Transitory Income Shocks Made Permanent: The Plight of Farmers in the US Cotton South 1910-30

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Abstract

Black men born in the US Cotton South during the early twentieth century earned fifty percent less than their white counterparts. In this paper, I examine how transitory economic fluctuations effect the employment choices of farmers. Using US Census data, I find a negative correlation between wage work and cotton production for black farmers. The employment behavior of white households is unaffected by changes in cotton production. The results are consistent with black farmers using wage work as a coping mechanism in response to declining household incomes. The mechanism correlates with lower investments in human capital.

Introduction

In the decades following the end of the Civil War, black farmers lagged their white counterparts in most observable dimensions. Blacks had fewer years of schooling. Lower human capital investments contributed to lower wages (Carruthers and Wanamaker 2015). Blacks acquired financial assets at a slower pace. The lower levels of assets translated into fewer blacks owning farms relative to white farmers.

During the early twentieth, the majority of Southern blacks earned their livelihoods from the risky occupation of farming without the benefit of governmental safety nets in a society with institutional racism. In general, farming incomes frequently vary due to factors outside of the farmer's control, including market prices and weather fluctuations. Southern farmers were particularly susceptible to these factors due to the lack of crop diversification and low levels of capital investment for improvements including irrigation. Southern Congressmen during the early twentieth century actively worked to block federal policies from insuring farmers. The Congressmen's actions led to farmers not having crop, unemployment, and old age insurance. Laws establishing programs geared specifically towards helping farmers were subjected to funding cuts and repeal (Alston and Ferrie 1999). Relative to whites, black farmers also had to adapt to institutional racism. Black farmers faced discrimination when accessing credit, land, and employment.

The current paper examines if rural farming households in the U.S. Cotton South used wage work off the family farm to cope with declines in household incomes. I restrict my sample to rural farming households in the U.S. Cotton South during the early twentieth century. The rural South's lack of sectoral and crop diversification led cotton production to be the dominate income source for the region's farmers. Therefore, I use cotton yields as a proxy for farming household incomes. To test if farmers used off farm wage work as a coping mechanism, I examine the relationship between the probability of wage work and household incomes—cotton yields. The analysis raises endogeneity concerns due to the potential of simultaneous causality (i.e., household incomes affect the choice to work and vice versa). I limit the direction of causality to income's effect on the probability of wage work by predicting cotton yields. I predict cotton yields with precipitation and temperature measures during the crop cycle to generate transitory fluctuations and the arrival of the boll weevil for a persistent shock.[1]

My main results show a racial and temporal component in the decision to use farm wage work to cope with income declines. I find only black farmers use farm wage work to cope with income fluctuations following transitory income shocks due to the weather. In my extensions, I show the pattern is not uniform as only black tenant farmers and regions with a high share of cash tenant farmers react to the weather fluctuations. I observe farm wage work participation rates for both white and black farmers respond to the persistent income drop due to the boll weevil. However, the observed pattern is not consistent with the coping mechanism as wage work declines as incomes decline. Extensions show the pattern is not consistent across household types as only landowners react to the arrival of the boll weevil. The results show the decision to use farm wage work to cope with income shocks is a function of both household (i.e., race and farm type) and shock (i.e., transitory or persistent) characteristics.

The current paper contributes to the literature on the Southern labor markets. Ager et al. (2016) find the boll weevil's arrival led to significant changes in the Southern agricultural labor

[1] Weather fluctuations are not serially correlated across years, so the weather only affects the yields in a given year. I find no evidence of farmers adjusting production behavior in response to the weather. Therefore, I treat weather fluctuations as transitory. The boll weevil's arrival in a region led to lower yields for the next decade plus. Farmers knew of the persistent damage the boll weevil caused from previously infested regions (Lange et al. 2009). Therefore, I treat the boll weevil's arrival as a persistent negative income shock.

market. I find agricultural workers responded to both transitory and persistent income fluctuations (i.e., the weather and the boll weevil's arrival). The boll weevil's effect went beyond the agricultural labor market. My results show the boll weevil reduce the probability of nonfarm wage work by black households. Income shocks led to heterogeneous responses depending on household characteristics—race and farm type.

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 provide 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 household 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).

By examining wage work by rural farmers, the current paper extends several lines of research within the U.S. Cotton South literature. 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 (2017) which focuses on the connection between income fluctuations and schooling. However, the paper does not consider wage work's role in smoothing household consumption.

The paper contributes to a literature looking at the boll weevil’s economic consequences on the US Cotton South during the early twentieth century. The closest paper to the current research is Ager et al. (2016). The researchers use county level data to measure the boll weevil’s impact on farm size, number of tenant farmers, and labor force participation rates. The authors find the number of cash tenants and black female labor force participation rates decrease following the boll weevil's arrival. Bloome et al. (2017) find the decrease in tenancy following the boll weevil's arrival reduces the share of blacks marrying at young ages. Black school attendance rates increase (Baker 2015). Farmers switch agricultural production out cotton and into corn as cotton yields decline due to the boll weevil (Lange et al. 2009).

