**The Dust Bowl and Occupational Persistence in Agriculture**

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# The Dust Bowl and Occupational Persistence in Agriculture

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**Abstract**

The Dust Bowl of the 1930s in the United States refers to a period of severe dust storms caused by population-environment interactions. This paper investigates if this unforeseen adverse shock affected occupational persistence—whether children follow in their parents' footsteps by choosing the same occupation—when it comes to agriculture. Results show that those originally living in high-erosion counties decreased the occupational persistence rate by 2% after the Dust Bowl compared to those originally in low-erosion counties. Furthermore, those who moved out were less likely to work on-farm. This study identifies a part of the structural transformation in the mid-20$^{th}$ century United States, plausibly caused by the Dust Bowl.

**Keywords**: Dust Bowl, occupational persistence, structural transformation

**JEL Codes**: TBD

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# 1 Introduction

The persistence of occupation across generations is an extensively discussed topic in sociology. Nevertheless, despite the fact that farmers have the highest occupational persistence rate among all occupations (Blau and Duncan, 1967), relatively little of the literature has focused on agriculture. Based on the Economic Research Service (ERS) of the United States Department of Agriculture (USDA), farming is still primarily a family business in the United States. Family farms account for 98% of all farms and contribute to about 88% of agricultural production (USDA, 2022). The number of U.S. farms, however, has fallen sharply from a peak of 6.8 million in the mid-1930s to approximately 2.2 million in 2021 (USDA, 2022).

The rapidly decreasing number of farms in the US reflects the availability of increasing non-farm employment opportunities. Besides economic factors, climate change also plays an important role in shaping occupational choices in agriculture for the second generation from farm households. This is because the operation of farming is highly dependent on the environment, and an adverse disaster shock adds an element of uncertainty to keep working on farms.

This study investigates the impacts of the Dust Bowl in the mid-20$^{th}$ century on occupational persistence choice in agriculture. The Dust Bowl refers to the period of severe dust storms that occurred during the 1930s in the southern plains region of the US, known as the Great Plains areas.[1] During this period, the interactions of unusually high temperatures, severe drought, federal land policies, and a lack of soil conservation agricultural practices destroyed agricultural productivity. Many farm households were forced to abandon their (owned or rented) land and seek other employment opportunities.

I use 1920, 1930, and 1940 US decennial full count census at the individual level to identify occupational persistence choice. I limit the sample to the Great Plains counties

[1]The Great Plains refers to 12 states, including Colorado, Iowa, Kansas, Minnesota, Montana, Nebraska, New Mexico, North Dakota, Oklahoma, South Dakota, Texas, and Wyoming. Combined, these states represent approximately 40% of all contiguous US land area (Gutmann, 2018).

with much more similar agro-ecological and socio-cultural backgrounds. To link the two generations, I take advantage of the family inter-relationship variables constructed by the Integrated Public Use Microdata Series (IPUMS). These variables help link the child-father/child-mother data living in the same household during the survey year (Ruggles et al., 2022).

Given that the Dust Bowl only severely affected a specific population, I view the level of soil erosion due to the Dust Bowl as a plausibly exogenous treatment. I define those who lived in the high-erosion Great Plains counties in 1930 as being "treated," i.e., severely affected by the Dust Bowl.[2] More specifically, I investigate the plausible effect of facing high soil erosion during the Dust Bowl on the probability of working as a farmer for children of farmers. I apply the Difference-in-Differences (DiD) model based on the assumption that the occupational persistence rates for those in high-erosion counties would be similar to the others in low-erosion counties in which the Dust Bowl had not occurred.

The results show that children of farmers originally living in high-erosion counties were 2% less likely to work as a farmer after the Dust Bowl than those in low-erosion counties. Even though living in high-erosion counties with parents as farmers decreased the probability of being a self-employed farmer by 12%, it increased the probability of being a paid farm worker by 13%. The findings indicate that some children still persist in agriculture, choosing relatively familiar and lower-risk occupations—paid farm workers—after the Dust Bowl. Using the three main sectors as outcomes, the results show that children of farmers were significantly more likely to leave the primary sector by 2% and work in the secondary and tertiary sectors by 9% and 4%, respectively.

I further investigate the heterogeneous effects of the Dust Bowl by sex, birth order, race, and parents' self-employed status. The results show that among the firstborn children, there is no significant difference in the probability of working as a farmer between high- and low-erosion counties after the Dust Bowl. Among the non-firstborn children,

[2]The definition of high-erosion Great Plains counties refers to counties experienced more than 75% of topsoil loss during the Dust Bowl in the 1930s (Hornbeck, 2012).

however, those who originally lived in high-erosion counties were 2% less likely to work as farmers than in low-erosion counties after the Dust Bowl. The results also reveal the role of parental self-employment status in the occupational choices of children. Among children with parents as self-employed farmers, those originally living in high-erosion counties were more likely to work in the secondary or tertiary sector by 9% and 3%, respectively, than those in low-erosion counties after the Dust Bowl.

During the Dust Bowl, it is documented that many people left their homes and migrated to other areas in the US (Gutmann, 2018; Parton, Gutmann and Ojima, 2007). The migration decisions due to the Dust Bowl may have had an impact on occupational persistence choices, making it an important mediator to take into consideration. Therefore, I conduct a mediation analysis proposed by Acharya, Blackwell and Sen (2016). I explore the average total effects (ATE) of the Dust Bowl and average controlled direct effect (ACDE) with the control of migration to other non-Dust Bowl states. In sum, this paper shows evidence that the Dust Bowl played a role in accelerating structural transformation and may well have paved the way for the development of the non-agricultural sectors in the $20^{th}$ century.

The literature in this field has mainly focused on farm business succession. The research mainly discusses the inheritance of tangible assets (e.g., farmland) (Bleakley and Ferrie, 2016). Nevertheless, inheriting a farm does not necessarily mean the farmers' offspring keep working in the agricultural sector. Farm heirs could choose to be landlords rather than owner-operator. Absentee farm landlords raise some concerns, such as the farming knowledge succession, lack of participation in land management, and reduced use of soil conservation practices (Fairchild et al., 2022; Dillman and Carlson, 1982; Petrzelka, 2014).

In addition, previous research has documented occupational persistence choices for males. They show that farmers' sons are five times more likely to follow in their fathers' footsteps than those whose fathers are non-farm entrepreneurs (Blau and Duncan,

1967; Laband and Lentz, 1983). They do not have much to say about mother-daughter or father-daughter inheritance. Given the improvement of the linking method constructed by IPUMS, the full count census data could avoid the sex-biased issue in the linked sample even though women usually change their last names after marriage (Ruggles et al., 2022). Therefore, I aim to comprehensively explore occupational persistence in agriculture by sex and birth order.

It is well documented that parents impact their children's labor market outcomes through financial and human capital transformation (Solon, 2018; Ulvestad and Markussen, 2022). Colombier and Masclet (2008) show a positive inter-generational correlation in self-employment, but the results are not distinguished by occupations. To the best of my knowledge, there is no empirical plausible causal inference research on the inter-generational impact on occupational choices, especially in agriculture.

Even though there is significant literature that focuses on the Dust Bowl, most of them discuss the environmental outcomes (Howlader, 2020), health outcomes (Noghanibehambari and Fletcher, 2022; Cutler, Miller and Norton, 2007), migration (Hornbeck, 2020; Gutmann, 2018; Parton, Gutmann and Ojima, 2007; Long and Siu, 2018), and farmland productivity (Hornbeck, 2012). There is a lack of discussion on the causal inference regarding the occupational choices of the next generation in agriculture. Therefore, I would like to close the gap in the literature by providing more insights into the occupational choices of children of farmers after a natural disaster.

The paper proceeds as follows. Section 2 provides the historical background of the Dust Bowl in the United States. Section 3 describes the data used in this paper. Section 4 illustrates the DiD model and identification strategy. Section 5 shows the empirical results and potential mechanisms for occupational choices. Section 6 concludes and provides policy implications.

## 2 Historical Background

Several contributing factors led to the occurrence of the Dust Bowl, including unusual local climate changes. The U.S. experienced substantially reduced rates of precipitation and high temperatures that caused severe droughts (Schubert et al., 2004). Aggravating the effects of these droughts, human activities worsened the situation. In the mid-19th century, Congress encouraged settlement through the passage of the Homestead Act of 1862. This legislation allowed people to claim 160 acres of public land for free if they built a house or performed agricultural work there for more than five years (Gates, 1963; Johnson, Davidson and Bierman, 1953). Given the boom in available agricultural opportunities and improved farming practices, the surplus in yield led to dramatically reduced crop prices. During the late 1920s, corn prices fell from $1.30 per bushel to $0.47, which decreased by more than 60% (Hurt, 1981). The drop in crop prices led to more intensive land use in agricultural production. The dramatic expansion of farming activities and a lack of soil conservation practices contributed to extensive topsoil loss (White, 1991).

