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Keywords
Great Depression, market-based agriculture, agriculture-based economy

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Comments

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1 Introduction

The reallocation of labor across sectors is an important part of economic development and growth, and there is a large literature focusing specifically on the process of structural change from agriculture to manufacturing. This process is generally accompanied by large-scale urbanization, as workers leave the agricultural sector and migrate to cities. Periods of economic crisis, however, have witnessed substantial declines in the rate of migration from farms to cities, as well as increases in the rate of so-called *reverse migration* back to farms. This pattern has been observed during the Great Depression (Boyd, 2002; Spengler, 1936; Thompson, 1937), during the East Asian crisis of the late 1990s (World Bank, 2007; Li, 2009), as well as during the recent financial crisis of 2008-2009 (Kong, Meng, and Zhang, 2010; Huang et al., 2011).

In this paper we study the migration between agriculture and the nonfarm sector in the United States during the Great Depression, and particularly the movement out of towns and cities and onto farms. First, we show that the ability to move to farms serves as a source of informal insurance in the early years of the crisis, during a time when formal insurance is not widely available.[1] But while the farm sector as a whole absorbs large numbers of migrants, the pattern of migration is not evenly distributed across space. Capital-intensive farm areas are far less able to absorb in-migrants, and the bulk of the movement is to low-productivity farms for the purpose of subsistence production.

Second, we demonstrate that the movement to farms has spillovers on the broader economy. Counties with easier access to available farmland witness a relative decline in market-based output, indicating that the movement to farms facilitates a withdrawal from market-based consumption and a corresponding shift into home production. In a demand-constrained economy, this reduction in aggregate demand is likely to exacerbate the downturn in the market. At the same time, by reducing labor supply in the nonfarm sector, the subsistence farm sector also puts upward pressure on local nonfarm wages, with implications for the aggregate price level.

Third, we present evidence that the introduction of unemployment insurance in the later years of the Depression reduces the movement to farms. Taken together, our findings highlight an understudied channel through which formal insurance can have stabilizing effects during deep downturns: it helps to *divert* consumption away from home production and towards market-based expenditure. That is, it reduces the "market withdrawal" that accompanies some of the informal strategies that people employ to cope with shocks, like moving to farms.

Our empirical strategy in this paper relies on three main sources of spatial variation: (1) differences across U.S. counties in the initial nonfarm industrial composition, which affects the depth

1. Owen (1966) used the term "farm-financed social welfare" to refer to the "maintenance at farm-sector expense of any labor that is rendered redundant by the development process in that sector until such time as this labor actually realizes an alternative employment opportunity in the nonfarm sector." World Bank (2007) used the same term to refer specifically to the social protection provided by the movement to farms during the East Asian financial crisis.

of the economic downturn during the Great Depression; (2) variation in farm-related endowments, including land topography, which affects the suitability for mechanized agriculture; and (3) differences in state-level banking regulations, which lead to discrete changes across state boundaries in the level of exposure to formal credit markets. We use data from a number of sources, including the population and agricultural censuses. In addition to data on total population and farm population at the county level, we also have a direct measure of the movement to farms from towns and cities. This measure comes from the 1935 U.S. Census of Agriculture, which reported county-level statistics on the number of farm residents in 1935 who had previously lived in a nonfarm residence in 1930.[2]

We begin by confirming the prevailing narrative that the migration to farms is driven at least in part by the crisis in the nonfarm economy. We find that counties facing worse shocks to their nonfarm industries see higher rates of migration onto farms and a relative increase in their farm population. People are fleeing the cities with the most job losses and moving to farms because the farms provide some means of subsistence, like a job, food or shelter. In order to obtain causal impacts of the decline in local-area industrial employment, we construct two instruments, both of which are based on the initial industrial composition in the county in 1930. The first is the percentage of all manufacturing workers in the county in 1930 who are employed in industries classified as producing durable goods, and the second is the Bartik-predicted change in nonfarm employment between 1930 and 1940.[3]

We then examine the characteristics of the places that people are migrating to, and we observe that much of the movement is to less-productive farm areas.[4] We show that this variance in the rate of migration across counties reflects differing levels of modernization in the agricultural sector; that is, mechanization and commercialization reduce the ability of the land to provide informal insurance as a direct means of basic subsistence. Our empirical strategy relies on spatial variation in agricultural endowments that affect the suitability of the land for modernized production. We show how land topography — specifically the average slope, or *ruggedness*, of the land — influences the suitability for large-scale mechanized agriculture. Farm areas with smoother (or less-rugged) land have higher land values and more capital-intensive production. Rugged farm areas, however, are far more likely to attract in-migrants compared to their less rugged (and more mechanized) counterparts. While the ruggedness of the land makes these areas less amenable to modernization

2. The data are described in detail in Section 4.

3. Romer (1990) has shown that the national consumption decline in durable goods was much greater than for nondurables, and our results confirm that higher employment in durable industries translates into much larger job losses at the county level. On this topic, see also Rosenbloom and Sundstrom (1999) and Bernstein (1987). The Bartik-predicted change in county-level employment is obtained by weighting the national-level change in each nonfarm industrial sector by the initial county-level employment shares in those sectors (Bartik, 1991; Blanchard and Katz, 1992). See Section 5.1.

4. This is true across a variety of measures: people are moving to places with lower land values, lower values of farm equipment, lower measures of soil fertility and crop suitability, and lower levels of output per farm resident.

in agriculture, it also preserves the ability of these lands to provide a means of subsistence during the downturn. This insurance function appears to be quite valuable, especially during the worst years of the crisis, which occurred prior to the provision of New Deal relief programs.[5]

Two additional tests provide further support for the idea that modernization reduces the ability to migrate to farms during the crisis. First, we consider the effect of a proxy for market integration, namely, whether the county has access to navigable waterways, which reduces transport costs and makes it easier for farmers to ship their goods to market. Based on our earlier results, we would expect that farm areas with higher levels of market integration are less able to absorb in-migrants, and this is precisely what we find. Second, we test whether integration into formal markets for credit and banking affects the movement to farms. The reasoning is that access to financial capital promotes modernization by allowing for increased investment. And here again we find that exposure to markets reduces the movement to farms.

