the usage of cotton yields as a proxy for household incomes as cotton production was the dominate income source for the region's farmers. I predict cotton yields with precipitation and temperatures measures during the crop cycle. By instrumenting for cotton yields, I address concerns of the endogeneity of incomes in the decision to work off the farm for a wage. To test the importance of the strength of the shock, I generate estimates using a dummy variable for severe weather in place of the continuous predicted cotton yields.

My results are consistent with the predictions of Cameron and Worswick's (2003) model after adjusting for features of the Cotton South's labor market. I find no correlation between cotton yields and the probability of wage work. Based on previous research involving credit constraints in the Cotton South (Lombardi 2016), I focus on the response of groups with less access to credit—blacks and tenant farmers. Given the small number and low probability of black farmers receiving a non-farm wage job, I restrict my analysis to farm wage work. Following the adjustments, I find a negative significant relationship between household incomes and the probability of farm wage work for both tenant and black farmers. For large shocks, my estimate shows a stronger correlation between income shocks and farm wage work.

Increasing farm wage work in low yield periods likely results in a contradiction of the neoclassical model of labor supply. I lack direct evidence of local farm wages, but market forces suggest wages are lower: demand declines due to low output and supply increases due to more individuals wanting to work. If the market forces do lower farming wages, my results lead to a negative relationship between wages and labor supply. The finding of a negative relationship reverses the positive relationship predicted in the neoclassical labor supply model.

Literature Review

A broad literature from development economics analyzes how rural farming households smooth consumption despite having variable incomes. Farming incomes tend to be variable as yields can vary greatly with weather conditions. Developing economies generally lack government programs that compensate farmers in low yield periods or credit markets to borrow against future earnings. The combination of the desire to smooth consumption and the reality of variable incomes leads farmers to employ a wide range of coping mechanisms including preemptive measures.

In areas with a high risk of low yields, farmers plan ahead by saving more and diversifying household incomes. Work by Paxson (1992) shows households in higher risk areas save a higher percentage of transitory income from high yield periods than farmers in more stable yield areas. Recent research finds farmers try to diversify the household's income sources. Farmers in more volatile areas are more likely to be involved in household enterprises (Adhvaryu et al. 2013) and wage work (Ito and Kurosaki 2006). Researchers find risk even enters in the choice of crop: Farmers choose grain variants with lower yields, but are more resistant to weather fluctuations. Farmers grow a wide range of crops to diversify against weather variations (Dercon 2002).

A separate literature looks at how rural farming households respond to income shocks ex post. Beyond being a preventive measure, researchers also observe wage work increases following negative shocks (Cameron and Worswich 2003). Amazonian farmers turn to extractive behaviors including fishing (Takashi et al. 2010) following crop damage due to flooding. However, farmers do not appear to liquidate assets, farming livestock, to make up for temporary income losses (Fafchamps et al. 1998).

Even within the literature on increased wage work, researchers observe patterns that vary by time and location. The family member that enters the wage work labor market varies across studies. Following income shocks, some researchers have observed increases in female wage work participation (Bevan and Pankhurst 1994) while others only find an effect on male participation (Kochar 1999). In Vietnam, researchers found child wage work increased (Beck et al. 2016). The duration of the shock affects households responses too. Kenyan farmers used wage work to mitigate risk in the long term, but not in response to short term shocks (Mathenge and Tschirley 2015).

The current paper extends the literature by examining if wage work was used by rural farmers in the U.S. Cotton South to cope with negative income shocks. Few papers consider the coping mechanisms used by farmers to mitigate income fluctuations in this region during the early twentieth century. An exception is Lombardi 2016 which focuses on the connection between income fluctuations and schooling. However, the paper does not consider wage work's role in smoothing household consumption. Research from development economics shows wage work often serves a major role in this smoothing process. Features of the rural South's labor market obscure the viability of wage work to mitigate negative income shocks. Despite being a group likely to rely on wage work following a negative shock, rural black farmers had limited access to wage work outside of farming. The heavy reliance on cotton production generates a complicating factor for farmers seeking wage work within the farming industry. The same shock that generates the desire to seek wage work also reduces the demand for it. The conditions lead to an interesting question: Would farmers increase their labor supply even as wages decline? The current paper answers the question.

Historical Background on Southern Labor and Capital Markets

The conclusion of the Civil War marked the end of slavery in the United States. However, the legacy of slavery was clearly visible in Southern states for decades to come. Rural black[20] farmers had limited access to credit markets in part due to a lack of assets. The combination of the lack of credit market access and federal insurance programs left the farmers susceptible to income fluctuations due to weather shocks to their primary crop—cotton.

Small rural black farmers had few assets following the end of slavery. At the conclusion of the Civil War, there was no general pattern of land redistribution. Most land remained in the hands of the white elite. In Georgia, only one percent of the land was owned by blacks in 1874

[20] Poor farmers faced similar credit constraints regardless of their race (Wright 1986 and Ransom and Sutch 2001). Tenant farmers and farm laborers did not own land and had few assets to secure a loan besides crop liens. Credit could be secured only through the local merchant. Government laws on child labor and social programs were the same for all farmers.

and one point six percent by 1880. Across the Cotton Belt, less than ten percent of the farm land was owned by blacks (Ransom and Sutch 2001). Farm land was not the only asset blacks lacked. Within rural counties of Georgia, blacks owned less than three percent of the total taxable assets[21] (Ransom and Sutch 2001). Beyond a lack of assets, black households also accumulated assets at a slower pace than whites (Higgs 1982). However, one physical asset the rural farmer owned that could be used as collateral was his future crop production. From the perspective of a lender, a farmer "'could give virtually no security for his loans except the forthcoming crop (Anderson 2013).'" While crop liens gave farmers access to the credit market, they severely limited the sources of credit available to them.

The lack of assets besides crop liens limited the credit market for rural black farmers to the local merchant. Following the defeat of the Confederate Army, much of the South's formal banking system collapsed. In 1860, there were forty-nine state charter banks in Georgia and South Carolina. Only three of these banks survived the Civil War (Ransom and Sutch 2001). Even following the Reconstruction Era, the South's banking system lagged relative to other parts of the country. Of the nearly three thousand national banks in the United States in 1890, less than four hundred of them were located in the twelve southern states[22] (Ransom and Sutch 2001). Beyond this general tightness of credit markets in the South, the lack of land ownership ensured most rural black farmers were cut off from traditional sources of credit. To fill this void, local merchants offered credit to rural farmers by taking crop liens as collateral. Merchants' reliance on personal knowledge of individuals to judge their credit worthiness limited the threat of competition from outsiders. While landowners' wealth and familiarity with locals represented a

---

[21] Taxable assets includes land, city and town property, money and liquid assets, kitchen and household furniture, mules, horses, hogs, and etc., planation and mechanical tools, and all other property.

[22] The South in this case refers to Arkansas, Alabama, Georgia, Florida, Louisiana, Mississippi, North and South Carolina, Tennessee, Texas, Virginia, and West Virginia.

potential threat, merchants and landowners often worked together or simply were the same individual. Therefore, merchants were able to exercise a “territorial monopoly” (Ransom and Sutch 2001). The strength of the merchant’s monopoly can be seen in the level of interest charged for credit. Based on data from 1880s Georgian merchants, Ransom and Sutch (2001) estimate that the average markup for corn purchased on credit was thirty-five percentage points higher than cash purchases. From the differences in price markups, they estimate an implicit annual interest rate of 59.4%. Merchants’ monopoly power can also be observed in how the crop liens were written.

Merchants’ control of the credit market led to crop liens requiring farmers to grow just cotton. From the perspective of the merchant, cotton had several benefits over other crops. The market for cotton was large and well established. Cotton can be easily stored without fear of spoilage. By forcing the farmers to grow just cotton, the merchant reinforced the farmer’s dependence as the farmer had to buy food and animal feed on credit. Indebted farmers knew the importance of growing cotton: “…cotton is the only crop that will bring money… cotton brings the money, and money pays debts…” (Wright 1986). Besides cementing the farmer’s reliance on the merchant, cotton yields declined due to this practice. Southern farmers were not able to apply scientific farming techniques used by northern farmers to increases yields--crop rotation and fallow fields. While the local merchant’s monopoly over credit developed organically, other features of the southern farming economy grew from the white elites’ desire to limit the economic advancement of former slaves.

During the first half of the twentieth century, Southern Congressmen voted to eliminate or limit federal programs meant to insure individuals against idiosyncratic shocks. Research by Alston and Ferrie (1999) details the strategies used by southern Congressmen to exclude farmers from federal welfare programs. When the U.S. Congress passed the Social Security Act, farmers were excluded from both the unemployment and old age provisions. Southern Congressman also succeeded in having farmers excluded from the Fair Labor Standards Act. By eliminating farmers, children were still able to work on farms. In the case of the Farm Security Administration, the southern Congressmen were initially able to defund the program and later have the act that established it abolished. The act would have provided grants to farmers following natural disasters. (The administration also threatened merchant control by establishing co-operatives of farmers) (Alston and Ferrie 1999). While the motivation of Southern congressmen is not critical for the current paper, their success in affecting policy is. Farmers were not insured against weather shocks.

Theoretical Model

To generate predictions about the relationship between cotton yields and wage work, I rely on a model of household utility maximization introduced by Cameron and Worswick (2003). Households maximize expected discounted lifetime utility by choosing consumption, $c(\tau)$, own farm hours, $h_f(\tau)$, and wage work hours, $h_w(\tau)$, subject to a budget constraint:

$$U(t) + \left(\frac{1}{(1+\rho)}\right) E_t \left\{ \sum_{\tau=t+1}^{T} \frac{U(\tau)}{(1+\rho)^{\tau-t-1}} \right\}$$

$$\text{s.t. } S(\tau) \equiv A(\tau) - A(\tau-1)(1+r(\tau))$$

$$\equiv w(\tau)h_w(\tau) + F\left(h_f(\tau)\right) - p(\tau)c(\tau)$$

where τ indexes future time periods. The utility function is an increasing function in consumption, $c(\tau)$, and leisure, $\mathrm{l}(\tau)$: $U(\tau) = U(c(\tau), \mathrm{l}(\tau))$. Leisure is the available time in period τ minus hours work on the farm and at wage work: $\mathrm{l}(\tau) = \mathrm{T} - h_f(\tau) - h_w(\tau)$. Households have an intertemporal rate of time preference equal to ρ. $p(\tau)$ is the price of a composite commodity. The value of own farm production is $F\left(h_f(\tau)\right)$ and $w(\tau)$ is the wage rate for wage work. Weather variation enters the maximization problem through the own farm production function.