The Dust Bowl refers to the period of severe dust storms. The Dust Bowl period began in 1931, which was the first of four major waves of drought. The other three drought episodes occurred in 1934, in 1936, and from 1939 to 1940. The most severe dust storm occurred on April 14, 1935, and blew off an estimated three million tons of topsoil. After 1941, most of the counties in the US were back to receiving normal rainfalls and thus relieved of the droughts (Warrick, 1980; Hurt, 1981).

The environmental catastrophes endured during the Dust Bowl period destroyed agricultural production and negatively affected farm households living in the Great Plains. Federal emergency relief funding helped approximately 21% of farm households living in the Great Plains (Link, 1937). Many families reportedly abandoned their farms during this period and moved elsewhere. The current literature on this topic has documented that many of these families moved to California to search for jobs on local farms (Gutmann, 2018; Parton, Gutmann and Ojima, 2007). Alternatively, this internal migration

might have pulled farmers' offspring out of the agricultural sector and sped up occupational structural changes.

# 3 Data and Summary Statistics

I use 1920, 1930, and 1940 U.S. full count decennial census data from IPUMS (Ruggles et al., 2022). Decennial census data is conducted by the U.S. Census Bureau to determine the number of representatives to be assigned to each of the states. The census data includes a count of the whole population of the U.S. during the time period surveyed; therefore, this should be a representative sample.

To track trends in the occupational choice of individuals over the years, I linked the three census data using the linkage rules established by IPUMS. To retrieve information regarding parents' occupations, I take advantage of the family inter-relationship variables constructed by IPUMS. These variables help link children's data to their parents' data who lived in the same household (Ruggles et al., 2022). To evaluate the impacts of the Dust Bowl on occupational persistence choice, I restrict the sample aged 18 to 64 and drop the sample without any parent's information before 1930. The full sample includes children with and without parents as farmers for robustness checks.

To ensure that the treatment and comparison groups have similar agroecological and socioeconomic backgrounds, I limit the sample to individuals who lived in the Great Plains counties in 1930 (Hornbeck, 2012). The Great Plains counties are defined by the 1924 USDA Atlas of Agriculture, which identified a similar and contiguous set of ecological counties (Gutmann, 2018; Haines, 2005). I use the residency of 1930 to proxy for whether individuals were severely affected by the Dust Bowl during the 1930s.

Data for topsoil erosion damage after the Dust Bowl is obtained from Hornbeck (2012), which uses the data from the Soil Conservation Service to construct the county-level share of erosion. Hornbeck (2012) constructs the fraction of high-, medium-, and low-erosion

variables based on the cumulative topsoil erosion level.[3] I use the high erosion fraction variable to identify the "treatment" in this study, i.e., a proxy of being severely affected by the Dust Bowl. I define the treatment group as individuals who lived in the Great Plains county, where they experienced over 75 percent of topsoil loss. Those living in other Great Plains counties in 1930 are defined as the comparison group. Figure I displays the Great Plains counties by the treatment status. The red areas are high-erosion counties (i.e., treatment group), and the orange areas are low-erosion counties (i.e., comparison group).

To investigate occupational persistence in agriculture, the main outcome of interest is the probability of individuals working as a farmer. Based on the 1950 Census Bureau occupational classification system, the definition of a farmer in this research includes those who identified their occupation as one of the following categories: (1) Farmers (owners and tenants); (2) Farm managers; (3) Farm foremen; (4) Farm laborers, wage workers; (5) Farm laborers, unpaid family workers; (6) Farm service laborers, self-employed. For the robustness checks, I follow the 1950 Census Bureau industrial classification system to classify three main sectors: (1) Primary sector; (2) Secondary sector; and (3) Tertiary sector. Industry classification can help provide evidence for structural transformation from agriculture to non-agriculture.

For the control variables, I include time-varying variables, including marital status, number of siblings, and number of children. Information that remains constant over the years, such as age, sex, and race, is controlled by the individual fixed effect. For the migration variables, the census survey did not include migration questions before the Dust Bowl. To account for migration, I use the residency of individuals in each census year to identify whether they stayed or moved to different counties and states. By doing so, the migration information is only available for 1930 and 1940.

Table I shows the variable descriptions and descriptive statistics for the full sample,

[3] Hornbeck (2012) uses 75 and 25 percent of the topsoil loss as cutoffs for the three measures. High erosion is defined as more than 75 percent of topsoil loss. Medium erosion is defined as 25 to 75 percent of topsoil loss. Low erosion is defined as less than 25 percent topsoil loss.

which combines the sample of individuals living in high-erosion Great Plains (GP) counties and the sample of those living in low-erosion GP counties. For the outcome variables, the average individual-year shows that 53% of people worked as a farmer. About 19% of people had at least one parent as a farmer before 1930. Table II is the balance table for the full sample. It reports the outcomes of interest and the social characteristics before the Dust Bowl. The proportions of people working as farmers are 59% for the treatment group, which is significantly higher than 55% for the comparison group. Before the Dust Bowl, the proportion of self-employed farmers is higher in high-erosion counties than in low-erosion counties, while the proportion of paid farm workers is lower.

# 4 Empirical Framework

## 4.1 Estimation Strategy

I estimate the plausible impact of the Dust Bowl on occupational persistence choice in agriculture using a linear probability with DiD model. I compare those who lived in high-erosion counties with those who lived in low-erosion counties before the Dust Bowl. The baseline model can be written as:

$$y_{ict} = \gamma D_{ic} \times T_{t=1940} + \beta_1 X_{it} + \delta_i + \tau_t + \epsilon_{1ict}, \tag{1}$$

where $y_{ict}$ is a binary outcome of occupational choice for individual $i$ in county $c$ in year $t$.[4] $D_{ic}$ is a dummy variable equal to one for individual $i$ originally living in high-erosion county $c$. $T_{t=1940}$ is a dummy variable equal to one for after the Dust Bowl period, which is 1940 in the sample. The interaction term $D_{ic}$ and $T_{t=1940}$ indicates individuals living in most severe eroded regions after the Dust Bowl. $X_{it}$ is a vector of socioeconomic variables for individuals including marital status, number of children ,and number of siblings. $\delta_i$

[4] In the results section, I multiply the binary outcome variable by 100%.

and $\tau_t$ are individual and year fixed effects, respectively. The inclusion of the individual fixed effects helps deal with the endogeneity caused by unobservable and time-invariant heterogeneity across individuals. Similarly, the inclusion of the year fixed effects helps reduce endogeneity due to unobservable and individual-invariant heterogeneity across years. $\epsilon_{1ict}$ is the error term with a mean equaling zero.

The goal of this paper is to estimate $\gamma$ which captures the plausible effects of the Dust Bowl on the occupational choice in agriculture. More specifically, estimating $\gamma$ from equation (1) represents the effects of facing high-erosion during the Dust Bowl on the probability of occupational choice compared to those facing low-erosion. Therefore, the relevant statistical test consists of the null hypothesis $H_0$: $\gamma = 0$ versus the alternative hypothesis $H_A$: $\gamma \neq 0$. Rejecting the null hypothesis and showing that $\hat{\gamma}$ is significantly negative support the hypothesis that the Dust Bowl plausibly decreased the probability of occupational persistence choice for children of farmers.

Based on Abadie et al. (2017), the standard errors should be clustered at the treatment level. The treatment and comparison groups are defined at the county level. To account for potential internal migration during the Dust Bowl, I cluster standard errors at the county level based on residency in 1930, i.e., before the Dust Bowl. This is because individuals may not have stayed in the same county during my research period. Clustering the standard errors at the county level helps address the presence of unobserved shocks at this level that may be correlated with all residents' occupational choices in agriculture within the same county.

## 4.2 Identification Strategy

The DiD model depends on the parallel trends assumption, which assumes the average outcomes for treatment and comparison groups would have common paths over time in the absence of treatment. Take the outcome of working as a farmer for example. The parallel trend assumes that the probability of working as a farmer for those living in high-

erosion counties would be similar to those living in low-erosion counties if the Dust Bowl had not occurred. To ensure the validity of the parallel trends assumption, I restrict the sample to the Great Plains areas in the United States, as suggested by previous research (Hornbeck, 2012; Noghanibehambari and Fletcher, 2022; Haines, 2005).

The major concern of this research design is that the erosion level during the Dust Bowl period is not randomly assigned. In other words, high-erosion counties may differ from low-erosion counties due to unobservable confounders such as farming styles or the number of farms. These confounders may worsen the soil erosion during the Dust Bowl as it was caused by unusual weather factors in combination with inappropriate agricultural practices. Although the individual and year fixed effects address the time-invariant factors and unobservable individual-level heterogeneity, the coefficient can still be biased due to confounders that vary across years and individuals.