We investigate a number of related characteristics in order to determine *why* people are moving to these less-productive areas. We find that people are moving to farm areas not because there are explicit market-based employment opportunities available there, but because the farmland offers some other means of subsistence, such as shelter and the ability to grow your own food.[6]

Finally, we investigate how the reliance on migration as a source of social protection affects local labor markets and macroeconomic performance. In order to do so, we exploit the fact that ruggedness affects the rate of in-migration. We can then compare rugged areas to less-rugged areas in terms of their changes in both the farm and nonfarm sectors.

Rugged farms are drawing in migrants both from nearby (rugged) cities as well as from less-rugged places farther away. As a result, rugged counties experience a relative increase in population. Yet despite this influx of population, these areas see a relative decline in aggregate sales and employment in the local retail and wholesale sectors. One interpretation of this result is that a large number of people in the county are satisfying their needs via home production instead of engaging in market-based trade. So, while it's reasonable to think that (at least some of) these migrants are individually better off as a result of having access to available land, the accompanying retreat from the market economy may also exacerbate the downturn by reducing the market-based demand for goods and services.

At the same time, however, rugged counties witness a relative *increase* in the aggregate wage bill

5. Moreover, we find evidence that this pattern of migration is not unique to the Great Depression era. Using county-level population data from the decennial census from 1860 to 1940, we find that rugged areas gained population relative to less-rugged areas during the decades with lower rates of national GDP growth, and they lost population during decades with higher GDP growth. But this relationship is most stark in the Depression years.

6. We also show that the relative changes in the farm population are not driven solely by variation in the number of in-migrants seeking access to cheap or available land. In fact, a large proportion of counties actually witness a decline in their farm population. It's not just that there are fewer in-movers in these (modernized) areas, but that the existing population leaves, or gets driven out.

in these nonfarm sectors. The availability of a nearby subsistence farm sector puts upward pressure on nonfarm wages, most likely through the effects on labor supply. Because laid-off workers in rugged towns have the option of moving to farms, they are less likely to seek employment in the local retail and wholesale sectors; people in less-rugged towns, however, have more difficulty moving to farms and thus are more likely to search for nonfarm employment, driving down wages.

Our results have several implications for policy. First, since modernization in agriculture reduces access to informal insurance, as the economy modernizes there is a greater need for alternative insurance mechanisms like state-sponsored social insurance. Second, the results bring attention to an important channel through which formal insurance payments boost aggregate demand and help the economy buffer shocks: to the extent that cash payments reduce the movement to farms, they divert consumption away from home production and towards market-based expenditure. Third, in a deep crisis like the Great Depression, changes in labor supply can have large impacts on wages; to the extent that policies like unemployment insurance reduce search intensity in the labor market, this can actually lead to an increase in aggregate wages.

The remainder of the paper proceeds as follows. Section 2 discusses the relevance of our results in relation to the existing literature. We follow with a brief discussion of the historical background (Section 3), a description of our data (Section 4) and empirical specifications (Section 5), and our main empirical results (Section 6). Informed by our earlier results, Section 7 discusses the macroeconomic implications of the movements to farms. We present evidence that the provision of unemployment insurance substitutes for the informal insurance provided by migration to farms; we discuss the spillover effects of the withdrawal from the market; and we comment on the effects on agricultural prices. Section 8 offers concluding remarks on the implications of our findings for models of structural transformation.

2 Related Literature

Our paper relates to a number of existing literatures, including the large body of work studying the process of structural transformation from an agriculture-based economy to an industrialized economy (Lewis, 1954; Ranis and Fei, 1961; Matsuyama, 1992; Gollin, 2010). Models of long-term transformation contain assumptions about the mechanisms underlying the sectoral transitions. We study these transitions by taking a short-term view, which can be useful for judging the validity of existing growth models.[7] We also bring renewed attention to the concepts of surplus labor (Lewis, 1954) and access to land for the poor and dispossessed.

In addition, our paper relates to the literature on informal insurance and individual and household coping strategies in response to shocks. Klasen and Woolard (2009) look at changes in the dynamics of household formation in response to high unemployment in South Africa; in the US,

7. These implications are addressed in more detail in Section 8.

Kaplan (2010) finds that the option to delay leaving home or to move back in with parents serves as an important source of insurance for the young. Yagan (2014) finds large migration responses to labor market shocks. Like these papers, we see large changes in population movements in response to economic shocks; in addition, we present evidence of negative effects of this migration, in the form of reallocation of workers into low-productivity regions and sectors, as well as a general withdrawal from the market economy.

There is a large literature suggesting that exposure to markets and new technologies affects social relations and can erode traditional forms of social protection (Scott, 1985; Polanyi, 1944; Marx, 1847). Li (2009) discusses the rural migration during the East Asian crisis of the late 1990s, and she draws attention to the tension between inequality in access to land for the poor and the promotion of modernization in agricultural production. Our data from the historical U.S. reveals this same tension. While much of the existing literature focuses on this inequality as a source of *conflict*, our focus here is on the *economic* consequences and what they tell us about how markets function.[8]

The financial crisis of 2008 and subsequent global recession has led to renewed interest in the causes of sharp economic contractions, and it has inspired comparisons between the recent crisis and the Great Depression. Some early analyses of the causes of the Great Depression focused heavily on the shock to agricultural prices (Ohlin, 1931). More recently, Delli Gatti et al. (2012) focus on the relationship between long-run sectoral adjustments and short-run crises, and they draw explicit comparisons between the decline of agricultural employment in the U.S. economy in the 1920s and 1930s and the much more recent decline in manufacturing employment.[9] Our contribution to this literature is twofold. First, we offer evidence of the displacement of agricultural workers as a result of improved productivity on farms. And second, we highlight the heterogeneity within the agricultural sector, in the sense that the subsistence agricultural sector should be viewed as significantly distinct from the market-based commercial sector. While a naive reading of the agricultural population and output data might suggest a relative resurgence of "agriculture" during the Depression, we demonstrate how the increase in the agricultural population is in fact consistent with a large negative shock to that sector, and that any comparisons to (say) the manufacturing sector today should focus explicitly on market-based agriculture.

While the wealth of literature on the Great Depression is vast and impossible to survey here, there are several papers focused on migration that are especially relevant. Boustan, Fishback, and Kantor (2010) note that home economy shocks resulted in out-migration. Using variation in New

8. Our paper is also related to the work of Brown (2005), who focuses on how the impacts of the Depression in colonial Burma varied across different classes of agriculturalists.