I use the model to generate predictions after adapting it to fit the conditions faced by rural southern farmers during the early twentieth century. The average black farmer had little access to credit. Therefore, assets are not allowed to be negative (e.g. $A(\tau) \geq 0$). Previous research also shows that black farmers had few assets (Ransom and Sutch 2001) and would be unlikely to liquidate them (Fafchamps et al. 1998). Weather shocks lowers the crop yields across the region including the household's. As a result, both household production, $F\left(h_f(\tau)\right)$, and farm wages, $w(\tau)$, decline. Households with access to credit will borrow against earning. If borrowing is not an option, households draw down assets to zero (e.g. $A(\tau) = 0$). The model predicts households that cannot borrow and lack assets will increase labor supply, $h_w(\tau)$, even as wages decline. A related prediction is a large negative shock leads to a larger number household doing wage work as more households draw down their assets. Therefore, the connection between wage work and weather shocks is likely the strongest for tenant and black farming households as they have lower levels of assets and credit access compared to land owning and white farmers.

Data

The weather data used to measure crop shocks comes from the nClimDiv dataset from the National Oceanic and Atmospheric Administration. The dataset is based at the Climate Division level. Each state is composed of a half dozen or more divisions. The divisions themselves are composed of several counties. Figure one shows a map of the United States broken down into Climate Divisions. From the map, we can see the nClimDiv database provides weather data across the entire contiguous United States at a level in-between the state and county levels.

From the nClimDiv dataset, I use measures of rainfall and temperature. The one month Standardized Precipitation Index is normalized using the division's historical rainfall patterns over the period 1901 to 2001. A measure of zero represents the median value. Negative values are associated with dry periods and positives with wet periods. The greater the magnitude of the measure the more severe the weather conditions are. Figure two provides the reader with a visual representation of the variation in division's rainfall. From the average monthly temperature measures, I generate a variable for division's average temperature across the crop cycle. The variation within a climate division's two weather measures is critical to my instrumental variable strategy.

Cotton output and acreage comes from the U.S. Agricultural Census. I collect 1910 and 1920 Agricultural Censuses data from the Inter-University Consortium for Political and Social Research's Historical, Demographic, Economic, and Social Data: The United States, 1790-2002 series. For 1930, I transcribed the values from digital copies of the U.S. Agricultural Census (Ruggles). I aggregate the county level output and acreage variables to the climate division level. Using these values, I calculate the cotton yield per acre by dividing the division's total cotton output by the total acres of cotton.

Individual level data come from the Integrated Public Use Microdata Series' one percent samples from the 1910 and 1920 and the five percent sample from the 1930 U.S. Census. The key variable of interest is individual's occupation. The Census asks individuals what their main occupation is. At the household level, I generate indicator variables for wage work: in general, farm, and non-farm. I combine occupation and ownership status to generate indicator variables for farm type: land owning, tenant, and farm laborer.

By combining Census information on whether individuals live in urban or rural areas with farm status, I restrict my sample to rural farming households. I further restrict my sample to individuals from the Cotton South.[23] These restrictions reduce my sample to forty-one thousand households. (In terms of the Climate Divisions, the sample has sixty-seven divisions.) I exclude unrelated household members from my analysis.

The Censuses also provides demographic controls for education, race, and gender. Previous research shows that gender can factor into household's wage work decision. To address the role of gender, I combine individual's gender with occupation to generate wage work indicators as before (e.g. in general, farm, and non-farm), but gender. Unlike previous studies, controlling for households' race is critical for my results. Therefore, I create a race indicator for black households based on the average of the household's individual race indicators. Over ninety-eight percent of households are composed of just blacks or whites.[24] The education level of household head may affect the probability of entering into wage work. During my period of observation, the census does not have a direct measure of individual's educational attainment. Instead, I use literacy as a measure of individual's educational level. The Census defines literacy as the ability to read and write. Based on this definition, seventy percent of my sample is literate. From the literacy variable, I generate a variable equal to one when either the household head or the head's spouse is literate.

In addition to individual controls, the U.S. Decennial Census provides division level controls. The county level controls come from the Inter-university Consortium for Political and

---

[23] I use the same group of states as Davis et al. (2009): Arkansas, Alabama, Georgia, Florida, Louisiana, Mississippi, North and South Carolina, and Tennessee (excluding Texas). These states produced around 95% of cotton during the late 19th and early 20th century

[24] I drop households that are neither white or black, which affects less than 1% of the sample. Households with averages in-between white and black are assigned to the closest group (e.g. averages less than fifty percent are identified as white and over percent as black). The assignment affects less than 2% of the sample.

Social Research's Historical, Demographic, Economic, and Social Data: The United States, 1790-2002 series. The controls include information on the county's populations and farms. Population variables include the county's totals for the following groups: total, rural, white and blacks. For farms, I include the total number of farms, tenant farms, and owned farms. Tenant and owned farms are further broken down by race. The county measures are aggregated to the climate division level.

Empirical Methods

Examining the features of the ideal model to test the relationship between income shocks and wage work in credit constrained households guides the paper's model decisions. The sample population would experience the same exogenous shock to their incomes. The shock would only affect the wage work choice through the household income channel. We would have data on household, labor market, and community characteristics.

For the current paper, the ideal linear model could have the following form:

$$Probabilty\ of\ Wage\ Work_i = \alpha + \beta_{1i}\Delta Y_i + \beta_{2i}(CC_i * \Delta Y_i) + \boldsymbol{\beta}_{ni}\boldsymbol{X}_i + \boldsymbol{\beta}_{mc}\boldsymbol{X}_c$$

where ΔY_i is the exogenous change in household i's income from the previous period. CC_i is a measure of household i's level of credit constraint. X_i and X_c are household and community controls respectively. We expect β_{2i} to be negative and significant if households are credit constrained and using wage work to consumption smooth.

One adjustment to the ideal model I make is to the income variable—ΔY_i. There are no datasets with individual level income data from the early twentieth century with individual characteristics. Therefore, I replace individual income with a proxy variable. As previous researchers have done (Baker 2013), I use a measure of cotton production as proxy for the incomes of farmers in the Cotton South. Yields times price provides a good approximation of farming incomes. Due to the accessibility of data and variation at the county level, I use cottons yields over cotton prices as a proxy for incomes in rural farming households in the Cotton South.

I also use a proxy variable in place of a direct measure of household's level of credit constraint. My proxy variable for being credit constrained is black.[25] Based on the historical evidence, freed slaves tended to not have land or other tangible assets that banks would accept as collateral. Liens on future crop production were the only assets many freedmen owned and the local merchant was the only individual willing to accept these as collateral. Therefore, we expect the average black farmer to be more credit constrained than his white counterpart.

After incorporating the two proxy variables, I estimate the following linear model:

$$Percentage\ of\ Wage\ Work_{rtc} =$$

$$= \alpha + \beta_{1c} Cotton\ Yield_{ct} + \beta_{2c}(Black * Cotton\ Yield_{ct}) + \boldsymbol{\beta}_{mrc}\boldsymbol{X}_{rtc}$$

$$+ \phi_r + \delta_t + \gamma_c$$

$\boldsymbol{X}_{rtc}$ is a matrix of county controls by race and year. $Black$ is a dummy variable equal to one for black observations and zero otherwise. $Cotton\ Yield$ is a continuous variable equal to a county's cotton yield in a given year. The unit is five hundred pound cotton bales per acre. The model includes race ϕ_r, year, δ_t, and county, γ_c, fixed effects. The model's errors are clustered at the county level.

The model's key variable of interest is the interaction term between cotton yield and Black. If the consumption smoothing explanation for wage work is correct, we expect the coefficient on the interaction term, β_{2c}, to be significant. A significant β_{2c} means the credit constrained group reacts differently to income fluctuations relative to the reference group—whites.

[25]As an extension, I replace black with tenant farmer as proxies for being credit constrained in some regressions.

To address the possibility of cotton yields being endogenous, I implement an instrumental variable strategy. A concern in the above approach is the relationship between yields and wage work and the potential for simultaneous causality. More farm wage workers could make farm land more productive and increase yields. The paper argues yields, as a proxy for incomes, change the probability of wage work. Therefore, I use May rainfall and average temperature across the crop cycle as instruments. The instruments allow me to extract the exogenous portion of cotton yields and limit the direction of causality to the effect of yields on wage work and not vice versa.