I apply two ways to show the evidence for the parallel trend assumption. First, I rewrite the equation (1) by substituting the post-Dust Bowl dummy variable $T_{t=1940}$ to the time dummy variables, $T_{t=1920}$ and $T_{t=1940}$, and interacting them with $D$, respectively. The equation can be written as:

$$y_{ict} = \gamma_{1920} D_{ic} \times T_{t=1920} + \gamma_{1940} D_{ic} \times T_{t=1940} + \beta_2 X_{it} + \delta_i + \tau_t + \epsilon_{2ict}, \tag{2}$$

where $y_{ict}$ is the occupational choice for individual $i$ in county $c$ in year $t$. The dummy variables $T_{t=1920}$ and $T_{t=1940}$ are equal to one for pre- and post-Dust Bowl period, respectively. The interaction term $D_{ic} \times T_{t=1920}$ and $D_{ic} \times T_{t=1940}$ indicate individual $i$ living in high-erosion counties $c$ before and after the Dust Bowl, with residency in 1930 as a proxy for treatment and the 1930 sample as the baseline group. $X_{it}$ is a vector for the same socio-economic variables. $\delta_i$ and $\tau_t$ are individual and year fixed effects, respectively.

Although my sample only includes data from the 1920 and 1930 census waves prior to the Dust Bowl, estimating equation (2) allows for the heterogeneous effects varying by time and testifies to the trend before the Dust Bowl. The null hypothesis is $H_0 : \gamma_{1920} = 0$,

which implies that the parallel trend assumption could be valid. The alternative hypothesis is $H_A : \gamma_{1920} \neq 0$. Failing to reject the null hypothesis implies that there is a lack of evidence showing a difference between those in high- and low-erosion counties between 1920 and 1930. In other words, the consistency in the difference between pre-Dust Bowl offers evidence that the parallel trend assumption holds.

Because the census survey does not include agricultural information such as acres or values of farmland, I extract the agricultural census data at the county level collected by Hornbeck (2012) and reproduce the equation as follows:

$$y_{3cst} = \sum_{t=1910}^{1950} \eta_t (H_c \times T_t) + \beta_3 X_{3c} + \alpha_{st} + \epsilon_{3cst} \tag{3}$$

where $y_{3cst}$ is the county-level outcomes, including log value of farmland and buildings, number of farms, population, and tenant farmers in county $c$, state $s$, and year $t$. $H_c$ is a dummy variable equaling one if the county $c$ is defined as a high-erosion county during the Dust Bowl. $T_t$ is time dummy variable for year $t$, which indicate the year from 1910 to 1950. $X_{3c}$ is the vector of pre-1930s county characteristics. $\alpha_{st}$ is a state-by-year fixed effect. $\epsilon_{3cst}$ is an error term with zero mean.

$\eta_t$ is the coefficient of interest, which captures the heterogeneous effects of the Dust Bowl by time on the county-level outcomes. The statistical test is based on the null hypothesis $H_0$: $\eta_t = 0$ and the alternative hypothesis $H_A$: $\eta_t \neq 0$. This test examines whether the coefficients of the interaction variables in equation (3) are statistically different from zero, indicating heterogeneous effects of the Dust Bowl over time on high-erosion counties compared to low-erosion counties. Failing to reject the null hypothesis for the pre-Dust Bowl periods suggests a lack of evidence showing a difference in county-level characteristics between high- and low-erosion counties if the Dust Bowl had not occurred. It provides evidence for the parallel trend assumption used in DiD model.

Other threats to the identification strategy come from data limitations, leading to potential measurement errors. For the treatment variable, I use the residency of 1930 to

define the treatment group if the individual lived in high-erosion Great Plains counties. Since the first wave of the Dust Bowl happened in 1931, it is likely that individuals moved before the Dust Bowl and thus were misclassified in the treatment group. This kind of measurement error in the treatment variable can't be solved due to data limitation, which could make the estimated results underestimated.

For the outcome variable, approximately 90% of the female census samples missed the occupational information. It is possible that women labor participation rates were low before 1940, but it is also likely that there was missing occupational information, especially for unpaid family workers. For the parents' occupation, measurement errors are possible to come in. Based on family variables constructed by IPUMS, I use all connected and plausible parents' information. For the robustness check, I will limit the sample to those who have successfully linked to their biological parents and eliminate the concerns of bias from this kind of measurement error.

This study takes into account another concern about biased results that emerges from possible violation of the Stable Unit Treatment Value Assumption (SUTVA). The spillover effect of the Dust Bowl from high-erosion to low-erosion counties can bias the estimated effects with the same sign as the spillovers in the DID specification (Butts, 2021). In other words, the results would be underestimated if the control group is also affected by the severe erosion in their neighboring counties. Because of the loss of the topsoil during the Dust Bowl mainly due to wind erosion (caused by dust storms) and water erosion (caused by occasional heavy rains), it is inevitable that there would be spillovers to nearby counties (Hansen and Libecap, 2004; Hornbeck, 2012). I plan to apply auto-regression to account for the spatial spillovers as robustness checks.

# 5 Results and Discussion

## 5.1 Core Results

### 5.1.1 Occupational choice as a farmer by parents' occupation

Table III presents the results of the estimating equation (1) for the probability of children working as a farmer, with and without individual socio-economic variables. Table III includes DiD estimates for three samples: (i) full sample, (ii) sample with at least one parent as a farmer, and (iii) sample without any parent as a farmer. The results for different samples and specifications reveal a similar pattern: after controlling for individual and year-fixed effects, those who originally lived in the high-erosion counties were significantly less likely to work as a farmer compared to those living in the low-erosion counties.

Table III reports the impacts of the Dust Bowl on occupational choice in agriculture for the full sample in Columns (1) and (2). Column (1) addresses the full sample without the control variables, while column (2) includes the control variables. The results show that originally living in high-erosion counties decreased the probability of working as a farmer by 2.97% without the control variables and by 3.17% with the control variables compared to living in low-erosion counties.

Since the core research question of this paper is to investigate whether children followed in their parents' steps into agriculture, I split the sample by parents' occupations in Table III. Columns (3) and (4) present the estimated treatment effects among the sample with at least one parent working as a farmer. The results show that those who originally lived in high-erosion counties with parents as farmers were significantly less likely to follow their parents' steps in agriculture. The estimated probabilities of being a farmer decrease by 1.89% and 2.03%, respectively, compared with those in low-erosion counties. Columns (5) and (6) of Table III present the estimated treatment effects on a sample without any parent as a farmer. The results show a similar pattern that children originally living in high-erosion counties without parents farmers were less likely to work as

a farmer by 3.50% and 3.43%, respectively, compared with those in low-erosion counties.

In sum, these findings indicate that children were less likely to work as a farmer after the Dust Bowl, regardless of whether they had parents as farmers or not. the Dust Bowl decreased the inter-generational occupational persistence in agriculture. children of farmers were less likely to work on farms after this unforeseen adverse shock.

#### 5.1.2 Farmer's employment types by parents' occupation

To better understand the employment status of farmers, Table IV presents the results of the estimating equation (1) for three outcomes of interest: (i) being a self-employed farmer, (ii) being a paid farm worker, and (iii) being an unpaid family farm worker. From the results in columns (1) to (3) of Table IV, those who lived in high-erosion counties in 1930 with parents as farmers were significantly less likely to work as a self-employed farmer by 12.21% and more likely to work as a paid farm worker by 13.7%, compared with those in low-erosion counties after the Dust Bowl. The probability of working as an unpaid family farm worker decreased by 6.48%, but it was not significantly different between the treatment and comparison groups.

The findings for those without any parents as farmers show a similar pattern. As shown in columns (4) to (6) of Table IV, children facing high erosion during the Dust Bowl and did not have parents as farmers were significantly less likely to work as a self-employed farmer by 4.61% compared to those in low-erosion counties. Nevertheless, the probabilities of working as a paid farm worker and an unpaid family farm worker were not significantly different between the treatment and comparison groups.

#### 5.1.3 Job sectors by parents' occupation

Table V presents the results of the estimating equation (1) for outcomes of three main sectors: (i) the primary sector, (ii) the secondary sector, and (iii) the tertiary sector. Columns (1) to (3) of Table V show that children who faced high erosion and had parents as farmers

were significantly less likely to work in the primary sector by 1.74% and more likely to work in the secondary and tertiary sectors by 9.21% and 3.89%, respectively, compared with those faced low erosion during the Dust Bowl. These results suggest that the Dust Bowl decreased the probability of occupational persistence in agriculture and spurred a structural transformation that led children of farmers to shift to non-agricultural sectors. The results using job sectors are consistent with the findings using occupational choices as a farmer, providing further evidence of the impact of the Dust Bowl on inter-generational occupational choice.

Columns (4) to (6) of Table V report the findings for those without any parents as farmers. The trend is similar to those who have parents as farmers, but the estimated effects of the Dust Bowl only significantly decreased the probability of working in the primary sector. There is no significant difference in increasing the probabilities of working in the secondary and tertiary sectors after the Dust Bowl for children without parents as farmers.

## 5.2 Robustness Checks

### 5.2.1 Evidence for the parallel trends assumption

Table VI presents the heterogeneous effects of the Dust Bowl over time for the sample with parents as farmers. The findings show that there were no significant differences between treatment and comparison groups in terms of their occupational or job industry choices, except for unpaid family farm workers. Children in the treatment group had a significantly higher probability of working as unpaid family farm workers before the Dust Bowl. Overall, the consistency in the difference between 1920 and 1930 provides evidence that the parallel trend assumption is like to be held.