9. Earlier economists also emphasized the interaction between the agricultural and manufacturing sectors. Garraty (1987) quotes Gardiner Means arguing in 1935 (p.54) "The whole Depression might be described as a general dropping of prices at the flexible end of the price scale [agriculture] and a dropping of production at the rigid end [manufacturing]."

Deal program generosity and weather shocks, they study the effect of migration on local labor markets. They find that in-migration "had little effect on the hourly earnings of existing residents... [instead causing] some residents to move away and others to lose weeks of work or access to relief jobs" (p. 720). They note that the lack of an effect on wages is consistent with "the presence of sticky wages and high unemployment during the Depression" (pp. 720-721). Fishback, Horrace, and Kantor (2006) document a positive in-migration response to New Deal public works and relief grant spending. On the other hand, they find that payments made to farmers under the Agricultural Adjustment Act (to reduce production) were associated with out-migration on net.[10]

Much of this existing literature studies the New Deal period beginning after the dramatic downturn; indeed, a number of these papers exploit spatial differences in the intensity of New Deal fund disbursements as a source of identifying variation. In contrast, our paper examines the movement to farms during the economic crisis, most of which occurred during the initial downturn and prior to the introduction of New Deal policies. An important prerequisite for interpreting the findings discussed in these papers is to understand how the enormous shock of the downturn affected the distribution of population going into the New Deal. In this way our paper feeds into this rich literature.[11]

3 Historical Background

3.1 Agriculture and the Structural Transformation of the U.S. Economy

The settlement of America's West was completed by the turn of the 20th century. The closing of the frontier meant that the U.S. could no longer rely on westward expansion to increase agricultural production or to absorb a growing farm population. Nevertheless, the early 20th century saw continued increases in the farm population as well as the land under cultivation, as farmers increased acreage by expanding onto marginal lands. By around 1916, however, the farm population reached its peak; it then declined throughout the 1920s, as higher birth rates in farm areas no longer kept up with the increasing rates of farm-to-city migration. The country continued to urbanize and the farm

10. On the effects of the AAA, see also Depew, Fishback, and Rhode (2013) and Alston (1981). There are also a number of papers examining the growth and diffusion of tractors in the first half of the twentieth century. Sorensen, Fishback, and Kantor (2008) study the effects of New Deal programs on tractor adoption in the 1930s. They document an increase in the share of farms owning tractors between 1930 and 1940, from 16.8 percent to 32.4 percent. Lafortune, Tessada, and Gonzalez-Velosa (2013) look at the interaction between migration flows and technological change. They study the effect of immigration flows (and hence, access to labor) on technological choice, organizational form, and output between 1910 and 1940 using data from the Census of Agriculture. Higher labor availability is associated with smaller farm size and lower capital-labor ratios. They also find differences in response to immigration flows depending on county-level crop specificity. Where agriculture was relatively less specialized in terms of crop, the adjustment was on the crop mix margin, whereas in more specialized counties the margin of adjustment was more along the technology or organizational structure dimensions. Their identification strategy relies on historical immigration flows such as those developed by Card (2001).

11. We also demonstrate that there were systematic migration patterns occurring between the population censuses of 1930 and 1940, some of which were reversed. See for example Figure 1, which shows the dramatic rise and fall in the farm population, all of which occurred between 1930 and 1940. This means that we do not have great measures of local population levels *within* the 1930s, and therefore special care must be taken when interpreting other outcomes.

sector continued to modernize.

One of the factors influencing these changes was World War I and its effects on agricultural prices. The war caused an increase in demand for U.S. agricultural exports and a big increase in the prices farmers received for their crops. However, the end of the war brought a dramatic decline in agricultural prices. The commodity boom during the war coincided with a boom in land values and mortgage debt (Rajan and Ramcharan, 2012), but after the war, the agricultural sector went through a period of extreme distress — the so-called "farm depression" of the 1920s. Earlier concerns about the ability of agricultural production to keep up with a growing population shifted instead towards concerns about the shock to farm incomes and the falling farm population (Baker, 1929; Gray and Baker, 1930). In addition to a decline in farm incomes, this decade witnessed large numbers of farm foreclosures and rural bank failures.[12] Altschul and Strauss (1937, pp. 2-3) attribute what they call the "long run depression" in agriculture during the 1920s and 1930s to an "accelerated expansion in agricultural production" combined with the "low elasticity of demand for agricultural products".[13] While several factors may have contributed to the farm depression, Altschul and Strauss (1937, p. 2) argue that "one feature stands out from the rest, namely, rapid mechanization and its consequences."

The process of modernization and mechanization in U.S. agriculture had been going on for some time — notably including the introduction and widespread adoption of the reaper in the 19th century. But the 1920s witnessed the rapid expansion of several important agricultural technologies, including the motorized tractor, the automobile, the combined harvester-thresher (or combine), and the corn picker (Gardner, 2006). These innovations served to increase the amount of land that a single worker could cultivate, and they reduced the need for horses and mules as sources of power. As a result, mechanization also served to increase the available farmland: as tractors replaced mules and horses, land that had previously been used for pasture and feed crops was freed up for other uses.[14]

The effect of mechanization was not uniform across the country, however; it varied by geographic area and by crop. Altschul and Strauss (1937) note that mechanization initially had the greatest impact on wheat production.[15] Even within crops, there was important geographic varia-

12. Alston (1983) investigates the farm foreclosures during the 1920s and 1930s and finds a positive association between farm foreclosures and elevated levels of "mortgage debt, depressed farm earnings, and ex post excessive expansion during the World War I agricultural boom," though the latter is not significant in the 1930s.

13. These same features are key characteristics of the model developed by Delli Gatti et al. (2012).

14. Citing data from O.E. Baker, Altschul and Strauss (1937, p. 31) estimate the displacement of horses and mules on farms between 1915 and 1939 resulting from the introduction of the automobile and tractor freed up about 10% of total cropland and pastureland for other uses (corresponding to about 30 million acres of cropland and 31 million acres of pastureland).