My instrumental variable strategy must address the issue that by interacting cotton yields with Black I generate a second potentially endogenous variable. I use an approach discussed by Wooldridge (2010) to handle the concern. I interact my two instrumental variables with Black to generate two additional instruments. Therefore, my two first stage equations take the forms:

$$\begin{aligned} Cotton\ Yield_{dt} &= \alpha + \beta_1 May\ Rain_{dt} + \beta_2 May\ Rain\ X\ Black_{dt} + \beta_3 Avg\ Temperature_{dt} \\ &+ \beta_4 Avg\ Temperature\ X\ Black_{dt} + \boldsymbol{\beta X}_{dt} + \phi_r + \delta_t + \gamma_d \end{aligned}$$

$$\begin{aligned} Cotton\ Yield\ X\ Black_{dt} &= \alpha + \beta_1 May\ Rain_{dt} + \beta_2 May\ Rain\ X\ Black_{dt} + \beta_3 Avg\ Temperature_{dt} \\ &+ \beta_4 Avg\ Temperature\ X\ Black_{dt} + \boldsymbol{\beta X}_{rtd} + \phi_r + \delta_t + \gamma_d \end{aligned}$$

where $May\ Rain_{dt}$ is the May rainfall and $Avg\ Temperature_{dt}$ is average temperature across the crop cycle at the climate division level—d. The model includes race, year, and division fixed effects. The other portion of the equation is variables from the second stage. My second stage equation now has the following form:

$$Percentage\ of\ Wage\ Work_{rtd} = \alpha + \beta_1 \widehat{Cotton\ Yield}_{dt} + \beta_2 \widehat{Cotton\ Yield\ X}\ Black_{dt} + \boldsymbol{\beta X}_{rtd} + \phi_r + \delta_t + \gamma_d$$

The estimated cotton yield and interaction term replace the true values. I make several adjustments due to the instruments being measured at the climate division level. I cluster the errors and include fixed effects at the climate division level.

Results

The theoretical model provides several testable predictions. If black rural farming households are credit constrained, we expect to observe black wage work rates vary with fluctuations in household incomes. Using cotton yields as a proxy for household incomes, the model predicts wage work will be negatively correlated with cotton yields. Due to being less credit constrained, the model predicts white wage work will not vary with cotton yields. The model also predicts the relationship between black wage work and cotton yields will be stronger following larger income shocks as more households turn to wage work after drawing down their assets.

I implement an instrumental variable strategy to address potential endogeneity of cotton yields. If true, my model will have two endogenous covariates—Cotton Yield and Cotton Yield X Black. I address the issue by using May rainfall and average temperature across the crop cycle to extract the exogenous portion of the cotton yield's variation. For Cotton Yield X Black, I interact the two instruments with the black dummy variable. Table one presents the F-statistics for the two first stages. The combined Kleibergen Paap F-statistic ranges from 16.08 to 23.93. Using the critical values for models with two endogenous variables and four instruments (Stock and Yogo 2005), the second stage estimates are not biased due to weak instruments.

I provide the second stage results from the two stage least squares estimates in table two. We see the parameter on the interaction term, Cotton Yield X Black, is positive and significant at the one percent level in the first column. The results contradict the predictions made in the theoretical model. However, the addition of controls for household and division characteristics leads to cotton yields being an insignificant determinant of wage work for both whites and blacks. Blacks and literate household heads increase the probability of wage work. Relative to the excluded category, farm laborers, tenant and land owning households are significantly less likely to participate in wage work. The result is not surprising as most farm laborer households are involved in wage work, not unpaid family work.

A few technical notes regarding table two: I aggregate the data to the division level to match the level observation for the weather instruments. All three regressions include year and division fixed effects. I cluster the errors at the division level.

A potential concern with the estimates in table two is the jobs being considered. The dependent variable is the probability of being involved in wage work in general. The rural South had a limited number of wage jobs outside of agriculture. Discrimination and lower literacy rates further limited the options available to black households. Following a negative income shock, black households may not be able to quickly shift into non-farm wage work even if the desire existed. Farm wage work is a more realistic option given the farming background and availability of positions. If blacks are using wage work to smooth consumption, we are more likely to see a relationship between incomes and farm wage work.

I present the estimates for the relationship between cotton yields and farm wage work in table three. The first column of the table offers similar results as those in table two—a positive significant coefficient on Cotton Yield X Black. However, the addition of controls in columns two and three leads to starkly different estimates. Cotton yields are a significant factor in black labor participation in farm wage work. The coefficient is negative and significant at the one percent level. The result fits the predictions from the theoretical model: Following a negative income shock, households with limited assets and credit access will increase participation in wage work. Households with more assets and credit access will not change their labor patterns. The coefficient for literate household head is no longer significant. The result is intuitive as the importance of literacy is lower in farming relative to other industries. The results for black, tenant farmer and land owning farmers do not change going from table two to three.

Previous research on rural farming households in the Cotton South suggests tenant farming households faced similar conditions as black farming households. In the sample, almost two-thirds of black households are tenant farmers—61%. Within the pool of tenant farming households, blacks make up a little less than half of the group—49%. Therefore, a little over a half of the tenant farmers are white. The results in tables two and three suggest whites as a whole did not use wage work to cope with negative income shocks, but white tenant farmers share characteristics with black farmers including low levels of credit access and assets. Following negative income shocks, Lombardi (2016) shows tenant and black farmers make similar schooling choices. If credit access and assets explain the results in table three, we expect to observe similar results when considering tenant farmers in place of black farmers.

Table four presents the estimates from replacing black farmers with tenant farmers. As predicted, the relationship between farm wage work and income fluctuations is the same for tenant and black farming households. The probability of farm wage work increases as tenant farmer households' incomes decline (e.g. as cotton yields decline). The coefficient on the interaction term is significant at the one percent level in columns two and three. However, the magnitude for tenant farmers is smaller. The results for the control variables match across tables three and four. Literacy is not a determent of farm wage work. Blacks are more likely to participate. Tenant and land owning farmers are less likely to do farm wage work relative to farm laborers.

Table five provides the estimates from a less restrictive specification. I drop the interaction term and restrict my sample to subpopulations. The equations include the same controls as the previous estimates, but the coefficients are no longer jointly determined. In table three, the specification forces the size of the division's black population to have the same effect on both whites and blacks. By restricting the estimates to sub samples, the coefficient can vary across the groups. However, the less restrictive estimates lead to similar results. The coefficient on cotton yield is now the parameter of interest. The negative significant coefficient on cotton yields shows black and tenant farming households use farm wage work to cope with negative income shocks. The probability of farm wage work for white and land owning farmers is unaffected by cotton yields. While not statistically significant, the positive coefficient on cotton yields for white farmers fits the predictions of the neoclassical labor supply model (e.g. labor supply increases as wages increase).

Cameron and Worswick's (2003) model predicts the relationship between negative income shocks and wage work will be stronger for larger shocks. I test the prediction by replacing the continuous cotton yields measure with a dummy variable for an extremely wet May. I base the dummy variable on the division's May value of the one-month Standardized Precipitation Index. The advantage over a simple rainfall measure is the value is standardized by the division's historical rainfall. Therefore, the values are comparable across divisions. Based on National Oceanic and Atmospheric Administration's definitions, divisions with values of one or higher receive a dummy equal to one for an extremely wet May. All other divisions receive a zero.

Table six provides the reduced form estimates with a dummy variable for an extremely wet May. Wet Mays lead to lower cotton yields. Therefore, a positive and significant coefficient on the dummy variable matches results using cotton yields in table five. The probability of farm wage work increases for black and tenant farming households following a negative income shock. The different measures prevent direct comparison of the coefficients in tables five and six. However, the relationship between income and wage work is stronger in the specifications using the shock dummy variable in place of the continuous income variable. The coefficients for black and tenant farming households are significant at the one percent level in table six versus the five percent level in table five. The result fits the theoretical model's prediction regarding the size of income shocks and level of wage work.

Conclusion

Previous research into coping mechanisms used by rural farming households in response to negative income shocks frequently find credit constrained households increase participation in wage work. The participation rates of households with higher levels of credit access and assets are unaffected. Researchers focus on examples from modern developing economies. I extend the literature by examining if farmers in the U.S. Cotton South during the early twentieth used wage work in a similar fashion.

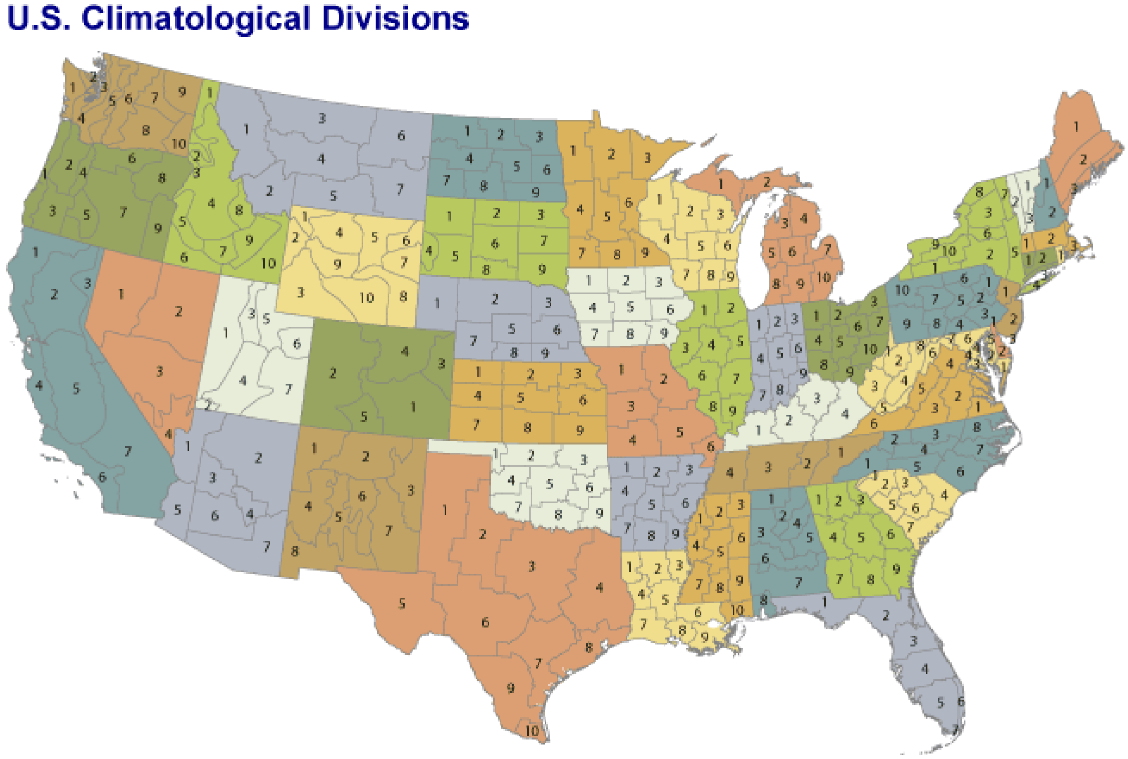
Using predicted cotton yields as a proxy for incomes, I find farmers' probability of wage work is uncorrelated with household incomes. However, the nature of the rural South's labor market causes a swift shift into wage work unlikely. Farming wage work represented a more viable option. After restricting my analysis to farm wage work, I find the probability of wage work by black and tenant farming households is negatively correlated with incomes. The correlation between farm wage work and incomes is stronger when I replace predicted cotton yields with a dummy variable for extreme weather. For white and land owning farming households, farm wage work participation is unaffected by household incomes.