Because the Dust Bowl occurred in the 1930s, this research design is not a staggered timing design. It does not suffer from negative weights issues proposed by the recent

econometrics papers (Goodman-Bacon, 2021; Callaway and Sant'Anna, 2021; Borusyak, Jaravel and Spiess, 2021; Sun and Abraham, 2021; Baker, Larcker and Wang, 2022). The estimated coefficient for high-erosion counties in 1940 reports the plausible effect of the Dust Bowl on occupational choices.

The results are robust to the main results shown in Section 5.1, indicating that children who faced high erosion during the Dust Bowl were less likely to work as farmers by 1.82% or self-employed farmers by 12.87% and more likely to work as paid farm workers by 14.23%. The results are also robust when using sectors as outcomes. Children of farmers originally living in high-erosion counties were significantly less likely to work in the primary sector by 1.48% and significantly shift to the secondary sector by 9.11% after the Dust Bowl.

Figure II illustrates estimated $\eta_t$ from estimating 3 using county-level outcomes. I find a similar pattern as shown in Hornbeck (2012): before the Dust Bowl, there is no significant difference between high- and low-erosion Great Plain counties for the log value of land and buildings per acre (IIa), number of farms per acre (IIb), and population (IIc). This county-level event studies analysis provides another evidence for the parallel trend assumption that the DiD method relies on.

#### 5.2.2 Continuous Treatment for occupational choices

Table A2 reports the continuous treatment effects for the sample with parents as farmers on occupational choices. The sign is robust to the binary treatment effects using the 75% cutoff point to define high- and low-erosion counties. Based on Sun and Shapiro (2022), variation in treatment intensity could lead to heterogeneous effects, which makes the two-way fixed effects estimator biased. De Chaisemartin and d'Haultfoeuille (2022) propose the exposure-adjusted DiD estimator, which corrects the diverging trends due to heterogeneous treatment.

## 5.3 Mechanism and Mediation

### 5.3.1 Heterogeneity by birth order, sex and race

Table VII presents the estimation results for occupational choices as a farmer by birth order. In Panel A of Table A3, no significant differences in the probability of agricultural persistence were found between high- and low-erosion counties among firstborn children. However, firstborn children originally living in high-erosion counties were 12.15% less likely to be self-employed farmers and 13.97% more likely to be paid farm workers. In Panel B of Table A3, non-firstborn children originally living in high-erosion counties were significantly less likely to work as farmers by 2.2% compared to those in low-erosion counties.

Table A3 presents the estimation results for choosing occupations as a farmer by sex. Because the women's labor force participation rate was low in the early $20^{th}$ century (Goldin, 2006), the number of women identified in the labor force was much lower than the number of men from 1920 to 1940. The results in Table A3 show that only male samples were significantly less likely to continue to work on farms and more likely to work in the secondary and tertiary sectors. Table A4 presents the DiD estimation results for choosing occupations as a farmer by race and ethnicity. The results for the sample of White, non-Hispanic show a similar pattern as the main results in Section 5.1, while the observations for the other races and ethnicities drop, and the results are not significant.

### 5.3.2 Heterogeneity by parents' self-employed status

Table VIII reports the heterogeneity for the sample with parents as farmers by parents' self-employed status. Panel A of Table VIII shows a similar pattern as in the core results. Among the children with parents as self-employed farmers, originally living in high-erosion counties were significantly less likely to work as a self-employed farmer but more likely to work as a paid farm worker compared to those in low-erosion counties.

Additionally, they were more likely to leave the primary sector and find a job in the secondary or tertiary sectors. Panel B of Table VIII shows results for children without parents as self-employed farmers. The sign of the estimated coefficient is robust, but those in the treatment group were significantly less likely to work as a farmer or work in the primary sector. There is no significant difference in the probabilities of working in the secondary and tertiary sectors between the treatment and comparison groups.

#### 5.3.3 Migration decision as a mediator for occupational persistence

Table IX presents the average total effects (ATE) and average controlled direct effects (ACDE) of the Dust Bowl on occupation outcomes (Acharya, Blackwell and Sen, 2016). The analysis uses migration decisions (i.e., moving to non-DB states) as a mediating variable. Due to the data limitation, migration information only available for samples in 1930 and 1940. The results indicate that, even after demediating the effects of the Dust Bowl, this unforeseen adverse shock significantly decreased the probability of occupational persistence in agriculture. The ATE, with bootstrap standard errors, is consistent with the main results in Section 5.1, except for the probability of being an unpaid family farm worker, which is significantly lower after the Dust Bowl.

## 6 Summary and Concluding Remarks

Using the historical census data with the DiD model that relies on the variation of topsoil erosion across counties, I explore how children of farmers choose their occupation after experiencing the Dust Bowl, one of the environmental catastrophes in the U.S. mid-$20^{th}$ century. This study contributes to a better understanding of the Dust Bowl's possible consequences on intergenerational occupational choice in agriculture.

This paper shows evidence that the Dust Bowl plausibly decreases the probability of occupational persistence in agriculture, even though the magnitude is not substantial

(approximately decreasing by 2%). Although originally living in high-erosion counties seemed to discourage children of farmers from being a self-employed farmer, some of them ultimately chose to work as a wage-paid farmer. Occupation as employed farmer has a lower risk than running a farm independently. Additionaly, relocating to non-Dust Bowl states was shown as a possible mediator of occupational persistence choice in agriculture for the next generation.

There are some limitations to the results that need to be mentioned. First and foremost, it is difficult to precisely know who was actually affected by the Dust Bowl due to data limitations. I use the residency of 1930 to define the treatment group if the individual lived in high-erosion Great Plains counties. Since the first wave of the Dust Bowl happened in 1931, it is possible that some people moved out of the focus area before the Dust Bowl and were thus misclassified in the treatment group. This phenomenon could lead the study to underestimate the effects of the Dust Bowl on occupational persistence in agriculture.

Second, the findings only apply to those living with their parents. This restriction emerges from other data limitations that make it difficult to include children with parents if they do not live together in the same household. Therefore, the findings could be underestimated or overestimated. For example, children of farmers who didn't live with their parents might be more likely to work as farmers in order to keep their family assets, which would make the results underestimated. Alternatively, it is also possible that children of farmers might be less likely to work on farms as they don't face expectations from their parents, which would make the results overestimated. Despite these limitations, the sample used in this study is still representative in answering the research question: What are the plausible impacts of the Dust Bowl on intergenerational occupational choices in agriculture, especially for those living with their farmer parents?

Third, these findings indicate the short-term plausible effects of the Dust Bowl. Some of the literature focuses on the long-term effects of the Dust Bowl on health outcomes,

agricultural productivity, or population, which could provide more implications for recent policies on healthcare or agriculture subsidies. This study focuses on the short-term because U.S. Census data imposes a 72-year restriction on access to the full count data. The most recent census year on IPUMS currently available to link the data is 1940.

Recent research on developing economics has documented that off-farm works provide higher return opportunities and thus raised the question of why poor people living in rural areas do not choose to take higher payoffs outside agriculture (Gollin, Lagakos and Waugh, 2014; Bryan, Chowdhury and Mobarak, 2014; Munshi and Rosenzweig, 2016). One of the explanations in India is that first-born sons are more likely to be restricted in their occupational choice due to land inheritance and social norms of taking care of their parents (Fernando, 2022). Another explanation is that people in developing economies tend to stay in their hometowns in rural areas, which limits their choice for non-farm work.

In light of this question, this study investigates whether the next generation of the farm household would continue in agriculture using the historical environmental event of the Dust Bowl in the US. The findings imply that the children of farmers were likely to leave the primary sector and find jobs in the secondary and tertiary sectors. The effects of the Dust Bowl on occupational choices are only significant for males, White, non-Hispanic, and more significant for those with parents as self-employed farmers.

In sum, this study shows that severe environmental catastrophes could pull the next generation out of agriculture in developing contexts. Still, the effects are not significant for disadvantaged groups. Additionally, this research identifies part of the structural transformation plausibly caused by the Dust Bowl.