15. Areas where wheat was the principal grain crop and where the harvest season was accompanied by dry weather were particularly amenable initially to the adoption of combine harvesters. Farmers in the winter wheat regions (southern Great Plains) began to adopt combines earlier, whereas farmers in the spring wheat regions (northern Great Plains) were less amenable to the combine early on, fearing hailstorms and weeds. Some of these obstacles were overcome with the introduction of the windrower in the mid-1920s.

tion in physical and climatic characteristics affecting the suitability for adoption of different agricultural technologies. The Great Plains region was the most amenable to mechanization due to such characteristics as "wide extremes of temperature, low rainfall, high winds, a loose loam soil, and comparatively large stretches of level land" (USDA, 1932, p.417) — with sloped land being relatively unsuitable for tractor use. A decade earlier, Baker (1921) had noticed that "[t]he invention and extensive use in the United States of farm machinery, which is constantly becoming more efficient and essential to profitable crop production, has greatly increased the influence of topography in determining the utilization of land"; that is, hilly regions were "poorly adapted to the use of modern farm machinery." We investigate the relationship between farm mechanization and land topography in more detail in Section 5.2.

During the 1920s, a growing nonfarm sector absorbed many of the workers no longer needed on farms. But with the onset of the Great Depression, large numbers of workers were expelled from nonfarm employment. At the same time, farm prices fell dramatically, putting further strain on the agricultural sector. Nevertheless, the net flow of people between farms and cities turned sharply away from cities and towards farms during the early years of crisis.

3.2 The Great Depression and the Movement to Farms

Our analysis focuses on characterizing the changes in migratory patterns during the Great Depression, as well as studying its effects on other economic outcomes. As shown in Figure 1, the process of structural transformation described in the previous subsection was associated with a decline in the U.S. farm population. In the 1920s, the farm population fell from 32 million at the start of the decade to 30.5 million by 1927, where it stayed until the onset of the Depression. During the Depression, however, there was a remarkable reversal. The farm population *increased* by two million people between 1930 and 1933, reaching a level above that at the start of the 1920s. A decade of "structural transformation" was undone in a three-year period. Figure 2 illustrates that this was comprised both of an increase in migration to farms, as well as a sudden stop in the flow of migrants from farms to cities. Thus, it is not just that farm population was increasing due to differentially higher rates of fertility; the years 1931-33 were a period when the net flow to farms was positive. Economists writing at the time, such as Galbraith and Black (1938), noted this reversal of urbanization as well as an increase in the production of agricultural goods for own consumption.[16]

This reverse migration became the subject of commentary by politicians and popular authors at the time. In 1931, Franklin Delano Roosevelt, then Governor of New York, gave a radio address in which he asked, "Is it worthwhile for us to make a definite effort to get people in large numbers to

16. Galbraith and Black (1938, p. 311) write, "It is a matter of common observation that the last depression caused many farmers to increase their reliance upon their own foodstuffs. And the farm population increases more rapidly than usual at such times because of a checking or reversing of the farm-to-city migration".

move out of cities...? It seems to me that to that question we must answer an emphatic YES."[17] The themes around reverse migration are documented in the literature of the time (Conn, 2009). Ralph Bosordi's book, *Flight from the City* (1933) included how-to chapters on "Domestic Production," "The Loom and the Sewing-machine," and "Water, Hot Water, and Waste Water." Other writers approached these topics through fiction. *Now in November* (1934) by Josephine Winslow Johnson tells of a family's return to the countryside following layoffs at a lumber mill.[18]

4 Data

4.1 County-level data

Much of the data used in this paper comes from the U.S. Population Census and the Census of Agriculture, and specifically the county-level tables published by the U.S. Census Bureau. These data were digitized by Haines and the Inter-university Consortium for Political and Social Research (2010) and made available on the ICPSR website.[19] Digitized versions of the 1925 and 1935 Censuses of Agriculture are not available on ICPSR, but these were generously provided to us by Michael Haines, Price Fishback, and Paul Rhode.

To obtain county-level statistics on farm mortgage debt in 1930, we digitized the corresponding tables from the 1930 Census of Agriculture. County-level information on employment, sales and wages in the retail, wholesale, and manufacturing sectors has been made available by Price Fishback. The original data sources are described in detail in the appendix to Fishback et al. (2011).[20]

In all, we have data on county-level population every ten years from the decennial census of population for the years 1860 to 1940. We know the population on farms for certain years in which there was an agricultural census, including the decennial census years between 1900-1940, as well as for 1925 and 1935. The agricultural censuses also include information on crop production, land values and farms equipment values. Notably, we do not have county-level information on agricultural wages or total persons employed in agriculture, but we do have some information on farm labor, including cash expenditure on farm labor (for the years 1910, 1920, 1925 and 1930) and number of hired workers (for 1935). We also know the value of farm garden vegetables grown for home use (in 1930 and 1935), which we use as a measure of home production.

17. As quoted in Garraty (1987, p. 199). But, as Garraty observes (p. 122), the resettlement of urban workers into rural areas was not just a phenomenon in the United States. Brazil removed 40,000 from cities to rural districts in 1930, a similar commission followed in Argentina in 1932. From 1935, France, whose depression started last, began subsidizing rural return. The Canadian government's response to depression included a back-to-the-farm program (Bowen, 1999).

18. Johnson's book won the Pulitzer Prize for the Novel in 1935.

19. The data are available at the following url: `http://doi.org/10.3886/ICPSR02896.v3`.

20. The data can be downloaded from `https://econ.arizona.edu/faculty/webpage2_fishback_climate.asp`.

4.2 Individual-level census data

We also make use of individual-level data from the population censuses, including the IPUMS 5% sample for 1930 and the 1% sample for 1940. Both of these data sets include information on the county of residence, as well as whether or not the person lives on a farm. We also use the IPUMS samples in order to construct county-level characteristics that are unavailable in the county-level files, including statistics related to age, household composition, and industrial composition.

The 1940 census also recorded where people lived in 1935, and whether the 1935 residence was on a farm. For people living in rural areas in 1935, the county of residence was recorded; for others, the town or city was recorded. We cleaned the string variables reporting 1935 location in the IPUMS sample and matched them to 1935 counties, so that we can trace individual movements across counties between 1935 and 1940. We also make use of the IPUMS Linked Representative Samples, which match individuals between the full 1880 U.S. population census and earlier and later 1% census samples between 1850 to 1930.[21]

In addition, we use a sample of individuals from the 1920 population census who have been matched to records from the 1930 census; this data set was created by Boustan, Kahn, and Rhode (2012).[22] For this sample, we know the location of residence in 1920 and 1930, but we only know the farm status for 1920.