The negative correlation between the probability of farm wage work and cotton yields contradicts the predictions of the neoclassical labor supply model. At low wage levels, the neoclassical model predicts a positive relationship between wages and labor force participation.[26] Tenant and black farming households are increasing their labor force participation even as farming wages are falling. The shock that reduces household incomes also reduces the demand and wages for farm labor. The correlation between declining farming incomes and wages explains why researchers generally find households seek wage work outside of farming.

The results from the current paper and Lombardi 2016 raise questions of how best to model the coping mechanisms used by rural farming households. Following a negative income shock, credit constrained households must choose between numerous coping mechanisms to smooth consumption including wage work and reducing child schooling. The household's choice of one approach is not independent of the others. However, researchers tend to ignore the connection between the different coping mechanism. Discrete choice models that consider more than two options (e.g. work a wage job or not) appear to be a logical progression for the literature.

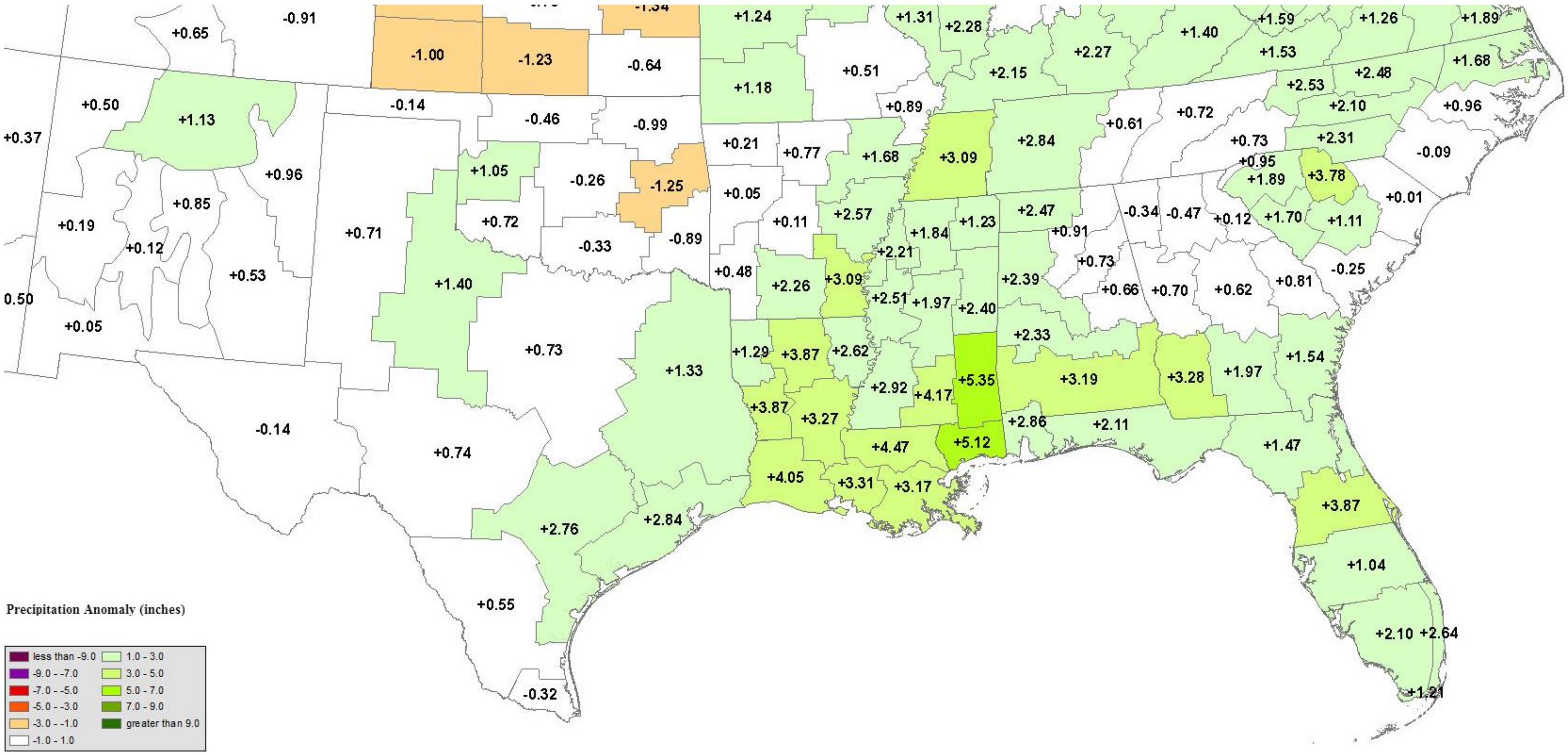
[26] The model predicts a negative relationship at high wage levels. However, this scenario is unrealistic for tenant and black farming households.

Figure 1: Map of the United States broken down into Climate Divisions



Source: National Oceanic and Atmospheric Administration/ National Weather Service Prediction Center

Figure 2: Map of the southern United States with Climate Divisional Precipitation Anomalies in May 1919



Source: National Oceanic and Atmospheric Administration/ National Weather Service Prediction Center

Table 1: F-Statistics from Two First Stages: Cotton Yield and Cotton Yield X Black

	(1)	(2)	(3)
Cotton Yield	16.91	16.20	15.94
Cotton Yield X Black	208.51	30.48	26.16
Controls:			
Household	No	Yes	Yes
Division	No	No	Yes

Table 2: Second Stage Estimates from Regressing the Probability of Wage Work on Predicted Values of Cotton Yield and Cotton Yield X Black Using 2SLS

	(1)	(2)	(3)
Cotton Yield	-0.574***	-0.179	-0.171
	(0.136)	(0.129)	(0.146)
Cotton Yield X Black	0.321***	0.004	-0.005
	(0.028)	(0.050)	(0.049)
Black		0.043**	0.047**
		(0.021)	(0.020)
Literate Household Head		0.011***	0.011***
		(0.003)	(0.003)
Farm Owner		-0.368***	-0.368***
		(0.016)	(0.016)
Tenant Farmer		-0.412***	-0.412***
		(0.016)	(0.016)
Controls:			
Division	No	Yes	Yes
Household	No	No	Yes

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Errors are clustered at the climate division level. All regressions include year and division fixed effects.

Table 3: Second Stage Estimates from Regressing the Probability of Farm Wage Work on Predicted Values of Cotton Yield and Cotton Yield X Black Using 2SLS

	(1)	(2)	(3)
Cotton Yield	-0.454***	-0.006	0.003
	(0.070)	(0.029)	(0.025)
Cotton Yield X Black	0.299***	-0.118***	-0.121***
	(0.026)	(0.031)	(0.031)
Black		0.071***	0.073***
		(0.013)	(0.013)
Literate Household Head		0.002	0.002
		(0.002)	(0.002)
Farm Owner		-0.068***	-0.068***
		(0.006)	(0.006)
Tenant Farmer		-0.067***	-0.067***
		(0.007)	(0.007)
Controls:			
Division	No	Yes	Yes
Household	No	No	Yes

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Errors are clustered at the climate division level. All regressions include year and division fixed effects.

Table 4: Second Stage Estimates from Regressing the Probability of Farm Wage Work on Predicted Values of Cotton Yield and Cotton Yield X Tenant Farmer Using 2SLS

	(1)	(2)	(3)
Cotton Yield	0.079	-0.036	-0.021
	(0.061)	(0.028)	(0.024)
Cotton Yield X	-0.528***	-0.070***	-0.074***
Tenant Farmer	(0.036)	(0.025)	(0.026)
Tenant Farmer		-0.039***	-0.038***
		(0.011)	(0.011)
Literate Household Head		0.002	0.002
		(0.002)	(0.002)
Farm Owner		-0.068***	-0.068***
		(0.006)	(0.006)
Black		0.023***	0.023***
		(0.002)	(0.002)
Controls:			
Division	No	Yes	Yes
Household	No	No	Yes

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Errors are clustered at the climate division level. All regressions include year and division fixed effects.

Table 5: Probability of Farm Wage Work Regressed on Cotton Yield Using 2SLS

	Black Farmers		***White Farmers***	
	(1)	(2)	(1)	(2)
Cotton Yield	-0.083**	-0.073**	0.018	0.014
	(0.036)	(0.034)	(0.016)	(0.016)
Controls:				
Household	Yes	Yes	Yes	Yes
Division	No	Yes	No	Yes
	Tenant Farmers		***Land Owning Farmers***	
	(1)	(2)	(1)	(2)
Cotton Yield	-0.111***	-0.085**	-0.008	-0.006
	(0.036)	(0.034)	(0.026)	(0.023)
Controls:				
Household	Yes	Yes	Yes	Yes
Division	No	Yes	No	Yes

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Errors are clustered at the climate division level. All regressions include year and division fixed effects.