The current paper has implications for literatures on intergenerational mobility and female labor force participation. Papers examining intergenerational mobility during the period focus on occupational changes between fathers and sons to measure mobility. Given the share of blacks in the rural South and the reduction in black non-farm employment, the arrival of the boll weevil likely reduced black economic mobility or at minimum represents a factor researchers need to control for in their analysis. Related is the reduction in black female employment in the nonfarm sector. Throughout the early twentieth century, female labor force participation was increasing (Goldin 1990). However, the current paper shows areas infested by boll weevils saw black female nonfarm employment decrease. The paper provides quantitative evidence of the strong cultural norm of white married women not working outside of the home. I find no evidence of off farm wage work by white wives in response to fluctuations in household incomes. The results are consistent with a broader set of results from the period (Goldin 1990).

Empirical Methods

To test if farmers use wage work to cope with income fluctuations, I need information on changes in household incomes. However, no datasets with individual level income data from the early twentieth century with individual characteristics exists. Therefore, I replace individual income with a proxy variable. As previous researchers have done (Baker 2013), I use a measure of cotton production as a 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.[2] An advantage of the proxy variable is I can generate exogenous variation in cotton yields. Generating exogenous variation in a direct measure of incomes would be significantly more difficult.

After incorporating the income proxy, I estimate the following linear model:

$$Probability\ of\ Wage\ Work_{tc} = \alpha + \beta_1 Cotton\ Yield_{tc} + \boldsymbol{\beta}_{mc}\boldsymbol{X}_{tc} + \delta_t + \gamma_c$$

$\boldsymbol{X}_{tc}$ is a matrix of county controls by year. $Cotton\ Yield$ 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 year, δ_t, and county, γ_c, fixed effects. The model's errors are clustered at the county level. I estimate the model by race to allow for a more flexible estimation. The coefficients on the control variable are not jointly estimated by blacks and whites. Therefore, the estimation does not force the effect of the number of black tenants to be the same for both black and white farmers.

The model's key variable of interest is cotton yield. If households are smoothing consumption by increasing wage work following a negative shock, we expect the coefficient on cotton yield, β_1, to be negative and significant. A negative significant coefficient on cotton yield suggests households' labor supply is an increasing function of wages.

[2] Due to the structure of the Southern agricultural economy, the price of cotton was uniform across the region. The structure also led the supply to be insensitive to price changes (Ransom and Sutch).

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. Using an instrumental strategy allows 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. I use two separate strategies: one based on weather instruments, May rainfall and average temperature across the crop cycle, and the other based on a dummy variable for the arrival of the boll weevil. The two strategies allow me to test transitory, weather instruments, and persistent, boll weevil, shocks to cotton yields. My two first stage equations take the forms:

$$Cotton\,Yield_{dt} = \alpha + \beta_1 May\,Rain_{dt} + \beta_2 Avg\,Temperature_{dt} + \boldsymbol{\beta X}_{dt} + \delta_t + \gamma_d$$

$$Cotton\,Yield_{ct} = \alpha + \beta_1 Boll\,Weevil_{ct} + \boldsymbol{\beta X}_{ct} + \delta_t + \gamma_c$$

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 weather based model includes year and division fixed effects. The boll weevil model includes year and county fixed effects. The other portion of the equations are variables from the second stage. My second stage equation now has the following form:

$$Probability\,of\,Wage\,Work_{tc} = \alpha + \beta_1 \widehat{Cotton\,Yield}_{tc} + \boldsymbol{\beta X}_{tc} + \delta_t + \gamma_c$$

The estimated cotton yield replaces the true values. I cluster the errors and include fixed effects at the division or county level depending on first stage used.

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. I convert the continuous rainfall measure into a dummy variable for extremely wet May when the Standardized Precipitation Index has a value greater than one as part of some reduced form estimates.[3]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.

Data on the presence of boll weevil in a county comes from a dataset provided by Paul Rhode. The dataset indicates the year in which boll weevils are first observed in a county. I convert the year data into a dummy variable equal to zero before the arrival of boll weevils. During the arrival and subsequent years, I set the dummy variable equal to one. The boll weevil

[3] As part of one extension, I further parse the continuous measure into three parts—wet, normal, and dry. I assign dry to divisions with SPI values less than zero and normal to division with values between one and zero.

variable differs from the wet dummy variable in that the variable is off, then on, and stays on. The reason for the different dummy variable structures is the persistence of the shocks to cotton yields. The weather varies by year and represents a new draw each year. Therefore, weather fluctuations only affect the yields in a single year's crop cycle. Following the arrival of the boll weevil, Lange et al. (2009) show cotton yields drop and stay low for the next decade or longer.