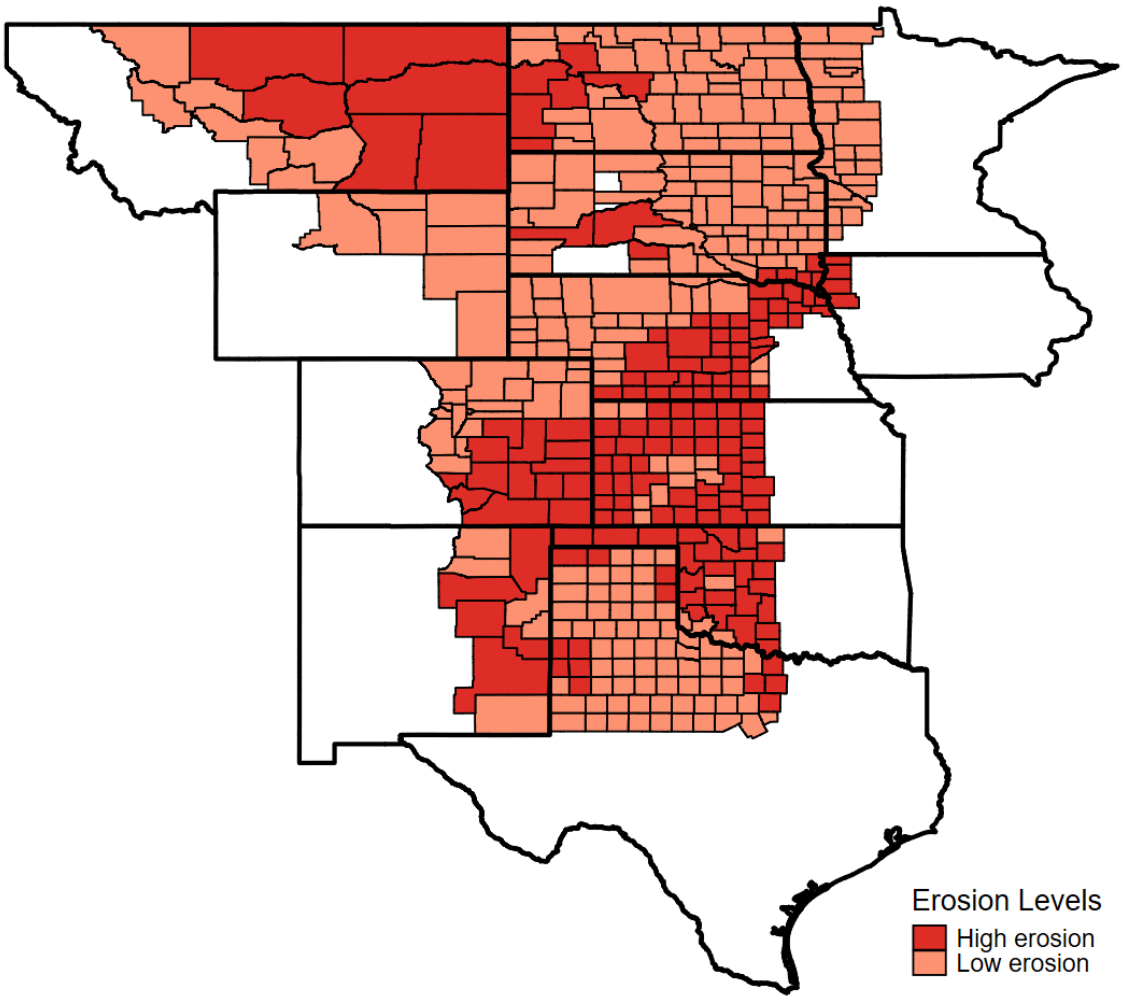
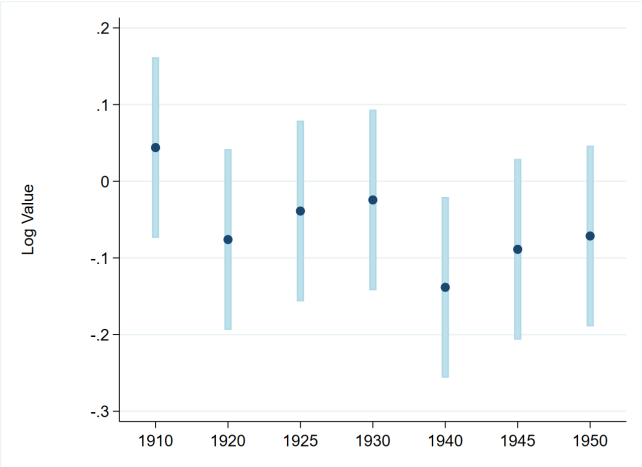
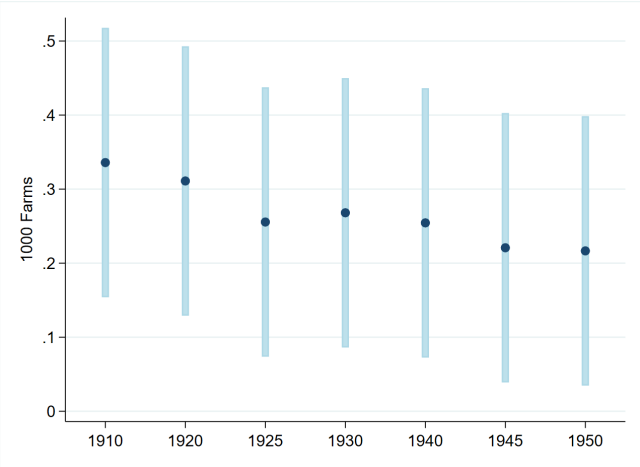


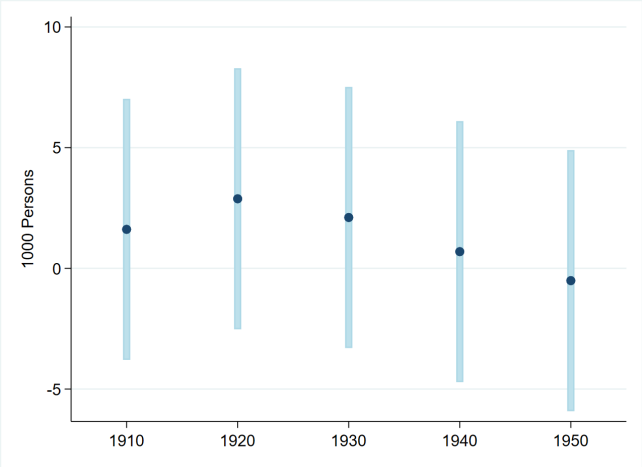

FIGURE I: The Great Plains Counties by Topsoil Erosion Levels




(A) Value of Farmland per Acre




(B) Farms per Acre




(C) Population

FIGURE II: Evidence for Parallel Trends Assumption using County-Level Outcomes

TABLE I: Variable Descriptions and Sample Statistics

| Variables | Descriptions | Full Sample | | High-Erosion GP Counties | | Low-Erosion GP Counties | |
|---|---|---|---|---|---|---|---|
| | | 100% | | 38% | | 62% | |
| | | Mean | S.D. | Mean | S.D. | Mean | S.D. |
| *Treatment - Soil Erosion* | | | | | | | |
| High Erosion Fraction (%) | Proportion of county facing over 75% topsoil loss | 13.654 | 26.056 | 35.881 | 31.411 | 0.000 | 0.000 |
| *Outcomes Variables* | | | | | | | |
| Farmer (%) | If working as a farmer (=1)*100 | 52.883 | 49.917 | 55.048 | 49.745 | 51.553 | 49.976 |
| Self-Employed Farmer (%) | If working as a self-employed farmer (=1)*100 | 40.551 | 49.099 | 43.628 | 49.592 | 38.661 | 48.697 |
| Paid Farm Worker (%) | If working as a paid farm worker (=1)*100 | 10.098 | 30.131 | 9.418 | 29.208 | 10.516 | 30.676 |
| Unpaid Family Farm Worker (%) | If working as a unpaid family farm worker (=1)*100 | 2.233 | 14.776 | 2.002 | 14.007 | 2.375 | 15.228 |
| Primary Sector (%) | If working in the primary sector (=1)*100 | 56.413 | 49.587 | 58.035 | 49.350 | 55.416 | 49.706 |
| Secondary Sector (%) | If working in the secondary sector (=1)*100 | 13.130 | 33.773 | 12.733 | 33.335 | 13.373 | 34.036 |
| Tertiary Sector (%) | If working in the tertiary sector (=1)*100 | 30.457 | 46.023 | 29.231 | 45.482 | 31.210 | 46.335 |
| *Parents' Occupation* | | | | | | | |
| w/ Parents as Farmers (0/1) | If having at least one parent as a farmer (=1) | 0.192 | 0.394 | 0.188 | 0.391 | 0.195 | 0.396 |
| w/ Parents as Self-Employed Farmers (0/1) | If having at least one parent as a self-employed farmer (=1) | 0.184 | 0.387 | 0.180 | 0.384 | 0.186 | 0.389 |
| *Socioecomoics* | | | | | | | |
| Married (0/1) | If married (=1) | 0.776 | 0.417 | 0.795 | 0.404 | 0.765 | 0.424 |
| Number of Children | Number of own children in the household | 1.953 | 2.076 | 1.985 | 2.052 | 1.934 | 2.090 |
| Number of Siblings | Number of own siblings in household | 0.428 | 1.260 | 0.379 | 1.182 | 0.458 | 1.305 |
| Male (0/1) | If identified as male in 1930 (=1) | 0.971 | 0.167 | 0.973 | 0.161 | 0.970 | 0.171 |
| Firstborn (0/1) | If identified as firstborn in 1930 (=1) | 0.069 | 0.253 | 0.065 | 0.247 | 0.071 | 0.256 |
| White non-Hispanic (0/1) | If identified as White, non-Hispanic in 1930 (=1) | 0.989 | 0.104 | 0.989 | 0.105 | 0.989 | 0.103 |
| Observations (N*T) | | 2,322,700 | | 883,854 | | 1,438,846 | |