Table 6: Probability of Farm Wage Work Regressed on a Dummy Variable for Extreme Wet May Using OLS

	Black Farmers		***White Farmers***	
	(1)	(2)	(1)	(2)
Cotton Yield	0.008***	0.008***	0.000	0.000
	(0.003)	(0.003)	(0.001)	(0.001)
Controls:				
Household	Yes	Yes	Yes	Yes
Division	No	Yes	No	Yes
	Tenant Farmers		***Land Owning Farmers***	
	(1)	(2)	(1)	(2)
Cotton Yield	0.009***	0.008***	0.001	0.001
	(0.002)	(0.002)	(0.002)	(0.002)
Controls:				
Household	Yes	Yes	Yes	Yes
Division	No	Yes	No	Yes

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Errors are clustered at the climate division level. All regressions include year and division fixed effects.

Chapter 3

Introduction

Can a causal connection be drawn from the weather to conflict using economic factors? Local weather conditions are a key determinant in the output of crops. Fluctuations in crop output can lead to large changes in prices and overall economic activity. The connection between output and economic activity is particularly strong in agrarian economies as crops are critical to many individuals' livelihood and survival. This threat to livelihood is the basis of the conflict as individuals may seek to remedy the issue though violence—theft or removal of competition. Violence is likely to occur between dissimilar groups— including racial, religious, or political groups.

The current paper examines the connection between weather and conflict in the Cotton South during the early twentieth century. The Cotton South provides an ideal candidate to test the mechanism as the economy of these states was heavily reliant on cotton production. Using cotton yields as a proxy for economic performance, I observe how communities respond to exogenous changes in the economy due to fluctuations in the weather. To measure the level of conflict in communities, I use data on the number of lynching incidents.

Lynchings[27] are a form of mob extrajudicial punishment that came to prominence in the U.S. South during the century following the Civil War. Without judicial review, lynching victims were publicly hung and/or shot by large groups as punishment for criminal acts. The public and extreme nature of lynchings led to the events being well documented. Between 1882 and 1968, the Tuskegee Institute documents 4,743 cases.[28] The extreme nature of lynchings has also led to

[27] I provide a more detailed history of lynchings in a later section—Historical Background on Southern Lynchings.
[28] Based on several studies, the number of documented lynchings varies between four and five thousand. The case evidence comes from newspaper articles. Therefore, researchers argue the estimates are a lower bound as rural lynching were not always documented by newspapers.

speculation regarding their origins. Previous explanations range from the psychological to political to economic. Based on an economic mechanism, the current paper considers the plausibility of lynchings being caused by weather fluctuations.

I find lynching are correlated with local weather conditions in the Cotton South during the early twentieth century. In my first stage estimates, I show that rainfall during the month of May is a statistically significant determinant of changes in cotton yields. Using May rain as an instrumental variable for cotton yields, I find a negative statistically significant relationship between cotton yields and the probability of a lynching occurring for the six months following the harvest. Cotton yields proxy for economic performance in the community. Therefore, I find a lynching is less likely to occur when the economy is doing well.

By connecting weather fluctuations to lynchings, the paper raises questions about the weather's ability to shape society in the Cotton South during the early twentieth century. Previous research on the region links lynchings with black disenfranchisement and migration. During the Reconstruction period, white supremacy groups used lynchings and other forms of intimidation to prevent blacks from voting. Following the election of Southern Democrats, violent intimidation mixed with legal barriers to further exclude blacks from voting. During the first half of the twentieth century, over six million blacks left the South as part of the Great Migration. Researchers point to the lack of rights and constant threat of violence, including lynchings, as being "push" factors for blacks to leave the South.

Literature Review

The current paper contributes to a large literature that finds a correlation between the weather and conflict. Hsiang and Burke (2014) examine over fifty papers on the topic. The papers have spatial scales ranging from an individual building to the global and temporal scales, from an hour to a millennium. Researchers consistently observe a strong correlation between the weather and conflict measures. However, the actual mechanisms that links the weather with conflict are not uniform and the researchers (Hsiang and Burke 2014) suggest that multiple mechanisms are potentially at work. Hsiang and Burke (2014) discuss eight potential mechanisms connecting weather fluctuations and conflict: government capacity, labor markets, inequality, food prices, migration and urbanization, logistics, misattribution, and psychology.

Of the eight mechanisms, the current paper fits within the group based on the misattribution mechanism. Individuals wrongly attribute deteriorations in the local economy to leaders (Hibbs 2006 and Manacorda et al. 2011), the government (Solomon 2010, Barrios et al. 2010, and Dell et al. 2012), or individuals (Miguel 2005 and Beck and Tolnay 1990). Following droughts and flooding in rural Tanzanian farming villages, Miguel (2005) observes the number of "witch" killings increase as individuals attribute the weather shocks to elderly female family members. In the Cotton South, contemporary commentators and researchers (Beck and Tolnay 1990) frequently document examples of whites blaming blacks for social and economic problems. I take this research further by connecting the economy to the weather.

Within the broader literature on the relationship between conflict and the weather, my research relates to a subset that uses rainfall as instrumental variable to predict conflict in agrarian societies. After instrumenting for economic growth rates with rainfall, researchers find a negative shock of five percent increases intercounty conflict for the following six months (Satyanath and Sergenti 2004). At the micro level, extreme levels of rainfall, drought or flooding, increases the probability of the killing of "witches" in rural Tanzania (Miguel 2005).

My research directly contributes to the literature examining the link between cotton production and lynching in the US Cotton South. Based on a time series analysis, Beck and

Tolnay (1990) found a correlation between aggregate cotton prices and lynchings. However, the researchers only observe the pattern between 1882 and 1900. The authors suggest the lack of a correlation for lynchings occurring between 1900 and 1930 is due to the declining role of the agriculture, “Jim Crow” laws, and the out migration of whites and blacks.

The mismatch in findings between the current paper and Beck and Tolnay (1990) is likely related to differences in the level of observation. The use of aggregate price levels misses variation at the local level and poorly measures local economic activity. If overall supply is low, output in some areas may still be above normal. The economy in these areas would be strong due to the combination of higher prices and output. The reverse case is feasible too (e.g. low prices and output). The Cotton South’s hegemony over global cotton production and prices is declining as output from Brazil and India continues to grow in this period. Local yields are a better measure of local economic conditions, which is critical as local economic activity is the basis of the connection between rainfall and lynchings.

Historical Background on Southern Lynchings

While the targets evolved over time, lynchings’ goal of punishing and threatening dissidents remained the same. Lynchings’ namesake, Charles Lynch, ordered the extralegal punishment of Loyalists during the American Revolution. Prior to the Civil War, abolitionists were victims of Southern mobs. During the Reconstruction period, Southern mobs turned their focus to Southern Republicans and their supporters—blacks. Following the return of Southern Democrats to power, southern blacks violating Jim Crowe or segregation laws were targeted. In western states, frontier justice led to the lynching of criminals.

Lynchings occurred across the U.S., but primarily in the southern states. Only four states in the contiguous U.S. do not have a documented lynching—Massachusetts, Rhode Island, New

Hampshire and Vermont. While wide spread, lynchings are predominately a Southern institution. Ninety percent of documented lynchings occurred in Southern states. The Southern bias for lynchings led to blacks being the dominate race of lynching victims—seventy-two percent.[29] Both whites and blacks were targeted by southern mobs during the Reconstruction period. Following the resurgence of Southern Democrats, lynching victims were almost exclusively black. Outside of the South, other marginalized groups were targeted including Chinese, Hispanics, and Italians.

Commentators and social scientists frequently agree lynchings have an economic basis, but debate the exact mechanism. The majority of explanations for lynchings fall under the umbrella of "threat models." Blacks threaten different aspects of southern white supremacy (Beck and Tolnay 1990). Following the Civil War and emancipation of slaves, the voting rights of Southern blacks threatened the political power of whites. Therefore, lynchings were used to subvert black voting resulting in a positive correlation between lynchings and black population densities (Beck et al. 1989). Breaking Jim Crowe laws and interracial marriages threatened caste boundaries (Inverarity 1976). Following disenfranchisement, Southern whites' greatest danger was the economic threat from blacks. Observers notice a clear connection between Southern economic activity and lynchings: "… periods of relative prosperity bring reductions in lynching and periods of depression cause an increase." (Raper 1933). Commentators frequently attribute the peak of lynchings in the 1890s to the arrival of the boll weevil and low cotton prices. During the sample period, Beck and Tolnay (1990) find Southern lynchings were correlated with lagged cotton prices. While agreeing on a connection between lynching and the economy, the exact mechanism is a source of disagreement. Raper (1933) argues lynchings results from employment

[29] The percentage is based on the Tuskegee Institute's lynching records.

competition between white and black farm laborers. Hovland and Sears (1940) argue the connection between lynchings and the economy results from goal frustration. Whites violently lash out against blacks seeing them as the source of misfortune.

Data

The HAL dataset provides information on lynching victims. The dataset ranges from 1882 to 1930. The dataset has information on every reported lynching in the US during this period. Critical to the current paper each entry includes the date and location of each incident.[30] The county where the lynching occurred is linked to the appropriate weather division. After matching the event to the correct division, I generate a dummy variable and variable for the total number of lynching that happen between August and July of the following year. The intuition for choosing August is farmers could potentially predict yields by this point in the crop's development.[31]

Weather data comes from the National Oceanic and Atmospheric Administration's nClimDiv dataset. The dataset begins in 1895 and runs through the present. The level of observation is the climate division. Divisions are composed of several counties and each state is composed of six to ten divisions. Division boundaries generally follow county lines. The counties within a division are selected due to similarities in their respective weather patterns.

I collect May precipitation measures from the nClimDiv dataset. Based on previous research predicting cotton yields in the Cotton South during the early twentieth, I predict yields with rainfall measures from the month of May. I use the one-month Standardized Precipitation measure instead of the level of rainfall. The standardized measure is preferred because the

---

[30] The dataset includes additional information on the victims including: name, gender, race, and alleged crime.

[31] The results are robust to choose different month to start in. The critical period is the time in-between the harvest and the planting of the next crop.

measure is standardized against the division's own historical rainfall. The standardization provides information on the relationship between the current year's rainfall versus the division's historical average. I convert the one-month Standardized Precipitation measure to a pair of dummy variables for extreme wet and dry periods.