Cotton output and acreage comes from the U.S. Agricultural Census. I collect 1910, 1920, and 1930 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. 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.

U.S. Agricultural Census also provides information on the local farming community. I collect data on the number of tenant farmers and landowning farmers by race. The measures are aggregated to the division level to match the level of the weather data. As part of the extensions to the main model, I collect information on the number of cash tenants. To examine the role of cash tenants, I generate a variable for the share of cash tenants by dividing the number of cash tenants by the overall number of tenants.

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.[4] 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). 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.[5] 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.

[4] 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

[5] 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.

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 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 black. 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.

Results

To examine if black households respond to income shocks differently than their white counterparts, I focus my analysis on the response of Southern farmers to fluctuations in their main source of income—cotton production. Research on farmers from modern developing economies with no governmental safety nets observe increases in wage work following negative shocks to household incomes. Therefore, I examine if cotton yields are correlated with the decision to do wage work off the family farm.

Table one shows the results from regressing the probability of wage work on cotton yields by race—black and white. The first two columns show the results for the black subsample. In the both columns, the reader sees the coefficient is negative, but insignificant. Therefore, cotton yields appear not to affect the decision of black farmers to work off the family farm. Cotton yields do not appear to affect the probability of working wage work off the family farm for white farmers either. Cotton yields are insignificant in both white regression—columns three and four.

A potential concern with the estimates in table one 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 nonfarm wage work even if the desire existed. Farm wage work is a more realistic option given the farming background and availability of positions.

Table two provides the estimates from regressing the probability of farm wage work on cotton yields. The change in dependent variable has little impact of the coefficient on cotton yields. Yields are negatively correlated with the odds of black farmers working off the family farm, but not a significant determinant. For white farmers, the relationship is positive and insignificant. However, the regressions still do not address the endogeneity concerns and resultant attenuation bias.

To address the potential endogeneity of cotton yields, I implement two separate instrumental variable strategies. The first strategy relies on the short-term fluctuations in yields caused by the weather. To measure the fluctuations, I use May rainfall and average temperature across the crop cycle. The second strategy relies on the persistent drop in yields caused by the arrival of boll weevils. I use a dummy variable equal to one following the arrival of boll weevils. The strategies allow me to extract the exogenous portion of the cotton yield's variation. Table three presents the F-statistics from the two first stages. For the weather instruments the Kleibergen Paap F-statistic ranges from 25.75 to 28.63 and 34.66 to 102.22. Based on the critical values from Stock and Yogo (2005), neither of the regressions are biased due to weak instruments.

I provide the second stage results from the Two Stage Least Squares (2SLS) estimates in table four. Under both instrumental variable strategies, the estimates show clear racial differences. Based on the weather instruments, predicted cotton yields have a negative and significant relationship with the probability of farm wage off the family farm for black farmers—as cotton yields increase black farmers are less likely to work off the family farm. For white farmers, the coefficients are still positive and insignificant. In columns five through eight, the reader sees the coefficients on the predicted cotton yields is positive for both black and white farmers. The coefficient is only significant in column seven for white farmers. However, the addition of county controls in column eight makes the coefficient insignificant.

In table five, I present the results from running Ordinary Least Squares (OLS) with the predicted cotton yields replaced by the instruments. This reduced form approach addresses any potential concerns about the instruments failing the exclusion restriction. At first glance, the results in table five appear to be a reversal of table four's. However, wet Mays and the boll weevil both have a negative relationship with cotton yields. Therefore, the positive significant coefficient on wet in columns one and two is equivalent to the negative significant coefficient on predicted cotton yields in columns one and two of table four. The only difference is the relationship is stronger in table five, as the coefficients are significant at the one percent level versus the five percent level in table four. Unlike the estimates using the temporary income shock caused by wet Mays, the boll weevil estimates do not show a clear divergence in household responses along racial lines. The coefficient on the boll weevil dummy variable is negative and weakly significant for white and black farmers. The arrival of the boll weevil makes both black and whites farmers less likely to do farm wage work off their family's farm. Thus far the estimates have only considered the racial nuances of the rural Cotton South in decision to work off the family farm. Tables six and seven explore the wage work decisions at a more disaggregate level to understand the implications of the agricultural ladder.[6]

In table six,[7] I show the estimates from breaking the black farmer sample into subsamples based on household types—tenant and land-owning farmers. The key result is the patterns observed in tables four and five cannot be generalized to a race. In table five, the coefficient on Wet is positive and significant for black farmers. However, table six shows not all black farmers increase farm wage work after a weather shock—only tenant farmers. The coefficient is positive, but insignificant for black landowning farmers. The reader observes the pattern in table five for boll weevil is not generalizable either. The coefficient on the boll weevil dummy variable is again negative and significant, but only for black landowning farmers. By disaggregating by farmer type, I find higher levels of statistical significance as the coefficients on the shocks are not jointly determined by tenants and landowning farmers. I observe a similar pattern for white farming households.