TABLE II: Balance Table for Full Samples

| | High-Erosion GP Counties | Low-Erosion GP Counties | Difference | S.E. |
|---|---|---|---|---|
| Farmer (%) | 58.600 | 54.585 | 4.015*** | 0.081 |
| Self-Employed Farmer (%) | 45.464 | 39.658 | 5.806*** | 0.080 |
| Paid Farm Worker (%) | 11.004 | 12.506 | -1.502*** | 0.053 |
| Unpaid Family Farm Worker (%) | 2.132 | 2.420 | -0.288*** | 0.024 |
| Primary Sector (%) | 61.833 | 58.798 | 3.035*** | 0.080 |
| Secondary Sector (%) | 10.188 | 11.150 | -0.962*** | 0.050 |
| Tertiary Sector (%) | 27.979 | 30.052 | -2.073*** | 0.074 |
| w/ Parents as Farmers (0/1) | 0.166 | 0.175 | -0.008*** | 0.001 |
| w/ Parents as Self-Employed Farmers (0/1) | 0.159 | 0.167 | -0.008*** | 0.001 |
| Male (0/1) | 0.974 | 0.971 | 0.004*** | 0.000 |
| Firstborn (0/1) | 0.056 | 0.062 | -0.006*** | 0.000 |
| Married (0/1) | 0.764 | 0.731 | 0.032*** | 0.001 |
| Number of Children | 1.969 | 1.915 | 0.054*** | 0.003 |
| Number of Siblings | 0.484 | 0.579 | -0.095*** | 0.002 |
| White non-Hispanic (0/1) | 0.989 | 0.990 | -0.001*** | 0.000 |
| Observations | 612,682 | 992,446 | | |

This table shows the mean of pre-Dust Bowl characteristics by soil erosion status and the balance tests.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

TABLE III: DiD Estimates for the Effect of the Dust Bowl on the Probability of Working as a Farmer by Parents' Occupations

| | Full Sample | | w/ Parents as Farmers | | w/o Parents as Farmers | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| | Dep. Var: Farmer (%) | | Dep. Var: Farmer (%) | | Dep. Var: Farmer (%) | |
| Dust Bowl—High Erosion Counties in 1940 (0/1) | -1.569* | -1.678** | -1.407** | -1.511** | -1.674** | -1.640** |
| | (0.848) | (0.825) | (0.606) | (0.590) | (0.847) | (0.834) |
| Married (0/1) | | -1.587*** | | -6.702*** | | 1.183*** |
| | | (0.159) | | (0.279) | | (0.175) |
| Number of Children | | -0.019 | | -0.106 | | 0.089*** |
| | | (0.025) | | (0.085) | | (0.024) |
| Number of Siblings | | 1.397*** | | 1.241*** | | -0.524*** |
| | | (0.079) | | (0.073) | | (0.065) |
| Mean of Dependent Variable | 52.88 | 52.88 | 74.36 | 74.36 | 47.78 | 47.78 |
| Percent Change (%) | -2.97 | -3.17 | -1.89 | -2.03 | -3.50 | -3.43 |
| Individual FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 2,322,700 | 2,322,700 | 446,146 | 446,146 | 1,876,554 | 1,876,554 |
| R-squared | 0.805 | 0.806 | 0.664 | 0.667 | 0.822 | 0.822 |

Standard errors cluster at the county level based on residency in 1930.
* p<0.10, ** p<0.05, *** p<0.01

TABLE IV: DiD Estimates for the Effect of the Dust Bowl on the Probability of Working as a Farmer by Parents' Occupations

| | w/ Parents as Farmers | | | w/o Parents as Farmers | | |
|---|---|---|---|---|---|---|
| | (1) Dep. Var: Self-Employed Farmer (%) | (2) Dep. Var: Paid Farm Worker (%) | (3) Dep. Var: Unpaid Family Farm Worker (%) | (4) Dep. Var: Self-Employed Farmer (%) | (5) Dep. Var: Paid Farm Worker (%) | (6) Dep. Var: Unpaid Family Farm Worker (%) |
| Dust Bowl—High Erosion Counties in 1940 (0/1) | -4.559*** | 3.698*** | -0.649 | -1.905*** | 0.461 | -0.196 |
| | (1.096) | (0.737) | (0.629) | (0.717) | (0.357) | (0.142) |
| Mean of Dependent Variable | 37.35 | 26.99 | 10.02 | 41.31 | 6.08 | 0.38 |
| Percent Change (%) | -12.21 | 13.70 | -6.48 | -4.61 | 7.57 | -51.33 |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes |
| Individual FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 446,146 | 446,146 | 446,146 | 1,876,554 | 1,876,554 | 1,876,554 |
| R-squared | 0.630 | 0.615 | 0.603 | 0.798 | 0.541 | 0.435 |

Controls include married (0/1), number of children, and number of siblings.
Standard errors cluster at the county level based on residency in 1930.
* p<0.10, ** p<0.05, *** p<0.01

TABLE V: DiD Estimates for the Effect of the Dust Bowl on Probability of Working in the Job Sectors by Parents' Occupations

| | w/ Parents as Farmers | | | w/o Parents as Farmers | | |
|---|---|---|---|---|---|---|
| | (1) Dep. Var: Primary Sector (%) | (2) Dep. Var: Secondary Sector (%) | (3) Dep. Var: Tertiary Sector (%) | (4) Dep. Var: Primary Sector (%) | (5) Dep. Var: Secondary Sector (%) | (6) Dep. Var: Tertiary Sector (%) |
| Dust Bowl—High Erosion Counties in 1940 (0/1) | -1.337** | 0.738** | 0.599* | -1.291* | 1.210 | 0.081 |
| | (0.553) | (0.362) | (0.339) | (0.754) | (0.854) | (0.279) |
| Mean of Dependent Variable | 76.61 | 8.01 | 15.39 | 51.61 | 14.35 | 34.04 |
| Percent Change (%) | -1.74 | 9.21 | 3.89 | -2.50 | 8.43 | 0.24 |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes |
| Individual FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 446,146 | 446,146 | 446,146 | 1,876,554 | 1,876,554 | 1,876,554 |
| R-squared | 0.665 | 0.545 | 0.642 | 0.804 | 0.627 | 0.753 |

Controls include married (0/1), number of children, and number of siblings.

Standard errors cluster at the county level based on residency in 1930.

* p<0.10, ** p<0.05, *** p<0.01

TABLE VI: Evidence of Parallel Trends for the Probability of Occupational Choices using Sample w/ Parents as Farmers

| | w/ Parents as Farmers | | | | | | |
|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| | Dep. Var: Farmer (%) | Dep. Var: Self-Employed Farmer (%) | Dep. Var: Paid Farm Worker (%) | Dep. Var: Unpaid Family Farm Worker (%) | Dep. Var: Primary Sector(%) | Dep. Var: Secondary Sector(%) | Dep. Var: Tertiary Sector(%) |
| Dust Bowl—High Erosion Counties in 1920 (0/1) | 0.799 | -1.279 | 0.732 | 1.346** | 1.048 | -0.043 | -1.004 |
| | (1.496) | (1.402) | (1.044) | (0.562) | (1.376) | (0.598) | (0.922) |
| Dust Bowl—High Erosion Counties in 1940 (0/1) | -1.356** | -4.806*** | 3.839*** | -0.389 | -1.134** | 0.729* | 0.405 |
| | (0.602) | (0.996) | (0.756) | (0.721) | (0.567) | (0.389) | (0.326) |
| Mean of Dependent Variable | 74.36 | 37.35 | 26.99 | 10.02 | 76.61 | 8.01 | 15.39 |
| Percent Change in 1940 (%) | -1.82 | -12.87 | 14.23 | -3.88 | -1.48 | 9.11 | 2.63 |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Individual FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 446,146 | 446,146 | 446,146 | 446,146 | 446,146 | 446,146 | 446,146 |
| R-squared | 0.667 | 0.630 | 0.615 | 0.603 | 0.665 | 0.545 | 0.642 |

Controls include married (0/1), number of children, and number of siblings.
Standard errors cluster at the county level based on residency in 1930.
* p<0.10, ** p<0.05, *** p<0.01