I gather population controls from the US Decennial and Agricultural Censuses. From the US Decennial, I collect information at the county level on the local population. The measures include the totals for the overall, urban, and black populations. The Agricultural Census provides data on the farming community at the county level. I collect information on the total number of farms and the number of tenant and land owning farmers by race. I aggregate the county level data from the two censuses to the division level.

The Agricultural Census provides the data used to generate cotton yields for the divisions. I collect data on the total number of bales produced and number of acres of cotton grown for each county. Based on the values aggregated to the division level, I generate division cotton yields by dividing the total number of bales by the total number of acres. The resulting unit of measure is the number of cotton bales per acre of cotton grown.

Empirical Methods

I measure conflict with a dummy variable for a lynching happening in an area. Lynching is particularly violent form of conflict perpetrated by multiple individuals usually under the guise of false acquisitions. Due to the extreme nature of lynchings, their occurrence was well documented. The extreme nature also means the measure only captures information in high level of conflict. A broader measure of conflict is preferable, but does not exist for the period of analysis.

Data limitation also dictate the usage of a proxy variable for economy output. The ideal variable to understand the role the economy plays in connecting weather fluctuations and conflict would capture just the changes to the overall economy due to the weather. Measuring economic output at the sub state level is challenging even in the modern US let alone the early twentieth century. Therefore, I focus on cotton yields as proxy for economic activity in the Cotton South. The cotton and the infrastructure associated with its production and sale represented a large of the overall economy in Cotton South during the early twentieth century. May rainfall can also be used to extract the exogenous portion of changes in cotton yields.

As part of my estimates, I instrument for the potential endogeneity of cotton yields. In the first stage of my two stage least squares estimates, I use a dummy variable for extremely wet Mays as an instrumental variable. A valid instrument needs to be correlated with the endogenous variable and not the dependent variable. Based on previous research, I know May rainfall is a strong determinant of cotton yields in the Cotton South (Lombardi 2016). My first stage estimates confirm this finding as the f statistics are over fifteen and the variable is statistically significant at the one percent level. For excludability, rain is unlikely to affect the propensity of individuals to perpetrate a lynching due to the timing. My dummy variable for a lynching occurring does not begin until closer to the October harvest (e.g. the measure goes from August to July of the subsequent year). If May rain directly caused lynching, unrelated to the economy, my estimates would be biased towards zero as my variable would link the lynching to the previous year's May rainfall.

To establish a correlation between weather and conflict, I regress my dummy variable for lynching on a measure of rainfall and controls Ordinary Least Squares. The equation has the form:

$$Lynching_{td} = \alpha + \beta_1 May\ Rain_{\boldsymbol{td}} + \boldsymbol{\beta X}_{td} + \delta_t + \gamma_d + \varepsilon_{td}$$

where $Lynching$ is a dummy variable equal to one if a lynching occurring in the division and zero otherwise. $May\ Rain$[32] is a dummy variable equal to one if the division experience an extremely wet May. [33] $\boldsymbol{X}$ is a matrix of controls for population and farming characteristics by division and year. I include year, t, and division, d, fixed effects.

When I estimate the connection between cotton yields on the lynching, I use two stage least squares, because of the potential endogeneity of cotton yields. In the first stage, I predict cotton yields with the dummy variable for extremely wet Mays:

$$Cotton\ Yield_{td} = \alpha + \beta_1 May\ Rain_{td} + \boldsymbol{\beta X}_{td} + \delta_t + \gamma_d + \varepsilon_{td}$$

The model includes year and division fixed effects and a matrix of control variables from the second stage—$\boldsymbol{X}$. I use the predicted cotton yields in the second stage:

$$Lynching_{td} = \alpha + \beta_1 \widehat{Cotton\ Yield}_{td} + \boldsymbol{\beta X}_{td} + \delta_t + \gamma_d + \varepsilon_{td}$$

The dependent variable is dummy variable for a lynching occurring in a division. I include controls for the division's population and farming characteristic and fixed effects for division and year.

One concern with my instrumental strategy is the excludability of weather (e.g., weather fluctuations affect the probability of lynchings through some other mechanism than cotton yields). If true, the weather variable cannot be used as instrument. Researchers have observed a direct connection between high temperatures and violence (Kenrick and MacFarlane 1986 and Jacob et al. 2007). However, the several month gap in-between my weather and lynching measures makes the issue unlikely as the previous studies only show a contemporaneous

[32] In the second set of estimates, I use the same approach but replace the rainfall measure with cotton yields.
[33] I use the May value of the 1 Month Standardized Precipitation as the basis of the dummy variable. I use the NOAA's definition of extreme for the cutoff values.

connection between high temperatures and violence—not lagged incidents. In potential extension, I could generate first stage estimates using Paul Rhode's dataset on the arrival of the boll weevil in place of weather measures.

Another potential violation of the exclusion restriction deals with law enforcement. A wet May lowers cottons yields leading to low tax revenues. The lower tax revenues cause the local government to cut back on police force expenditures. Therefore, the change in policing capacity, not incomes, leads to the higher probability of lynchings. The explanation does fit the government capacity mechanism for connecting the weather with violence. However, the mechanism is unlikely as lynching perpetrators did not fear prosecution as many posed for photos with the body and less than one percent were convicted of a crime. Local law enforcement members frequently participated in lynchings. From the criminal perspective, the extrajudicial threat of lynching was omnipresent. A gap exists between actual criminal activity and being targeted for lynching as historians and commentators frequently observe victims were innocent of their alleged crime.

Results

In table one, I present evidence that weather fluctuations were correlated with violent conflict. I estimate my reduced form equation with Ordinary Least Squares[34]. The key parameter of interest is the coefficient on the dummy variable for an extremely wet May. Following a wet May, the probability of a lynching occurring during the next fourteen months increases by eighteen percent. The correlation is statistically significant in all three specifications and

---

[34] I re-estimate the relationship between weather changes and lynching with a probit model due to the binary outcome variable. I provide the results in table two. The results generally match the sign and significance of the estimates from the linear probability model.

increases with the addition of controls for the local population (column 2) and farming community (column 3). Surprisingly, none of the coefficients on the population and farming characteristics are significant.

The results in table one show weather fluctuations are correlated with lynchings, but do not provide the reader with an intuition for the connection. A possible mechanism is the weather affects the local economy. If economic hardship is the link between the weather and conflict, we expect to observe a negative relationship between the economy and conflict. As economic output declines, the probability of violence increases. Due to their reliance on cotton production, I use cotton yields as a proxy for the local economic health for areas in the Cotton South.

In table three, I provide the reader with the OLS estimates for the correlation between a division's cotton yields and probability of a lynching occurring.[35] The estimates show no clear connection between yields and lynchings. The coefficient is statistically insignificant in all three specifics. A division's population and farming characteristics again fail to provide information on the probability of a lynching occurring.

A concern with the results table three is the potential endogeneity of cotton yields. Yields maybe capturing information from a three variable that affects both yields and the propensity of violence. Due to historical events including slavery and the Civil War, the direction causality between violence and cotton production in the Cotton South is not obvious. Given these issues, I use the weather shocks to extract the exogenous portion of cotton yields. The instrument variable approach also addresses the concern of simultaneous causality.

[35] I re-estimate the relationship between cotton yields and lynching with a probit model due to the binary outcome variable. I provide the results in table four. The results surprisingly suggest a positive relationship between yields and lynching. As with the OLS estimates in table three, the potential endogeneity of yields reduces the informative value of the results.

Table five shows the second stage estimates from two stage least squares correlating predicted cotton yields with the probability of a lynching occurring in the subsequent period.[36] The final row of the table shows the dummy variable for an extremely wet May is a strong predictor of cotton yields in October as the f statistic is over fifteen in all three specifications. I find a negative statistically significant relationship between cotton yields and lynchings. The result suggests that conflict declines as the economy strengthens. The negative relationship is consistent with the reduced form estimates in table one.

The empirical estimates show a correlation between weather fluctuations and violent conflict based on an economic channel. The results in table one show that extremely wet periods led to an increase in the probability of lynching occurring in the subsequent year. However, the results do not provide information on why the correlation. In tables three and five, I consider an economic link between the weather and conflict. After using weather fluctuations to address the issue of endogeneity, I find increases in the cotton yields, a proxy for economic activity, lead to a decrease in the probability of a lynching. The finding shows the relationship between weather and conflict has an economic basis.

Conclusion

I use the Cotton South to examine the connection between weather fluctuations and conflict. I find May rain is a strong predictor of cotton yields. Using May rainfall to generate exogenous variation in cotton yields, I find cotton yields are negatively correlated with the probability of a lynching occurring in the subsequent six month following the harvest. Cotton yields are a good proxy for local economic activity as communities in the Cotton South relied

[36] The estimates based on a IVProbit model are presented in table six. The results generally fit the patterns observed in table five in terms of sign and significance.

heavily on cotton production. As communities experienced economic hardships due to weather fluctuations, the chance for violent conflict (e.g. lynchings) in the community grew.

The pattern connecting the weather and conflict through economic outcomes is likely more general than the Cotton South in the early twentieth century. The Cotton South shares key factors with modern developing economies. Agricultural output makes up a large share of overall output. Farmers are not insured against crop losses. Climate scientist predict global warming lead to greater variability in weather condition and developing economies are the most vulnerable to the changes. The combination of these factors suggest that the connection between the weather and conflict will become a greater concern going forward.

Additional Work

To increase the number of observations and try a different approach to estimate the treatment effect, I would like estimate a difference in differences model based on lynchings and a dummy for the introduction of the boll weevil. I have a dataset that provides the year in which the boll weevil is first present in a county. The mechanism would be similar to the current paper. However, the exogenous change in cotton yields would be driven by the introduction of the boll weevil instead of May rain. The difference allows for a lower level of observation (e.g. the county versus the weather division).