5 Empirical Methodology

5.1 The shock to industry

For the first part of our analysis, we want to test whether the movement to farms is driven by the economic downturn. In order to do so, we exploit variation across counties in the magnitude of the shock to the nonfarm sector.

Appendix Figure A2 displays the distribution of county-level changes in log manufacturing employment between 1929 and 1933. While virtually all counties witnessed a decline in manufacturing employment during this period, there is substantial variation in the depth of the shock.

To study the causal impact of the decline in nonfarm employment on the movement back to farms, we need to isolate some exogenous variation in the shock to nonfarm employment. Even though manufacturing industries are more likely than the retail and wholesale sector to be producing tradable goods, and thus less likely to be influenced by local demand, it is still possible that the

21. The data are available at `https://usa.ipums.org/usa/linked_data_samples.shtml`. Individuals are matched between the following pairs of years: 1850-1880, 1860-1880, 1870-1880, 1880-1900, 1880-1910, 1880-1920, and 1880-1930.

22. We are grateful to Leah Boustan for kindly sharing these data with us. Individuals were matched between the census rounds based on their first and last names, year of birth, and state of birth. We keep only those individuals for whom corresponding IPUMS data were available for 1920, dropping the "oversampled" individuals. See Boustan, Kahn, and Rhode (2012) for more details.

employment change in manufacturing is influenced by local economic conditions. In order to isolate more exogenous shocks to the local nonfarm sector, we construct two instruments that are strongly related to the local decline in manufacturing employment.

The IPUMS industry classifications categorize manufacturing industries into either durable and non-durable. We use this classification to construct our first instrument, which is simply the percentage of manufacturing employment in the county that is in durable industries. Romer (1990) has shown that the national consumption decline in durable goods was much greater than for non-durables; Rosenbloom and Sundstrom (1999) have demonstrated how this translated into lower employment growth for regions specialized in the production of durables.

As an additional instrument, we construct the Bartik-predicted change in county-level employment, or the "Bartik shock," after Bartik (1991). Using data from the 1930 and 1940 IPUMS samples, we determine the percentage change in aggregate national employment in each of the available industrial classifications. Using the 1930 IPUMS sample, for each county we determine the share of total county-level nonfarm employment in each industry. Then, we weight the national-level employment growth in each industry by the county-level employment shares, and this gives us the predicted employment change between 1930 and 1940.[23] The Bartik shock has the advantage that it is constructed using data from all nonfarm sectors, unlike the durables instrument. However, a disadvantage is that the Bartik shock is constructed using the change in employment over the entire decade, even though we are most interested in the shock during the early crisis years. For this reason, the durables instrument may provide a stronger prediction of the depth of the initial downturn.

Table 1 displays the first stage relationship between these two instruments and the change in employment in the manufacturing sector between 1929 and 1933. As expected, the percent durable employment is strongly (negatively) correlated with the change in manufacturing employment, while the Bartik shock is positively and significantly correlated. The joint F statistic for these two instruments is over 50. When we run the first stage separately for each instrument, the durables instrument results in a larger F-statistic (105) than the Bartik instrument (24.0).

5.2 Agricultural modernization and the movement to farms

The second part of our empirical strategy relates variation across counties in farm migration to characteristics of the local agricultural sector. We begin by showing the OLS correlations between county-level farm characteristics and rates of to-farm migration. In order to better understand the mechanisms at work, we then consider the effects of several instruments for the county-level suitability for modernized agriculture. We consider two characteristics of the land endowments: the

23. Since the 1940 sample is only a 1% sample, we do not compute the actual county-level change in employment by industry, which would be necessary in order to construct the "leave one out" measure of change in national employment by industry. Instead, we confirm that our results are robust to dropping counties that contain a large share of national employment in any one sector.

ruggedness of the terrain, and whether the county has direct access to navigable waterways. As mentioned above, the *ruggedness* of the land affects the suitability of the land for mechanized production. We take access to navigable waterways to be an instrument for transport costs or market access (broadly interpreted). We also examine the effects of access to credit and banking markets, which may facilitate agricultural modernization by allowing for easier access to capital.

We examine the effects of ruggedness on mechanization using two proxies for the level of mechanization on farms: the value of agricultural equipment and the number of tractors on farms. This also allows us to run instrumental variables regressions, in which we instrument for mechanization using the average ruggedness of the county, and examine the effects on migration and other outcomes.

Column 1 of Table 3a displays the first stage results in which we regress the proportion of farms with tractors on the average ruggedness in the county, conditional on state fixed effects. As expected, tractors are negatively correlated with ruggedness, and the relationship is strongly significant, with an F-statistic of 12.5.[24] Using the total value of farm equipment as an alternative measure of mechanization on farms, we again find a negative and strongly significant relationship with ruggedness.

When we regress baseline characteristics on ruggedness, it is clear that many of our baseline characteristics are not balanced between rugged and non-rugged areas; indeed, this is to be expected, since mechanization in US agriculture had been going on for some time. There are two important points to make here. First, we show that several key characteristics do not vary substantially by ruggedness during the decade prior to the 1920s, which supports our argument that the observed patterns during the Depression are related to the downturn. Second, part of our argument is that rugged areas are indeed different, and this is what makes the observed migration patterns so interesting. For example, these areas have lower land values and lower agricultural output per person precisely because they are less amenable to mechanized farming, and yet we see large inflows of population to these farms.

We also test whether the observed migration patterns are in some sense related to exposure to the market, holding constant the suitability of the land for mechanized production. To do so, we look at whether the county has access to a navigable waterway, which is likely to lower transport costs and make it easier for farmers to access markets for their output.

To further investigate our conjecture that market exposure reduces access to farms, we study the effects of exposure to banking and credit markets. During the time period of our study, variation in state-level banking regulations meant that access to banking services could change abruptly at state

24. We also run this regression separately for each state in order to show that the relationship is relatively consistent across space and not driven largely by a single region. Appendix Figure A1 displays the histogram of first stage t-statistics (on ruggedness) for the 48 separate regressions. The estimated relationship is negative in 41 out of 48 states.

boundaries (Rajan and Ramcharan, 2012; Calomiris and Mason, 2003).[25] We can test this conjecture by comparing the county-pair differences in farm mortgage debt for county pairs that straddle a state boundary to those for county pairs located in the same state. By county-pair differences, we mean that for each pair of neighboring counties in the U.S., we compute the absolute value of the difference across the two counties in the average farm mortgage debt-to-value ratio. When we regress this difference on an indicator for whether the neighbors are located in different states, the coefficient is strongly significant.