TABLE VII: DiD Estimates for the Effect of the Dust Bowl on Occupational Choices by Birth Order Using Sample w/ Parents as Farmers

| | w/ Parents as Farmers | | | | | | |
|---|---|---|---|---|---|---|---|
| | (1) Dep. Var: Farmer (%) | (2) Dep. Var: Self-Employed Farmer (%) | (3) Dep. Var: Paid Farm Worker (%) | (4) Dep. Var: Unpaid Family Farm Worker (%) | (5) Dep. Var: Primary Sector(%) | (6) Dep. Var: Secondary Sector(%) | (7) Dep. Var: Tertiary Sector(%) |
| | Panel A: Firstborn | | | | | | |
| Dust Bowl—High Erosion Counties in 1940 (0/1) | -1.115 | -3.445** | 4.166*** | -1.836 | -0.777 | 0.950** | -0.174 |
| | (0.752) | (1.346) | (1.077) | (1.120) | (0.727) | (0.481) | (0.520) |
| Mean of Dependent Variable | 75.22 | 28.34 | 29.81 | 17.06 | 77.41 | 7.89 | 14.69 |
| Percent Change in 1940 (%) | -1.48 | -12.15 | 13.97 | -10.76 | -1.00 | 12.04 | -1.18 |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Individual FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 113,655 | 113,655 | 113,655 | 113,655 | 113,655 | 113,655 | 113,655 |
| R-squared | 0.675 | 0.600 | 0.582 | 0.583 | 0.674 | 0.564 | 0.661 |
| | Panel B: Non-Firstborn | | | | | | |
| Dust Bowl—High Erosion Counties in 1940 (0/1) | -1.629*** | -4.701*** | 3.345*** | -0.273 | -1.513*** | 0.666* | 0.848** |
| | (0.595) | (1.055) | (0.674) | (0.505) | (0.553) | (0.380) | (0.351) |
| Mean of Dependent Variable | 74.07 | 40.43 | 26.02 | 7.62 | 76.33 | 8.04 | 15.62 |
| Percent Change in 1940 (%) | -2.20 | -11.63 | 12.86 | -3.58 | -1.98 | 8.27 | 5.43 |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Individual FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 332,491 | 332,491 | 332,491 | 332,491 | 332,491 | 332,491 | 332,491 |
| R-squared | 0.665 | 0.639 | 0.630 | 0.608 | 0.663 | 0.539 | 0.637 |

Controls include married (0/1), number of children, and number of siblings.

Standard errors cluster at the county level based on residency in 1930.

* p<0.10, ** p<0.05, *** p<0.01

TABLE VIII: DiD Estimates for the Effect of the Dust Bowl on Occupational Choices by Parents' Self-employed Status Using Sample w/ Parents as Farmers

| | w/ Parents as Farmers | | | | | | |
|---|---|---|---|---|---|---|---|
| | (1) Dep. Var: Farmer (%) | (2) Dep. Var: Self-Employed Farmer (%) | (3) Dep. Var: Paid Farm Worker (%) | (4) Dep. Var: Unpaid Family Farm Worker (%) | (5) Dep. Var: Primary Sector(%) | (6) Dep. Var: Secondary Sector(%) | (7) Dep. Var: Tertiary Sector(%) |
| | Panel A: w/ Parents as Self-Employed Farmers | | | | | | |
| Dust Bowl—High Erosion Counties in 1940 (0/1) | -1.491** | -4.683*** | 3.884*** | -0.692 | -1.309** | 0.715** | 0.594* |
| | (0.592) | (1.093) | (0.751) | (0.635) | (0.551) | (0.350) | (0.341) |
| Mean of Dependent Variable | 75.22 | 37.80 | 27.05 | 10.37 | 77.39 | 7.69 | 14.93 |
| Percent Change in 1940 (%) | -1.98 | -12.39 | 14.36 | -6.67 | -1.69 | 9.30 | 3.98 |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Individual FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 426,535 | 426,535 | 426,535 | 426,535 | 426,535 | 426,535 | 426,535 |
| R-squared | 0.662 | 0.628 | 0.615 | 0.604 | 0.660 | 0.542 | 0.639 |
| | Panel B: w/o Parents as Self-Employed Farmers | | | | | | |
| Dust Bowl—High Erosion Counties in 1940 (0/1) | -1.653* | -1.895*** | 0.430 | -0.188 | -1.307* | 1.216 | 0.092 |
| | (0.846) | (0.706) | (0.378) | (0.140) | (0.766) | (0.858) | (0.278) |
| Mean of Dependent Variable | 47.86 | 41.17 | 6.29 | 0.40 | 51.70 | 14.35 | 33.95 |
| Percent Change in 1940 (%) | -3.45 | -4.60 | 6.85 | -46.75 | -2.53 | 8.47 | 0.27 |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Individual FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 1,896,165 | 1,896,165 | 1,896,165 | 1,896,165 | 1,896,165 | 1,896,165 | 1,896,165 |
| R-squared | 0.820 | 0.797 | 0.545 | 0.443 | 0.803 | 0.627 | 0.753 |

Controls include married (0/1), number of children, and number of siblings.

Standard errors cluster at the county level based on residency in 1930.

* p<0.10, ** p<0.05, *** p<0.01

TABLE IX: Mediation Analysis Using Sample w/ Parents as Farmers

| | w/ Parents as Farmers | | | | | | |
|---|---|---|---|---|---|---|---|
| | (1) Dep. Var: Farmer (%) | (2) Dep. Var: Self-Employed Farmer (%) | (3) Dep. Var: Paid Farm Worker (%) | (4) Dep. Var: Unpaid Family Farm Worker (%) | (5) Dep. Var: Primary Sector(%) | (6) Dep. Var: Secondary Sector(%) | (7) Dep. Var: Tertiary Sector(%) |
| Average Total Effects (ATE) | -1.300*** | -4.518*** | 3.942*** | -0.725*** | -1.052*** | 0.692*** | 0.360 |
| | [0.300] | [0.343] | [0.340] | [0.272] | [0.299] | [0.252] | [0.258] |
| Percent Change | -1.81% | -10.79% | 22.10% | -5.92% | -1.42% | 7.38% | 2.18% |
| Average Controlled Direct Effects (ACDE) | -1.091*** | -5.260*** | 4.032*** | 0.137 | -0.852*** | 0.643** | 0.209 |
| | [0.301] | [0.360] | [0.340] | [0.287] | [0.299] | [0.253] | [0.258] |
| Percent Change | -1.52% | -12.56% | 22.60% | 1.12% | -1.15% | 6.86% | 1.27% |
| Share of Dust Bowl's Effect Explained by Migration | 16.08% | -16.42% | -2.28% | 118.90% | 19.01% | 7.08% | 41.94% |
| Mean of Dependent Variables | 71.96 | 41.88 | 17.84 | 12.24 | 74.14 | 9.37 | 16.48 |

This table shows the average total effects (ATE) and average controlled direct effects (ACDE) of the Dust Bowl on occupation outcomes (Acharya, Blackwell and Sen, 2016). Migration – moving to non-DB states is viewed as a mediating variable. Controls including married (0/1), number of children, and number of siblings are viewed as possibly non-mediating covariates. All regression controls for individual and year fixed effects. Standard errors in the bracket are estimated based on bootstrapping procedure with 500 replications. * p<0.10, ** p<0.05, *** p<0.01

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TABLE A1: Variable Descriptions and Sample Statistics for the Mediation Analysis