Table seven shows white farming households' responses to income fluctuations vary by farmer type. Like black farmers, the patterns we observe in tables four and five are not uniform across household types. Farm wage work by white tenant and landowning farmers does not correlate with wet Mays. Following the boll weevil's arrival, the probability of white landowning farmers working off the family farm decreases at one percent significance level. Similar to wet Mays, the tenant farmer's response to the boll weevil is not significant. In tables six and seven,

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[6] The agricultural ladder refers to the relative ranking of farmers in the Cotton South and the general pattern of farmers progressing in orderly manner through the ranks. Researchers using the Decennial Census can break farming households into three ranks from the lowest being farm laborer, then tenant farmer, and finally land-owning farmer. In practice, the tenant farmers included subcategories, share cropper, share tenants, and cash tenants, but the census does not provide enough household information to disaggregate beyond the tenant level.

[7] Table six provides the estimates from the reduced form approach. The 2SLS estimates are similar.

the reader observes both white and black landowning farmers are less likely to participate in farm wage work off the family farm following the boll weevil's arrival.

The main results show the decision to take farm wage work off the family farm is a function of race, farm type, and the persistence of shock. I find black tenant farmers are the only group to increase wage work off the family farm following income declines. The pattern only occurs following transitory income fluctuations caused by the weather and not the persistent income shock caused by the boll weevil's arrival (i.e., statistically significant positive correlation with wet Mays and negative correlation with predicted cotton yields). The negative correlation between cotton yields and wage work by black tenant farmers is the only case I observe of households using off farm wage to cope with income declines. To understand the potential cause for the pattern, I examine how the requirement of paying a fixed rent before the next crop cycle influences black tenant farmers in response to wet Mays in table eight.

In tables six and seven, I find the boll weevil's arrival reduces the probability of off farm wage work for black and white landowning farmers. The negative coefficient implies as household incomes decline, so does the likelihood of working off the family farm. The pattern does not fit with the coping mechanism hypothesis, but does fit with traditional Becker models of labor supply (i.e., a positive correlation between wages and labor supply). In table nine, I examine how gender roles effect the negative relationship for land owners in tables six and seven.

I consistently find income fluctuations are independent of the choice of taking nonfarm wage work off the family farm. Unlike farm wage work, disaggregating the sample, by race or farm type, or using income stocks with different levels of persistence does not change the insignificant results. The rural South's lack of nonfarm wage work in general makes switching from farm to nonfarm difficult especially during a negative shock in the farm sector. To find employment opportunities outside of the farm sector, households would likely need to migrate to urban areas. The intuition fits with the observed pattern of black migration out of the rural South into urban areas in Northern states—the Great Migration. By focusing on the rural South, my sample loses households that move to urban areas. The combination of migration out of rural areas and the challenge of finding nonfarm work for households who stay likely explains the insignificant results for nonfarm wage work. In table ten, I discuss the exception to the rule—black landowning farmers and the arrival of the boll weevil.

Extensions

In table eight, I examine if rental payments cause blacks to work as wage workers in response to declines in household incomes. I break the sample into divisions with high and low shares of cash tenant farmers and estimate a Reduced Form model by subsamples—high and low share of cash tenants.[8] The first row shows the estimates for black farming households in general. The coefficient on the dummy variable for wet Mays is positive and significant at the one percentage in divisions with a high share of cash tenants. The results match the results for black farmers in table six. I find the coefficient is insignificant for regions with a low share of cash tenants. The second row of table eight shows the coefficients on the dummy variable for wet Mays for black tenant and landowning farmers in division with high shares of cash tenants. The results are not as strong as the first row, but the pattern matches our expectations. The probability of farm wage work is correlated with income changes for tenant farmers and not

[8] Cutting the sample into high and low subsample shrinks the sample enough that the weather instruments are no longer valid. Therefore, I do not provide the 2SLS estimates.

landowners. The reduction in significance likely relates to the estimates being based on only fifty divisions.[9]

In the main results, I observe following the arrival of the boll weevil the odds of farm wage decrease for black and white landowning farm households. In table nine, I split households along gender lines. Despite observing a negative correlation for whites and blacks, I find the spouse who responds varies by race. From row one, the reader sees the white husband's farm wage work declines with the boll weevil's arrival. In the case of black households, the wife's labor supply declines and not the husband's. Observing white husbands being the margin responding to income fluctuations fits the qualitative evidence of the period. White married women rarely work outside of the household. While less than their husbands, black wives frequently participated in the wage labor market—farm and nonfarm. In table ten, we observe black wives working outside of the farm sector were also hurt by the boll weevil's arrival.