For our empirical specification, we regress the level of to-farm migration and the change in farm population on the debt-to-value ratio for farm mortgages in the county. The debt-to-value ratio is defined as the total value of outstanding mortgage debt for all owner-operated farms in the county divided by the total value of those farms. Our identification relies on cross-border differences in state-level debt ratios, and counties that are not located adjacent to a state border are dropped. The sample includes all possible pairs of geographically-adjacent counties located in two separate states — that is, all cross-border county pairs. Specifically, we estimate the following equation for county c located in cross-border county-pair p:

$$y_{cp} = \text{debt}_{cp} + \gamma_p + X_{cp} + e_{cp}$$

where γ_p is a fixed effect for the border county-pair. Each county is included in the sample one time for every pair of which it is a member; since many counties are located in multiple cross-border pairs, many counties will be in the sample more than once. Following Dube, Lester, and Reich (2010), we use multi-way clustering to adjust for clustering separately at the state level as well as the state-border-segment level. Doing so accounts for the arbitrary serial correlation induced by the fact that counties can be located in more than one pair, in addition to accounting for arbitrary serial correlation across counties within the same state. In order to ensure that we are identifying off of the variation provided by the state-level policies, we instrument debt_{cp} in the above equation using $\text{debt}_{s,-c}$, which represents the average debt ratio in state s after *excluding* county c.

6 Empirical Results

In this section, we first discuss our results on migration patterns during the Depression. As our main outcome variables, we focus on the county-level movement to farms from towns and cities, as well as the change in various measures of county-level population, including the farm population, urban population, and total population. We then turn to the effects on employment and output in the nonfarm sectors.

25. As noted in Rajan and Ramcharan (2012), inter-state banking was prohibited.

6.1 Impacts of nonfarm employment shocks on the migration to farms

We begin by examining the effects of county-level employment losses in the nonfarm sector on the movement to farms. Column 2 of Table 1 displays the results of a "reduced form" specification where we regress migration to farms directly on our two instruments for the nonfarm shock: the percent of manufacturing employment in durables, and the Bartik-predicted change in employment. A higher percentage of employment in durables (which corresponds to a bigger drop in nonfarm employment during the crisis) leads to a statistically significant increase in the proportion of farms in the county reporting a to-farm mover.[26] We also run an instrumental variables specification, where we predict the change in manufacturing employment between 1929 and 1933 using both of our instruments; the results indicate that a better performing manufacturing sector results in fewer farms reporting in-migrants. When we run the same regressions using the farm population as the outcome, we find similar results. A better-performing manufacturing sector leads to a relative reduction in the 1935 farm population (controlling for the initial 1930 farm population). The Bartik shock also enters significantly in the accompanying reduced form specification: a higher predicted increase in county-level employment is associated with a lower farm population in 1935.

The results here are consistent with the explanation that counties facing a larger shock to their nonfarm sector see higher levels of migration out of their towns and cities and onto their farms; that is, people are moving within the county from nonfarm residences to farms. Employment losses in nonfarm industries appear to serve as a "push" factor driving people out of nonfarm areas.

Because our data do not indicate where migrants are leaving from, we need to examine additional outcomes in order to confirm this explanation. We do so in Section 6.3 below. But first, we want to understand more about the farm areas that are receiving migrants.

6.2 Agricultural modernization and in-migration to farms

While the shock to the nonfarm sector acts as a "push" factor driving people out of towns and cities, we also want to investigate the "pull" factors that are attracting in-migrants to farms. We start by looking at simple correlations between the movement to farms and various characteristics of the local agricultural sector. Table 2 shows how people tend to move to farm areas with lower land values, lower values of farm equipment, and lower values of crop output. People also move to areas with less suitable land for growing crops, as proxied by the average water capacity of the soil or by the average agro-ecological suitability across six main crops. Interestingly, we note that our index of crop yield (i.e., output per acre) is not significantly correlated with migration to farms.[27]

These correlations suggest that people are moving to places with lower-value agriculture. We are especially interested in finding out to what extent the migration patterns are related to modern-

26. The coefficient on the Bartik shock is not statistically significant.

27. The index of yields is also uncorrelated with several measures of mechanized agricultural production, such as the percent of farms reporting tractors.

ization and mechanization on farms, so we consider the effects of our three instruments for suitability for modernized agriculture: land topography; access to navigable waterways; and cross-border differences in access to credit.

6.2.1 Land Topography

The suitability of farmland for mechanized agriculture is strongly influenced by land topography: places with plenty of smooth, flat farmland are the most amenable to mechanization. Table 3 displays the relationship between movement to farms and the average slope of the land in the county — our measure of ruggedness. There is a strong positive relationship between ruggedness and in-migration to farms. A 10 percentage point increase in slope corresponds to an increase in the percent of farms reporting a city-to-farm migrant of 1.4 percentage points. Similarly, ruggedness is strongly correlated with the change in the farm population, with a 10% increase in slope leading to about a 5% increase in the 1935 farm population.

In Table 4, we display the results of instrumental variables regressions, where we instrument the percent of farms reporting tractors in 1930 with the average ruggedness of the land. The results are highly significant. We do not interpret this estimate as the direct effect of tractors *per se*, since ruggedness affects agriculture and migration in more ways than simply through the prevalence of motorized tractors. Instead, we interpret tractors as a proxy for mechanized agriculture more generally. The estimated magnitudes are useful for interpreting the effects. The point estimate indicates that a 16 percentage point increase in share of farms with tractors (corresponding to 1 standard deviation) results in a 4.8 percentage point decrease (0.7 standard deviations) in the share of farms reporting in-migrants from cities. The table also shows the results of specifications where we use the total value of farm equipment as a proxy for mechanization, and instrument this using ruggedness. Again the results are strongly significant and indicate a relative decrease in population on mechanized farms.