Broader question I have is why no deaths from lynchings after 1930. The overall conditions did not change greatly in terms the economy relying on cotton production and the presence of weather fluctuations during the 1930s and 40s. However, the development of stronger institutions potentially prevented the use of extralegal violent acts. By 1930, the legal and punitive systems may have developed sufficiently that lynching was no longer a feasible expression of conflict. With conflict between blacks and whites unabated, did the strengthening of institutions lead to overt acts of violence being replaced with extractive institutions? The presence of Jim Crow laws suggests white black conflict in the South had institutional aspects.

To see if extractive institutions were present in the Cotton South, I would use tax and criminal data from the state of Georgia during the early twentieth century. I would use a similar instrumental variable approach as the current paper to generate exogenous variation in the local economy (e.g. weather fluctuations). However, I would use a dataset based at the county level that includes 50 counties in Georgia. I measure the extractive nature of local institutions by examining data on tax defaulters and criminals. Georgia tax records between 1888 and 1936 includes information on the race and number of defaulters at the county level. The records also include the amount of assets seized from defaulters. The crime reports provide information on the number of convicts by race at the state level during a similar period. For the years 1905 and 1921, the reports include information on the number of force labors by race and county. From the reports, I can observe if Georgia's tax and crime systems were used to extract assets and labor from blacks. Due to the replication of the reports, I can also examine how the pattern evolved over time.

Table 1: The Probability of a Lynching Occurring in Weather Division Regressed on a Dummy Variable for an Extremely Wet May Using OLS

	(1)	(2)	(3)
Extremely Wet May	0.144*	0.153*	0.182**
	(0.077)	(0.084)	(0.084)
Total:			
Population		0.259	0.327
		(0.487)	(0.485)
Urban Population		-0.256	-0.310
		(0.477)	(0.482)
Black Population		-0.350	-0.244
		(0.821)	(0.908)
Farms		0.418	-0.148
		(2.36)	(2.33)
White Land Owning Farmers			-0.806
			(1.15)
White Tenant Farmers			1.87
			(2.68)
Black Land Owning Farmers			4.74
			(5.31)
Black Tenant Farmer			-1.49
			(1.15)

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Errors are clustered at the climate division level. All regressions include year and division fixed effects. The controls are divided by one hundred thousand.

Table 2: The Probability of a Lynching Occurring in Weather Division Regressed on a Dummy Variable for an Extremely Wet May Using Probit

	(1)	(2)	(3)
Extremely Wet May	0.798*	0.885	1.183**
	(0.485)	(0.614)	(0.566)
Total:			
Population		0.400	0.662
		(0.387)	(0.452)
Urban Population		-0.903*	-1.01*
		(0.502)	(0.547)
Black Population		0.296	0.168
		(0.609)	(0.639)
Farms		-0.868	-1.39
		(1.82)	(1.62)
White Land Owning Farmers			7.70*
			(4.22)
White Tenant Farmers			-3.96
			(3.62)
Black Land Owning Farmers			-11.3
			(7.36)
Black Tenant Farmer			0.617
			(1.10)

Notes: Standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Errors are clustered at the climate division level. All regressions include year and division fixed effects. The controls are divided by ten thousand.

Table 3: The Probability of a Lynching Occurring in Weather Division Regressed on a Cotton Yields Using OLS

	(1)	(2)	(3)
Cotton Yield	0.549	0.618	0.543
	(0.441)	(0.521)	(0.574)
Total:			
Population		0.342	0.363
		(0.476)	(0.472)
Urban Population		-0.398	-0.437
		(0.494)	(0.509)
Black Population		-0.225	-0.136
		(0.800)	(0.915)
Farms		-0.988	-1.27
		(2.51)	(2.50)
White Land Owning Farmers			-0.726
			(1.49)
White Tenant Farmers			1.01
			(2.61)
Black Land Owning Farmers			4.71
			(6.36)
Black Tenant Farmer			-0.842
			(1.31)

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Errors are clustered at the climate division level. All regressions include year and division fixed effects. The controls are divided by one hundred thousand.

Table 4: The Probability of a Lynching Occurring in Weather Division Regressed on a Cotton Yields Using Probit

	(1)	(2)	(3)
Cotton Yield	8.004*	8.141*	17.96**
	(4.17)	(4.25)	(8.34)
Total:			
Population		0.694*	0.699*
		(0.385)	(0.416)
Urban Population		-1.26**	-1.65***
		(0.635)	(0.6409)
Black Population		0.289	1.12
		(0.553)	(0.754)
Farms		-2.06	-4.13**
		(2.51)	(2.50)
White Land Owning Farmers			14.2**
			(6.25)
White Tenant Farmers			-12.0**
			(5.36)
Black Land Owning Farmers			13.9*
			(8.40)
Black Tenant Farmer			0.766
			(1.01)

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Errors are clustered at the climate division level. All regressions include year and division fixed effects. The controls are divided by ten thousand.

Table 5: The Probability of a Lynching Occurring in Weather Division Regressed on a Predicted Cotton Yields Using 2SLS

	(1)	(2)	(3)
Cotton Yield	-2.44**	-2.87**	-3.08**
	(1.10)	(1.32)	(1.27)
Total:			
Population		0.241	0.328
		(0.359)	(0.367)
Urban Population		-0.009	-0.047
		(0.401)	(0.402)
Black Population		-0.792	-0.794
		(0.640)	(0.682)
Farms		3.39	2.8
		(2.34)	(2.24)
White Land Owning Farmers			-1.10
			(1.37)
White Tenant Farmers			2.37
			(2.00)
Black Land Owning Farmers			10.5**
			(4.99)
Black Tenant Farmer			-1.38
			(0.901)
F Statistic	18.88	15.03	16.63

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Errors are clustered at the climate division level. All regressions include year and division fixed effects. The controls are divided by one hundred thousand.

Table 6: The Probability of a Lynching Occurring in Weather Division Regressed on a Predicted Cotton Yields Using IVProbit

	(1)	(2)	(3)
Cotton Yield	-6.77	-10.05**	-10.03**
	(4.44)	(3.61)	(3.64)
Total:			
Population		0.256	0.167
		(0.222)	(0.196)
Urban Population		-0.573	-0.254
		(0.363)	(0.299)
Black Population		0.048	-0.220
		(0.359)	(0.401)
Farms		0.24	0.745
		(1.09)	(1.05)
White Land Owning Farmers			2.90
			(2.48)
White Tenant Farmers			-1.42
			(2.18)
Black Land Owning Farmers			-2.58
			(4.18)
Black Tenant Farmer			0.001
			(0558)

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Errors are clustered at the climate division level. All regressions include year and division fixed effects. The controls are divided by ten thousand.

References

Adhvaryu, Achyuta, Namrata Kala, and Anant Nyshadham. "*Booms, Busts, and Household Enterprise: Evidence from Coffee Farmers in Tanzania*. mimeo, 2013.

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

Anderson, Aaron D. *Builders of a New South: Merchants, Capital, and the Remaking of Natchez, 1865-1914*. Univ. Press of Mississippi, 2013.

Baker, Richard B. "From the Field to the Classroom: The Boll Weevil's Impact on Education in Rural Georgia." September 2013.

Baland, Jean-Marie, and James A. Robinson. "Is Child Labor Inefficient?" *Journal of Political Economy* 108.4 (2000): 663-679.

Barnhouse Walters, Pamela, and Carl M. Briggs. “The Family Economy, Child Labor, and Schooling: Evidence from the Early Twentieth-Century South.” *American Sociological Review* 58.2 (Apr., 1993): 163-181.

Barrios, Salvador, Luisito Bertinelli, and Eric Strobl. "Trends in Rainfall and Economic Growth in Africa: A Neglected Cause of the African Growth Tragedy." *The Review of Economics and Statistics* 92.2 (2010): 350-366.

Beck, E. M., James L. Massey, and Stewart E. Tolnay. "Gallows, the Mob, and the Vote: Lethal Sanctioning of Blacks in North Carolina and Georgia, 1882 to 1930, The." *Law & Society Rev.* 23 (1989): 317.

Beck, Elwood M., and Stewart E. Tolnay. "The Killing Fields of the Deep South: The Market for Cotton and the Lynching of Blacks, 1882-1930." *American Sociological Review* (1990): 526-539.

Beck, Ulrik, Saurabh Singhal, and Finn Tarp. “Coffee Price Volatility and Intra-Household Labor Supply.” No. UNU-WIDER Research Paper wp2016-0016. 2016.

Beegle, Kathleen, Rajeev H. Dehejia, and Roberta Gatti. "Child labor and agricultural shocks." *Journal of Development Economics* 81.1 (2006): 80-96.

Beegle, Kathleen, Rajeev H. Dehejia, and Roberta Gatti. "Why should we care about child labor? The education, labor market, and health consequences of child labor." *Journal of Human Resources* 44.4 (2009): 871-889.

Belley, Philippe, and Lance Lochner. “The Changing Role of Family Income and Ability in Determining Educational Achievement.” *Journal of Human Capital* 1:37-89.

Bevan, Pip, and A. Pankhurst. “Ethiopian Village Studies.” University of Oxford, Center for the African Economies. http://www.csae.ox.ac.uk/evstudies/main.html.

Brittain, M. L. “Thirty Ninth Annual Report of the Department of Education to the General Assembly of the State of Georgia for the School Year Ending December 31, 1910.” *State Printer*. 1911.

Cameron, Lisa A., and Christopher Worswick. "The Labor Market as a Smoothing Device: Labor Supply Responses to Crop Loss." *Review of Development Economics* 7.2 (2003): 327-341.

Card, David. *Earnings, Schooling, and Ability Revisited*. No. w4832. National Bureau of Economic Research, 1994.

Card, David. "The Causal Effect of Education on Earnings." *Handbook of Labor Economics* 3 (1999): 1801-1863.

Carruthers, Celeste K., and Marianne H. Wanamaker. "Separate and Unequal in the Labor Market: Human Capital and the Jim Crow Wage Gap." *Department of Economics Haslam College of Business* Working Paper No. 2015-01 (2015).