In table ten, I investigate the persistence of the shock caused by boll weevil's arrival on nonfarm wage work by male and female household heads from black landowning farm households. The first row of the table shows the estimates based on a dummy variable equal to zero before the arrival of the boll weevil and one in the arrival year and every year afterwards (i.e. the same variable used throughout the rest of the paper). We observe the coefficient on the dummy variable is negative and weakly significant for both male and female household heads. Following the boll weevil's arrival, both male and female household heads from black landowning farm households are less likely to do nonfarm wage work. However, the dummy

[9] In a separate extension, I repeat a similar analysis of divisions with high and low cotton intensities. Cotton intensity is the ratio of cotton acres and total farm acres. I find division with high cotton intensities show a stronger correlation between the probability of black farm wage work and cotton yields than divisions with low cotton intensity. The results support the assertion that changes in cotton yields drive my results and not some other mechanism.

variable says the impact is same in the year the boll weevil arrivals as ten years afterwards. In the second row, I estimate three separate equations with dummy variable equal to one if the current year is within three years of boll weevil's arrival, within five years, and within ten years. In columns five and six, the dummy variable is negative and significant for male household heads within three and five years of the boll weevil's arrival. In columns seven and eight, the dummy variable is negative and significant for female household heads within five and ten years. Therefore, the negative impact on nonfarm wage participation caused by the arrival of the boll weevil hits black male household heads earlier than their spouses.

Conclusion

Previous research into the coping mechanisms used by rural farming households in response to negative income shocks frequently finds households increasing 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 Economy History literature by examining if farmers in the U.S. Cotton South during the early twentieth used wage work in a similar fashion.

My results show the decision to take wage work off the family farm is complex and not a function of a single household or shock characteristic. Black tenant farmers' increase in farm wage work following transitory weather based income shocks fits the hypothesis of wage work as a coping mechanism—a negative correlation between household incomes and probability of wage work. However, I only observe the pattern with black tenant farmers after transitory shocks. Following the boll weevil's persistent negative income shock, I observe household responses fitting traditional Becker labor supply theories—a positive correlation between wage work and wages. I find the probability of farm wage work declines for black and white landowning farmers.

My extensions demonstrate the important role of norms and institutions play in shaping households' responses to income shocks. The response of black tenants is stronger in areas with higher shares of cash tenants. The need to pay a fixed payment in the next period fits with the incentive to work off the family farm to make up for a down income year. Failing to make the payment ensures the farmer moves down the agricultural ladder and potentially reverses years of hard work. Unlike white wives, the higher labor force participation rate of black wives allows their labor to be a margin of adjustment. When black landowning households respond to the boll weevil's arrival, the wives' labor adjusts not the husbands'. The pattern is a reversal of white households. The rural South's lack of employment outside of the farming sector influences households' choice to seek off farm wage work. Across household types, I consistently find no correlation between nonfarm wage work and income shocks. The sole exception is black landowning farmers and the arrival of boll weevil—a negative significant correlation. The current paper's results show the dramatic impact of the boll weevil's arrival in and outside of the agricultural sector. However, the results raise a question of why the lack of a correlation between tenant farm off farm wage and boll weevil. My results combined with previous research on the Great Migration suggest black tenant farmers are responding, but along a different margin—migration. If households leave a county due to the lack of nonfarm work, my analysis will not capture their movement. However, the inability to measure migration generates future research opportunities based on linked Census datasets that allow researchers to track households over time and location.

The results raise the question of what are the consequences of household responses to income shocks? The evidence suggests the responses lead to worse outcomes for the households. Lombardi (2017) shows the same weather fluctuations I examine in the current paper correlate with black school attendance rates. Negative income shocks caused by weather fluctuations lead to school attendance rates to decrease and increases the probability of couples doing wage work off the family farm in black farming households. Therefore, the coping mechanism correlates with lower levels of schooling obtainment. Raper (1936) provides a potential mechanism for the correlation between schooling and wage work in black farming households. Following a negative shock, black wives were expected to find work off the family farm to make up for the drop in household earnings. To cover for the wife's absence, the children were expected to cover more of the household duties—potentially at the expense of schooling (Raper 1936).

References

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

Ager, Philipp, Markus Brueckner, and Benedikt Herz. "The Boll Weevil Plague and its Effect on the Southern Agricultural Sector, 1889–1929." *Explorations in Economic History* 65 (2017): 94-105.

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." *The Journal of Economic History* 75.04 (2015): 1128-1160.

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

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.