| Variables | Descriptions | Full Sample | | High-Erosion GP Counties | | Low-Erosion GP Counties | |
|---|---|---|---|---|---|---|---|
| | | 100% | | 38% | | 62% | |
| | | Mean | S.D. | Mean | S.D. | Mean | S.D. |
| *Treatment - soil erosion* | | | | | | | |
| High Erosion Fraction (%) | Proportion of county facing over 75% topsoil loss | 13.621 | 26.011 | 35.866 | 31.364 | 0.000 | 0.000 |
| *Migration* | | | | | | | |
| Stay - same county (%) | If stayed at the same Great Plains county (=1)*100 | 61.462 | 48.668 | 61.430 | 48.676 | 61.482 | 48.664 |
| Stay - move within GP (%) | If moved within the Great Plains (=1)*100 | 35.945 | 47.984 | 35.572 | 47.873 | 36.174 | 48.050 |
| Move - to non-DB States (%) | If moved to non-Dust Bowl state (=1)*100 | 2.593 | 15.892 | 2.999 | 17.055 | 2.344 | 15.130 |
| *Work* | | | | | | | |
| Farmer (%) | If working as a farmer (=1)*100 | 50.228 | 50.000 | 52.196 | 49.952 | 49.023 | 49.990 |
| Self-Employed Farmer (%) | If working as a self-employed farmer (=1)*100 | 39.068 | 48.790 | 41.988 | 49.354 | 37.280 | 48.355 |
| Paid Farm Worker (%) | If working as a paid farm worker (=1)*100 | 8.135 | 27.337 | 7.489 | 26.321 | 8.530 | 27.933 |
| Unpaid Family Farm Worker (%) | If working as a unpaid family farm worker (=1)*100 | 3.025 | 17.128 | 2.718 | 16.262 | 3.213 | 17.635 |
| Primary Sector (%) | If working in the primary sector (=1)*100 | 53.593 | 49.871 | 55.013 | 49.748 | 52.724 | 49.926 |
| Secondary Sector (%) | If working in the secondary sector (=1)*100 | 14.591 | 35.302 | 14.289 | 34.996 | 14.777 | 35.487 |
| Tertiary Sector (%) | If working in the tertiary sector (=1)*100 | 31.816 | 46.576 | 30.698 | 46.124 | 32.500 | 46.837 |
| *Migration & Work* | | | | | | | |
| Stay & Farmer (%) | If stayed at the Great Plains and worked as a farmer (=1)*100 | 49.518 | 49.998 | 51.251 | 49.984 | 48.457 | 49.976 |
| Stay & non-Farmer (%) | If stayed at the Great Plains and not worked as a farmer (=1)*100 | 47.890 | 49.955 | 45.751 | 49.819 | 49.199 | 49.994 |
| Move & Farmer (%) | If moved to non-Dust Bowl state and worked as a farmer (=1)*100 | 0.710 | 8.397 | 0.945 | 9.675 | 0.566 | 7.504 |
| Move & non-Farmer (%) | If moved to non-Dust Bowl state and not worked as a farmer (=1)*100 | 1.883 | 13.591 | 2.054 | 14.182 | 1.778 | 13.215 |
| Stay & Primary Sector (%) | If stayed at the Great Plains and worked in the primary sector (=1)*100 | 52.792 | 49.922 | 53.966 | 49.842 | 52.073 | 49.957 |
| Stay & Secondary Sector (%) | If stayed at the Great Plains and worked in the secondary sector (=1)*100 | 13.734 | 34.420 | 13.319 | 33.978 | 13.988 | 34.686 |
| Stay & Tertiary Sector (%) | If stayed at the Great Plains and worked in the tertiary sector (=1)*100 | 30.882 | 46.201 | 29.716 | 45.701 | 31.596 | 46.490 |
| Move & Primary Sector (%) | If moved to non-Dust Bowl state and worked in the primary sector (=1)*100 | 0.801 | 8.915 | 1.046 | 10.175 | 0.651 | 8.043 |
| Move & Secondary Sector (%) | If moved to non-Dust Bowl state and worked in the secondary sector (=1)*100 | 0.858 | 9.222 | 0.971 | 9.804 | 0.789 | 8.846 |
| Move & Tertiary Sector (%) | If moved to non-Dust Bowl state and worked in the tertiary sector (=1)*100 | 0.934 | 9.618 | 0.982 | 9.860 | 0.904 | 9.467 |
| *Parents' Occupation* | | | | | | | |
| Parents as Farmers (%) | If at least one parent work as a farmer (=1) | 6.565 | 24.766 | 5.943 | 23.644 | 6.945 | 25.422 |
| Observations (N*T) | | 1,691,332 | | 642,303 | | 1,049,029 | |

TABLE A2: Continuous Effect of the Dust Bowl on the Probability of Occupational Choices using Sample w/ Parents as Farmers

| | w/ Parents as Farmers | | | | | | |
|---|---|---|---|---|---|---|---|
| | Dep. Var: Farmer (%) | Dep. Var: Self-Employed Farmer (%) | Dep. Var: Paid Farm Worker (%) | Dep. Var: Unpaid Family Farm Worker (%) | Dep. Var: Primary Sector(%) | Dep. Var: Secondary Sector(%) | Dep. Var: Tertiary Sector(%) |
| Dust Bowl—High Erosion Fraction (%) | -0.003 | -0.051*** | 0.047*** | 0.001 | -0.006 | 0.006 | -0.000 |
| | (0.010) | (0.019) | (0.012) | (0.012) | (0.009) | (0.006) | (0.005) |
| Mean of Dependent Variable | 74.36 | 37.35 | 26.99 | 10.02 | 76.61 | 8.01 | 15.39 |
| Percent Change – High Erosion Fraction | -0.004 | -0.138 | 0.175 | 0.011 | -0.007 | 0.071 | -0.000 |
| Individual FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 446,146 | 446,146 | 446,146 | 446,146 | 446,146 | 446,146 | 446,146 |
| R-squared | 0.664 | 0.607 | 0.603 | 0.571 | 0.662 | 0.543 | 0.640 |

Controls include married (0/1), number of children, and number of siblings.

Standard errors cluster at the county level based on residency in 1930.

* p<0.10, ** p<0.05, *** p<0.01

TABLE A3: DiD Estimates for the Effect of the Dust Bowl on Occupational Choices by Sex Using Sample w/ Parents as Farmers

| | w/ Parents as Farmers | | | | | | |
|---|---|---|---|---|---|---|---|
| | (1) Dep. Var: Farmer (%) | (2) Dep. Var: Self-Employed Farmer (%) | (3) Dep. Var: Paid Farm Worker (%) | (4) Dep. Var: Unpaid Family Farm Worker (%) | (5) Dep. Var: Primary Sector(%) | (6) Dep. Var: Secondary Sector(%) | (7) Dep. Var: Tertiary Sector(%) |
| | Panel A: Male | | | | | | |
| Dust Bowl—High Erosion Counties in 1940 (0/1) | -1.526** | -4.599*** | 3.740*** | -0.667 | -1.371** | 0.749** | 0.622* |
| | (0.592) | (1.104) | (0.742) | (0.628) | (0.556) | (0.367) | (0.339) |
| Mean of Dependent Variable | 75.42 | 37.93 | 27.36 | 10.13 | 77.64 | 8.05 | 14.30 |
| Percent Change in 1940 (%) | -2.02 | -12.13 | 13.67 | -6.58 | -1.77 | 9.29 | 4.35 |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Individual FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 438,946 | 438,946 | 438,946 | 438,946 | 438,946 | 438,946 | 438,946 |
| R-squared | 0.655 | 0.627 | 0.615 | 0.603 | 0.653 | 0.545 | 0.621 |
| | Panel B: Female | | | | | | |
| Dust Bowl—High Erosion Counties in 1940 (0/1) | -0.041 | -0.710 | -0.082 | 0.751 | 1.712 | -0.185 | -1.527 |
| | (1.895) | (0.780) | (0.861) | (1.610) | (1.995) | (1.393) | (2.275) |
| Mean of Dependent Variable | 9.78 | 2.22 | 4.14 | 3.42 | 13.57 | 5.06 | 81.38 |
| Percent Change in 1940 (%) | -0.42 | -31.96 | -1.99 | 21.99 | 12.62 | -3.66 | -1.88 |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Individual FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 7,200 | 7,200 | 7,200 | 7,200 | 7,200 | 7,200 | 7,200 |
| R-squared | 0.655 | 0.624 | 0.562 | 0.606 | 0.655 | 0.589 | 0.640 |

Controls include married (0/1), number of children, and number of siblings.

Standard errors cluster at the county level based on residency in 1930.

* p<0.10, ** p<0.05, *** p<0.01

TABLE A4: DiD Estimates for the Effect of the Dust Bowl on Occupational Choices by Race Using Sample w/ Parents as Farmers

| | w/ Parents as Farmers | | | | | | |
|---|---|---|---|---|---|---|---|
| | (1) Dep. Var: Farmer (%) | (2) Dep. Var: Self-Employed Farmer (%) | (3) Dep. Var: Paid Farm Worker (%) | (4) Dep. Var: Unpaid Family Farm Worker (%) | (5) Dep. Var: Primary Sector(%) | (6) Dep. Var: Secondary Sector(%) | (7) Dep. Var: Tertiary Sector(%) |
| | Panel A: White, non-Hispanic | | | | | | |
| Dust Bowl—High Erosion Counties in 1940 (0/1) | -1.554*** | -4.608*** | 3.692*** | -0.638 | -1.385** | 0.780** | 0.605* |
| | (0.588) | (1.097) | (0.736) | (0.628) | (0.551) | (0.357) | (0.339) |
| Mean of Dependent Variable | 74.40 | 37.44 | 26.94 | 10.02 | 76.64 | 7.97 | 15.39 |
| Percent Change in 1940 (%) | -2.09 | -12.31 | 13.70 | -6.36 | -1.81 | 9.79 | 3.93 |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Individual FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 443,635 | 443,635 | 443,635 | 443,635 | 443,635 | 443,635 | 443,635 |
| R-squared | 0.668 | 0.630 | 0.615 | 0.603 | 0.666 | 0.545 | 0.643 |
| | Panel B: Other Races and Ethnicities | | | | | | |
| Dust Bowl—High Erosion Counties in 1940 (0/1) | 5.140 | 3.758 | 4.774 | -3.392 | 6.673* | -5.940 | -0.732 |
| | (3.737) | (3.224) | (3.633) | (3.243) | (3.644) | (4.192) | (2.852) |
| Mean of Dependent Variable | 66.99 | 21.62 | 34.81 | 10.55 | 71.09 | 14.18 | 14.74 |
| Percent Change in 1940 (%) | 7.67 | 17.38 | 13.72 | -32.14 | 9.39 | -41.90 | -4.97 |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Individual FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 2,511 | 2,511 | 2,511 | 2,511 | 2,511 | 2,511 | 2,511 |
| R-squared | 0.654 | 0.590 | 0.610 | 0.605 | 0.658 | 0.573 | 0.613 |

Controls include married (0/1), number of children, and number of siblings.

Standard errors cluster at the county level based on residency in 1930.

* p<0.10, ** p<0.05, *** p<0.01