6.2.2 Market Access

We expect access to navigable waterways to promote modernized agriculture through facilitating market integration via lower transport costs. Columns 4 and 6 of Table 3a further support our hypothesis that modernized agricultural production reduces the movement to farms: areas with better market access see lower rates of to-farm migration and relative decreases in the farm population during the crisis. Column 2 displays the relationship between market access and mechanization: there is a positive relationship between waterways and tractorization, but this relationship is weaker than the relationship between waterways and migration. In addition, when we add controls for ruggedness or tractors to the specification in column 4, the coefficient on market access continues to enter significantly (not shown). These results suggest that mechanization alone may not fully account for the observed relationship between migration and modern agricultural production. That

is, the mechanism prohibiting in-migration or driving out existing farm residents from these areas appears to be more than simply capital-intensive production reducing the demand for farm labor.

6.2.3 Credit Access

The results in panel (b) also support the interpretations so far: that modernization reduces movement to farms, and that the channel may be broader than simply mechanization. We see no relationship between measures of farm mortgage indebtedness and tractors on farms. But we do see a relationship with movement to farms. Columns 3 and 5 run cross-sectional regressions using all counties and including state fixed effects, and these results indicate that farm areas with more exposure to credit markets see lower rates of migration to farms. These estimates are likely to be plagued by omitted variables bias, however, since county-level farm mortgage debt is surely influenced by a number of factors.

To address these concerns, columns 4 and 6 display the results using the cross-border county pairs sample. These specifications include fixed effects for each county pair, and the county-specific debt ratio is instrumented using the state-level debt ratio. Comparing neighboring counties ensures that these areas are likely to be similar in terms of factors like climate and topography. Instrumenting with state-level variables allows us to exploit the differences in credit exposure due to state-level banking characteristics. Column 4 indicates the estimated effect of the debt ratio on in-migration; while the point estimate is negative, it is not statistically significant at conventional levels. But the result in column 6 indicates that counties with higher debt-to-value ratios see relative declines in their farm population between 1930 and 1935. These results suggest that either fewer people are moving to farms in highly leveraged counties, or more people are leaving farms, or both.

6.3 Characterizing the migration flows

One of the challenges we face with the available data on migration to farms is that we are only able to observe the locations where people are moving to, and not where they are coming from. But by separately examining the effects on migration and population changes, and by looking at the effects of both "push" and "pull" factors, we are able to infer quite a bit about the migration patterns. Table 5 displays the results of regressions where we examine the effects of ruggedness and nonfarm employment shocks on a number of population-related outcomes.

The results in Table 1 described above suggest that in counties experiencing larger negative shocks to their nonfarm sector during the Depression, people are leaving the towns and cities and moving to farms. In Table 5, we find additional support for this interpretation. The table shows the effects on total county-level population, urban population, and rural population. We have information for these variables for 1930 and 1940, but not during the middle of the decade. Larger employment losses in the nonfarm sector translate into a decline in total population, total urban population, and the percent located in urban areas, but an increase in the percentage of the population

on farms.[28] Taken together, these results indicate that negative shocks to nonfarm employment lead to movement within the county from towns and cities onto farms, and they also drive people out of the county.[29]

The specifications in Table 5 also display the effects of county-level ruggedness. As we saw earlier, rugged areas see higher rates of in-migration to their farms and a bigger increase in their farm population. Table 5 indicates that these areas also see relative increases in their total population over the 1930s, and this increase is driven entirely by increases in the rural population. If anything, these rugged counties see a relative decline in their urban population, though the coefficient is not statistically significant in the specification shown in Table 5. Accordingly, rugged counties also see a decline in the percent of the population in urban areas and a rise in the percent on farms. Compared to less rugged areas, these counties are de-urbanizing and becoming more agricultural. The people moving to farms in rugged areas appear to be coming not only from nearby towns and cities, but also from other less rugged counties, thus contributing to a rise in county-level population. At the same time as the U.S. experiences a reallocation of the population into the agricultural sector as a whole, it also sees a reallocation of the existing farm population away from more-productive farmland towards less-productive farmland.

An important limitation of our data is that we do not have direct information on the flows of individuals between locations, so we can only compare the relative differences across regions in population levels or in rates of in-migration. This means that when we observe a negative coefficient estimate for the effect of ruggedness on urban population, we cannot distinguish between the following two scenarios. It could be that, within rugged counties, there is a flow of individuals from towns to farms; or, it could be that, within non-rugged counties, there is a flow of individuals from farms into the cities.

6.4 Mechanisms and alternative explanations

We now investigate the mechanisms through which ruggedness might matter. One reason likely has to do with its effects on land prices. Less rugged farm areas have higher values precisely because of their better suitability for mechanized farming, and economic refugees fleeing the cities during the Depression are probably searching for inexpensive land.

Indeed, while this explanation is likely to account for a sizable portion of the observed migration patterns, we note that it is not the only dynamic at play. For example, at the same time that large

28. The results for total rural population are more ambiguous, and the two instruments give conflicting results. There are likely two competing effects: a positive shock to nonfarm employment pulls people into the county, some of whom are moving to towns still classified as rural, contributing to an increase in the rural population; but the positive shock also pulls people off farms and into towns and cities, contributing to a decrease in rural population. The overall effect is some combination of these separate effects.

29. Unfortunately these results do not tell us what percentage of people leaving the county are moving to farms in other counties or to other cities.

numbers of people are moving to farms, there are large numbers of people leaving farms. Appendix Figure A3 displays the histogram of county-level changes in log farm population between 1930 and 1935. Thirty-seven percent of the counties in the sample witness declines in their farm population over this period. Of those, 37% have durable manufacturing shares above the median — meaning that their nonfarm sectors are performing worse than average, and so the decline in farm population is not likely to be driven by a booming nonfarm sector. Additionally, 31% of counties see a drop in their total population between 1930 and 1940, and these counties tend to be less rugged.[30]

The Depression witnessed a large shock to the agricultural sector in the form of falling prices. As a result, expenditures on inputs fell dramatically as well, including expenditure on farm labor. The places with the largest decline in cash expenditure on farm labor also see the largest decline in farm population. This decline in farm labor expenditure was largest in the least rugged areas — those places with the most tractors and the highest-value agriculture.[31] This result points to a second possible channel: the agricultural labor market. When the commercial farm sector gets shocked by the Depression, the demand for farm labor falls dramatically, and the consequence is out-migration of farm workers from the commercial farm sector.