Bloome, Deirdre, James Feigenbaum, and Christopher Muller. "Tenancy, Marriage, and the Boll Weevil Infestation, 1892–1930." *Demography* 54, no. 3 (2017): 1029-1049.

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.

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).

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

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.

Goldin, Claudia. *The Gender Gap: An Economic History of American Women*. New York: Cambridge University Press, 1990.

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

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

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.

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.

Lange, Fabian, Alan L. Olmstead, and Paul W. Rhode. "The impact of the boll weevil, 1892–1932." *The Journal of Economic History* 69.3 (2009): 685-718.

Lombardi, Paul. “Examining the Effect of Income Shocks on the Schooling Choices of Credit Constrained Households.” 2017

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.

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

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

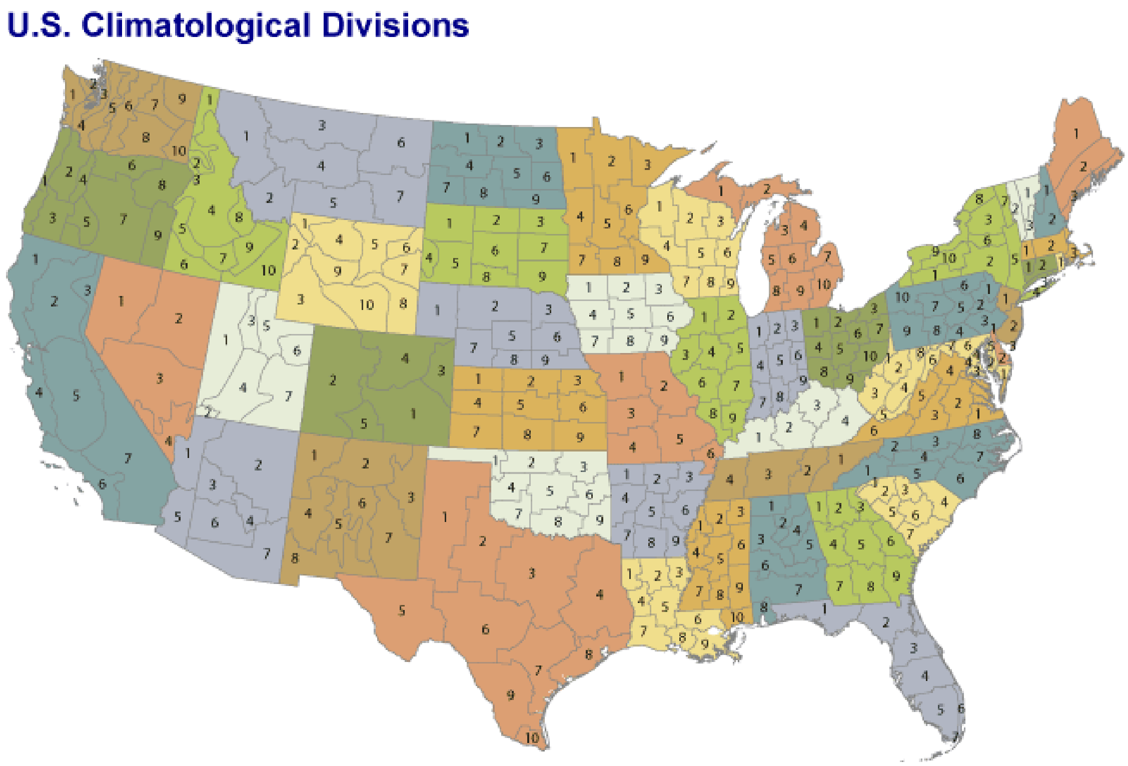
Raper, Arthur Franklin. *Preface to Peasantry: A Tale of Two Black Belt Counties*. University of South Carolina Press, 1936.

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.

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.