Caucutt, Elizabeth, and Lance Lochner. "Borrowing Constraints on Families with Young Children." *Innovation in Education* (2005): 39-48.

Caucutt, Elizabeth M., and Lance Lochner. *Early and Late Human Capital Investments, Borrowing Constraints, and the Family*. No. w18493. National Bureau of Economic Research, 2012.

Cavalieri, Claudia H. "The impact of child labor on educational performance: an evaluation of Brazil." *Seventh Annual Meeting of the Latin American and Caribbean Economic Association (LACEA)*. 2002.

Collins, William J., and Robert A. Margo. "Historical perspectives on racial differences in schooling in the United States." *Handbook of the Economics of Education* 1 (2006): 107-154.

Davis, Joseph H., Christopher Hanes, and Paul W. Rhode. "Harvests and business cycles in nineteenth-century America." No. w14686. National Bureau of Economic Research, 2009.

Dell, Melissa, Benjamin F. Jones, and Benjamin A. Olken. "Temperature Shocks and Economic Growth: Evidence from the Last Half Century." *American Economic Journal: Macroeconomics* (2012): 66-95.

Dercon, Stefan. "Income Risk, Coping Strategies, and Safety Nets." *The World Bank Research Observer* 17.2 (2002): 141-166.

Duncan, Greg J., et al. "How Much Does Childhood Poverty Affect the Life Chances of Children?." *American Sociological Review* (1998): 406-423.

Duryea, Suzanne, and Mary Arends-Kuenning. "School attendance, child labor and local labor market fluctuations in urban Brazil." *World Development* 31.7 (2003): 1165-1178.

Edmonds, Eric V., and Nina Pavcnik. "Product Market Integration and Household Labor Supply in a Poor Economy: Evidence from Vietnam." *World Bank Policy Research Working Paper* 3234 (2004).

Fafchamps, Marcel, Christopher Udry, and Katherine Czukas. "Drought and Saving in West Africa: Are livestock a Buffer Stock?." *Journal of Development economics* 55.2 (1998): 273-305.

Haines, Michael R., and Inter-university Consortium for Political and Social Research. Historical, Demographic, Economic, and Social Data: The United States, 1790-2002. ICPSR02896-v3. Ann Arbor, MI: Inter-university Consortium for Political and Social Research [distributor], 2010-05-21. http://doi.org/10.3886/ICPSR02896.v3

Heckman, James J. "Building Bridges Between Structural and Program Evaluation Approaches to Evaluating Policy." *Journal of Economic Literature* 48.2 (2010): 356-398.

Hibbs, Douglas A. *Voting and the Macroeconomy*. Centrum för forskning om offentlig sektor (CEFOS), 2005.

Higgs, Robert. "Accumulation of property by Southern blacks before World War I." *The American Economic Review* (1982): 725-737.

Hovland, Carl Iver, and Robert R. Sears. "Minor Studies of Aggression: VI. Correlation of lynchings with Economic Indices." *The Journal of Psychology*9.2 (1940): 301-310.

Hsiang, Solomon M. "Temperatures and Cyclones Strongly Associated with Economic Production in the Caribbean and Central America." *Proceedings of the National Academy of Sciences* 107.35 (2010): 15367-15372.

Hsiang, Solomon M., and Marshall Burke. "Climate, Conflict, and Social Stability: What Does the Evidence Say?." *Climatic Change* 123.1 (2014): 39-55.

Inverarity, James M. "Populism and Lynching in Louisiana, 1889-1896: A Test of Erikson's Theory of the Relationship between Boundary Crises and Repressive Justice." *American Sociological Review* (1976): 262-280.

Ito, Takahiro, and Takashi Kurosaki. "Weather Risk, Wages in Kind, and the Off-Farm Labor Supply of Agricultural Households in a Developing Country." *American Journal of Agricultural Economics* 91.3 (2009): 697-710.

Jacob, Brian, Lars Lefgren, and Enrico Moretti. "The Dynamics of Criminal Behavior Evidence from Weather Shocks." *Journal of Human Resources* 42.3 (2007): 489-527.

Jacoby, Hanan G., and Emmanuel Skoufias. "Risk, Financial Markets, and Human Capital in a Developing Country." *The Review of Economic Studies* 64.3 (1997): 311-335.

Karoly, Lynn A., and Hugh P. Levaux. *Investing in our Children: What We Know and Don't Know about the Costs and Benefits of Early Childhood Interventions*. Rand Corporation, 1998.

Kenrick, Douglas T., and Steven W. MacFarlane. "Ambient Temperature and Horn Honking a Field Study of the Heat/Aggression Relationship." *Environment and behavior* 18.2 (1986): 179-191.

Kochar, Anjini. "Smoothing Consumption by Smoothing Income: Hours-of-Work Responses to Idiosyncratic Agricultural Shocks in Rural India." *Review of Economics and Statistics* 81.1 (1999): 50-61.

Kruger, Diana I. "Coffee production effects on child labor and schooling in rural Brazil." *Journal of Development Economics* 82.2 (2007): 448-463.

Lang, Kevin. "Ability Bias, Discount Rate Bias and the Return to Education." (1993).

Lochner, Lance, and Alexander Monge-Naranjo. "Credit Constraints in Education." *Annual Review of Economics* 4.1 (2012): 225-256.

Lombardi, Paul. "Examining the Effect of Income Shocks on the Schooling Choices of Credit Constrained Households." 2016

Lovenheim, Michael F. "The effect of liquid housing wealth on college enrollment." *Journal of Labor Economics* 29.4 (2011): 741-771.

Margo, Robert. "Accounting for Racial Differences in School Attendance in the American South, 1900: The Role of Separate-But-Equal." *NBER* Working Paper No. 2242. May 1987.

Margo, Robert. "Educational Achievement in Segregated School Systems: The Effects of 'Separate-But-Equal.'" *NBER* Working Paper No. 1620. May 1985.

Margo, Robert A. *Race and Schooling in the South, 1880-1950: An Economic History*. University of Chicago Press, 1990.

Mathenge, Mary K., and David L. Tschirley. "Off-Farm Labor Market Decisions and Agricultural Shocks Among Rural Households in Kenya." *Agricultural Economics* 46.5 (2015): 603-616.

Meghir, Costas, and Guglielmo Weber. "Intertemporal Nonseparability or Borrowing Restrictions? A Disaggregate Analysis Using a US Consumption Panel." *Econometrica: Journal of the Econometric Society* (1996): 1151-1181.

Miguel, Edward. "Poverty and Witch Killing." *The Review of Economic Studies*72.4 (2005): 1153-1172.

Miguel, Edward A., Marco Manacorda, and Andrea Vigorito. "Government Transfers and Political Support." *American Economic Journal: Applied Economics* 3.3 (2011): 128.

Miguel, Edward, Shanker Satyanath, and Ernest Sergenti. "Economic Shocks and Civil Conflict: An Instrumental Variables Approach." *Journal of Political Economy* 112.4 (2004): 725-753.

Moore, Henry Ludwell. *Forecasting the Yield and the Price of Cotton*. Macmillan, 1917.

Naidu, Suresh. *Suffrage, schooling, and sorting in the post-bellum US South*. No. w18129. National Bureau of Economic Research, 2012.

O'Neil, June. "The Role of Human Capital in Earnings Differences Between Black and White Men." *The Journal of Economic Perspectives* 4.4 (Autumn, 1990): 25-45.

Patrinos, Harry Anthony, Cristóbal Ridao-Cano, and Chris N. Sakellariou. *Estimating the Returns to Education: Accounting for Heterogeneity in Ability*. Vol. 4040. World Bank Publications, 2006.

Paxson, Christina H. "Using Weather Variability to Estimate the Response of Savings to Transitory Income in Thailand." *The American Economic Review*(1992): 15-33.

Ranjan, Priya. "Credit Constraints and the Phenomenon of Child Labor." *Journal of Development Economics* 64.1 (2001): 81-102.

Ransom, Roger L., and Richard Sutch. *One Kind of Freedom: The Economic Consequences of Emancipation*. Cambridge University Press, 2001.

Raper Arthur, F. "The Tragedy of Lynching." (1933).

Ravallion, Martin and Quentin Wodon. "Does Child Labour Displace Schooling? Evidence on Behavioural Responses to an Enrollment Subsidy." *The Economic Journal* 110.462 (March 2000): 158-175.

Ruggles, Steven, J. Trent Alexander, Katie Genadek, Ronald Goeken, Matthew B. Schroeder, and Matthew Sobek. "*Integrated Public Use Microdata Series: Version 5.0"* **[Machine-readable database]. Minneapolis: University of Minnesota, 2010.**

Stephens Jr, Melvin. "The Consumption Response to Predictable Changes in Discretionary Income: Evidence from the Repayment of Vehicle Loans." *The Review of Economics and Statistics* 90.2 (2008): 241-252.

Stock, James H., and Motohiro Yogo. "Testing for Weak Instruments in Linear IV Regression." *Identification and Inference for Econometric Models: Essays in Honor of Thomas Rothenberg* (2005).

Takasaki, Yoshito, Bradford L. Barham, and Oliver T. Coomes. "Smoothing Income Against Crop Flood Losses in Amazonia: Rain Forest or Rivers as a Safety Net?." *Review of Development Economics* 14.1 (2010): 48-63.

Thomas, Duncan, et al. "Education in a Crisis." *Journal of Development Economics* 74.1 (2004): 53-85.

United States Bureau of Education. "Report of the Commissioner of Education Made to the Secretary of the Interior for the Year Ended June 30, 1909." U.S. Government Printing Office, 1910.

Wooldridge, Jeffrey M. *Econometric Analysis of Cross Section and Panel Data*. MIT press, 2010.

Wright, Gavin. *Old South, new South: Revolutions in the Southern Economy Since the Civil War*.

Basic Books (AZ), 1986.