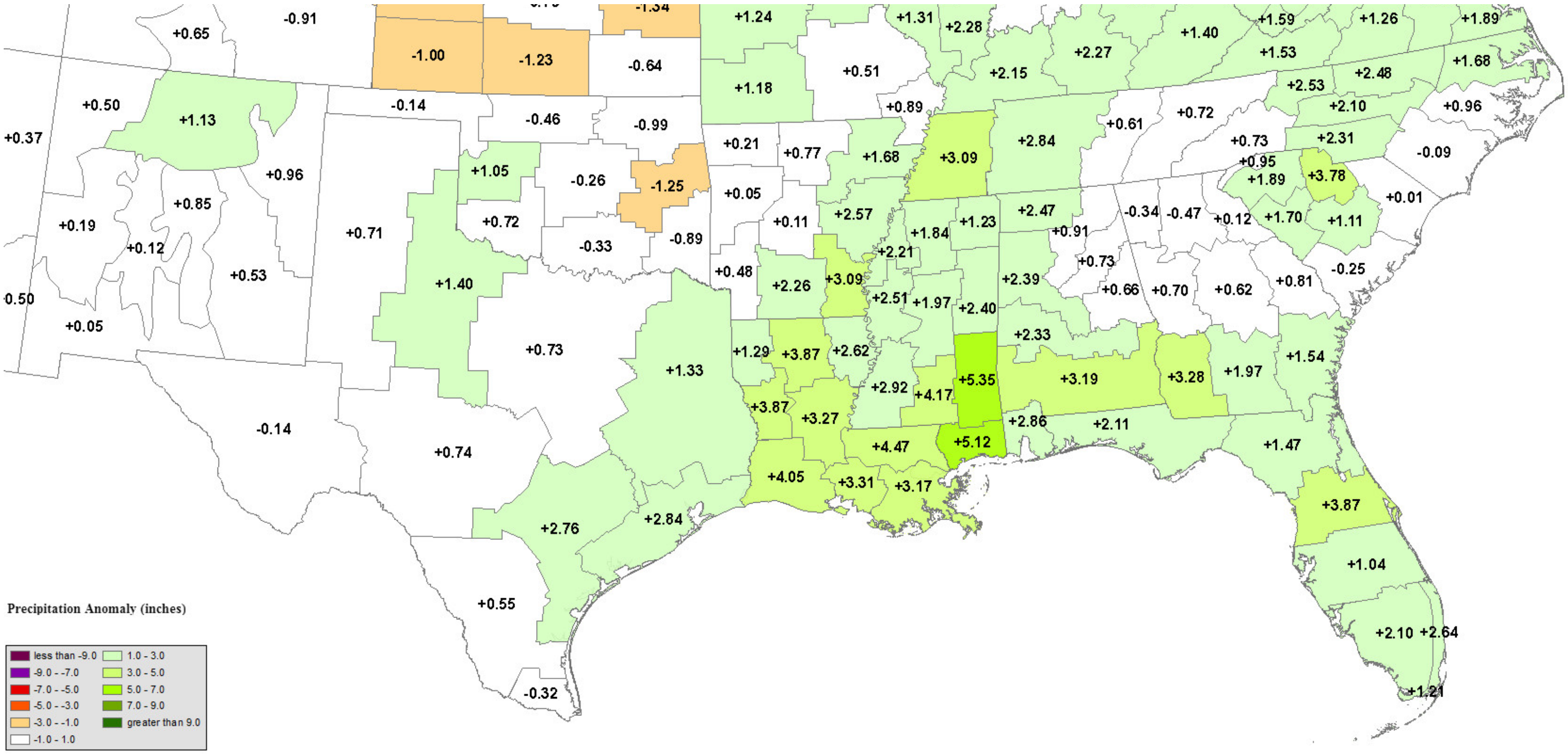
Wright, Gavin. “Old South, new South: Revolutions in the Southern Economy Since the Civil War.” Basic Books (AZ), 1986.

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: Probability of Wage Work Regressed on Cotton Yield Using OLS

	Black Farmers		*White Farmers*	
	(1)	(2)	(3)	(4)
Cotton Yield	-0.025	-0.023	0.016	0.016
	(0.028)	(0.031)	(0.019)	(0.020)
Controls:				
Household	Yes	Yes	Yes	Yes
County	No	Yes	No	Yes

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 2: Probability of Farm Wage Work Regressed on Cotton Yield Using OLS

	Black Farmers		*White Farmers*	
	(1)	(2)	(3)	(4)
Cotton Yield	-0.009	-0.001	0.010	0.006
	(0.022)	(0.023)	(0.008)	(0.009)
Controls:				
Household	Yes	Yes	Yes	Yes
County	No	Yes	No	Yes

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 3: F-Statistics from the Two First Stages: Weather and Boll Weevil Instruments

	Weather Instruments		*Boll Weevil Dummy Variable*	
	(1)	(2)	(3)	(4)
Cotton Yield	28.63	25.75	102.22	34.66
Controls:				
Household	Yes	Yes	Yes	Yes
Division (County)	No	Yes	No	Yes

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 division (county) fixed effects.

Table 4: Probability of Farm Wage Work Regressed on Cotton Yield Using 2SLS

	Weather Variables			
	Black Farmers		*White Farmers*	
	(1)	(2)	(3)	(4)
Predicted 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
	Boll Weevil Dummy Variable			
	Black Farmers		*White Farmers*	
	(5)	(6)	(7)	(8)
Predicted Cotton Yield	0.081	0.141	0.139**	0.122
	(0.077)	(0.124)	(0.069)	(0.075)
Controls:				
Household	Yes	Yes	Yes	Yes
County	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 (county) level. All regressions include year and division (county) fixed effects.

Table 5: Probability of Farm Wage Work Regressed on Cotton Yield Predictors

	Black Farmers		*White Farmers*	
	(1)	(2)	(1)	(2)
Wet	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
	Black Farmers		*White Farmers*	
	(1)	(2)	(1)	(2)
Boll Weevil	-0.015	-0.017*	-.007*	-0.010*
	(0.010)	(0.010)	(0.004)	(0.005)
Controls:				
Household	Yes	Yes	Yes	Yes
County	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 (county) level. All regressions include year and division (county) fixed effects.

Table 6: Probability of Farm Black Wage Work Regressed on Cotton Yield Predictors

	Black Tenant Farmers		*Black Land-Owning Farmers*	
	(1)	(2)	(1)	(2)
Wet	0.255***	0.204***	0.097	0.151
	(0.079)	(0.063)	(0.110)	(0.100)
Controls:				
Household	Yes	Yes	Yes	Yes
Division	No	Yes	No	Yes
	Black Tenant Farmers		*Black Land-Owning Farmers*	
	(1)	(2)	(1)	(2)
Boll Weevil	-0.005	-0.005	-.049**	-0.060**
	(0.011)	(0.011)	(0.022)	(0.024)
Controls:				
Household	Yes	Yes	Yes	Yes
County	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 (county) level. All regressions include year and division (county) fixed effects.

Table 7: Probability of Farm White Wage Work Regressed on Cotton Yield Predictors

	White Tenant Farmers		*White Land-Owning Farmers*	
	(1)	(2)	(1)	(2)
Wet	0.086	0.148	0.003	0.004
	(0.144)	(0.115)	(0.003)	(0.003)
Controls:				
Household	Yes	Yes	Yes	Yes
Division	No	Yes	No	Yes
	White Tenant Farmers		*White Land-Owning Farmers*	
	(1)	(2)	(1)	(2)
Boll Weevil	-0.004	-0.003	-0.014***	-0.011***
	(0.003)	(0.003)	(0.004)	(0.004)
Controls:				
Household	Yes	Yes	Yes	Yes
County	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 (county) level. All regressions include year and division (county) fixed effects.

Table 8: Probability of Black Farm Wage Work Regressed on Wet Mays Using Reduce Form

	High Share of Cash Tenants		***Low Share of Cash Tenants***	
	(1)	(2)	(1)	(2)
Wet	0.087***	0.100***	0.008	.149
	(0.032)	(0.031)	(0.199)	(0.176)
Controls:				
Household	Yes	Yes	Yes	Yes
Division	No	Yes	No	Yes
	High Share of Cash Tenant Farmers			
	Black Tenant Farmers		***Black Landowning Farmers***	
	(1)	(2)	(1)	(2)
Wet	0.086*	0.078*	-0.039	0.062
	(0.051)	(0.041)	(0.085)	(0.072)
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 9: Probability of Farm Wage Work by Gender Regressed on Boll Weevil

	White Land-Owning Farmers			
	Male Household Head		*Female Household Head*	
	(1)	(2)	(3)	(4)
Boll Weevil	-0.012***	-0.010**	-0.002	-0.001
	(0.004)	(0.004)	(0.002)	(0.002)
Controls:				
Household	Yes	Yes	Yes	Yes
County	No	Yes	No	Yes
	Black Land-Owning Farmers			
	Male Household Head		*Female Household Head*	
	(5)	(6)	(7)	(8)
Boll Weevil	-0.011	-0.016	-0.036**	-.042**
	(0.019)	(0.019)	(0.016)	(0.018)
Controls:				
Household	Yes	Yes	Yes	Yes
County	No	Yes	No	Yes

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 10: Probability of Nonfarm Wage Work by Gender Regressed on Boll Weevil

	Black Landowning Farmers			
	Male Household Head		*Female Household Head*	
	(1)	(2)	(3)	(4)
Boll Weevil	-0.018*	-0.012	-0.028*	-0.026*
	(0.010)	(0.011)	(0.015)	(0.015)
Controls:				
Household	Yes	Yes	Yes	Yes
County	No	Yes	No	Yes
	Black Landowning Farmers			
	Male Household Head		*Female Household Head*	
Boll Weevil Arrival	(5)	(6)	(7)	(8)
Plus 3 Years	-0.024**	-0.024**	-0.010	-0.015
	(0.009)	(0.009)	(0.013)	(0.013)
Plus 5 Years	-0.022**	-0.019**	-0.020*	-0.022*
	(0.009)	(0.009)	(0.012)	(0.012)
Plus 10 Years	-0.002	0.004	-0.020**	-.022**
	(0.006)	(0.007)	(0.009)	(0.010)
Controls:				
Household	Yes	Yes	Yes	Yes
County	No	Yes	No	Yes

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.