Beyond wage workers we also see strong correlations between the decline in the farm population and the percent of farms operated by tenants. Tenancy is a pervasive feature of the agricultural labor market at the time. Rather than hire laborers and pay them wages, many landowners rent land to tenants, who pay in cash, or with a share of farm output, or by working on the owner's land. When the crisis hits, these areas see the lowest levels of to-farm migration and the biggest drops in farm population, as many existing tenants leave (or are forced off) their farms. Appendix Table A2 displays the relationship between migration to farms and the prevalence of tenant farms. In-migration to farms is negatively related to farm tenancy, and strongly so. Similar results hold for the change in farm population. In contrast, places with many owner-operated farms are more likely to absorb in-migrants and less likely to see declines in population. These results suggest that the migration patterns are affected by property rights and the consequent impact on access to the land.

Table 6 displays the results from regressions examining the effects of ruggedness and the non-farm employment shock on the production of garden vegetables for home consumption on farms. Rugged areas see a relative increase in the total production, as well as production per farm resident, relative to less rugged areas. This result indicates that the people moving to farms are engaging in subsistence production. Since this type of production is likely to be less mechanized and less capital-intensive than commercial production, the relative disadvantage of rugged areas is likely to be far smaller.

In addition, places with a higher employment share in durables see relative increases in this

30. When we regress an indicator variable for negative population growth on ruggedness, the estimated coefficient is negative and highly significant.

31. Prior to the downturn, these places had higher levels of farm labor expenditure, on average.

home production as well — these are the places that experience worse shocks to their nonfarm sectors. This result indicates that the shock to market-based work leads people to substitute into home production, which is consistent with the findings of Aguiar, Hurst, and Karabarbounis (2013) for the contemporary U.S.

Columns 3 and 4 of Table 6 display the effects on the composition of farm labor between family and hired labor. Rugged areas see a higher proportion of farmwork in 1935 performed by family members of the farm owner. The same result holds for areas experiencing worse shocks to their nonfarm employment. These findings are consistent with our interpretation so far: that people are moving to rugged areas and engaging in small-scale farm production, rather than being drawn there by better formal employment opportunities on farms.

6.5 Effects of migration on nonfarm sector

In the previous section, we established that land topography has a large impact on migration: ruggedness acts as a strong "pull" factor attracting people to farms. We now use this fact to examine the effects of the back-to-farm movements on the local economy. Comparing rugged areas to less-rugged areas, we examine the economic performance of the local *nonfarm* sector. Specifically, we look at the change in employment, sales, and wages at the county level between 1929 and 1935 in the retail, wholesale, and manufacturing sectors.

Table 7 reports the results from a regression of county-level log employment, log sales, or log total wages on ruggedness. The specifications are panel regressions with county fixed effects, containing data for several years. Data availability varies across outcomes and sectors. All specifications contain data for the years 1929, 1935, and 1939, and some specifications include data for 1931, 1933, or 1937. We estimate the following equation for county c in year t:

$$y_{ct} = \gamma_c + \delta_t + \beta_{1t} \cdot \delta_t \cdot \text{ruggedness}_c + \beta_{2t} \cdot \delta_t \cdot \mathbf{X}_c + \epsilon_{ct}$$

where γ_c is a county fixed effect, δ_t is a year fixed effects and $\mathbf{X}_c$ is a vector of county-level controls containing the log population and log farm population in 1930 and the initial 1929 level of the dependent variable. We interact county-level ruggedness with the year fixed effects, and omit the interaction for the initial year, 1929. As a result, the coefficient on the interaction can be interpreted as the effect of ruggedness on the outcome in that year, relative to 1929.

Panel (a) of Table 7 presents the results for the retail and wholesale sectors. The point estimates on log total retail sales are negative for 1933, 1935, and 1939, but only the 1935 estimate is significant and only at the 10% level. These results suggest that retail sales are falling in rugged areas, relative to their less rugged counterparts; at the very least, sales are not increasing in rugged areas. This is despite the fact that rugged areas see a large influx of migrants and a consequent increase in the total county population. We saw above that the increase in population was entirely explained

by the movement to farms. Since many of the people moving to farms are presumably poor or unemployed, their consumption levels are likely to be lower than average. And many of them may be moving in with relatives, so their housing demand would be low as well. We might therefore have reason to expect a decline in per capita sales in the places receiving migrants, but it is rather surprising that we also witness a decline in aggregate sales. In column 4, we see that total wholesale sales declines in these areas as well, and the coefficients are strongly significant.

Looking at the effects on employment and wages in retail and wholesale, in both sectors we see a decline in employment and an increase in the aggregate wage bill. This result allows us to rule out that the observed effects are driven entirely by changes in the demand for labor, since shifts in labor demand cause employment and wages to move in the same direction. But in our case, we observe a relative increase in wages accompanying a decline in employment, which means that, in addition to any changes in labor demand, there are differential changes in labor supply between rugged and non-rugged areas. The results correspond to either a fall in labor supply in rugged areas, or an increase in labor supply in non-rugged areas, or some combination of both. Because we are identifying *relative* changes only, we are unable to distinguish between these scenarios. Both scenarios seem plausible: the shock to the nonfarm sector could make moving to farms an attractive option, one that people in rugged areas are more able to take advantage of; alternatively, people in non-rugged areas who have been forced off of farms or laid off from factories could be crowding in towns and cities looking for nonfarm employment opportunities.

Moreover, in our case we see a relative increase not just in average wages, but also in the aggregate wage bill. This result is more likely to occur when the demand for labor is *inelastic*. We can interpret the observed increase in wages in the retail and wholesale sectors as evidence that the demand for labor is relatively inelastic, which makes sense in the context of a severe depression.

7 Conceptualizing the Aggregate Impacts

Our paper draws attention to the role of the agricultural sector in providing a source of informal social protection during times of crisis. In this section, we describe how our earlier results — based on observed variation across local labor markets — can help us understand the overall impacts on the broader economy. We do so in part by contrasting the effects of the movement to farms with formal methods of social protection, like unemployment insurance.

7.1 Unemployment insurance reduces the movement to farms

We begin by asking the following question: How does the provision of formal insurance affect the uptake of informal protection? Intuition suggests that if formal social protection is made available, people will be less likely to rely on informal means of protection. We confirm this prediction using data from the *second* half of the 1930s, where we find evidence that the provision of unemployment insurance reduced the movement from cities back to farms.

Using individual-level data from the 1940 census, we have information on a person's location (the county) in both 1935 and 1940, as well as their farm status in both years. In 1935, Congress passed the Social Security Act, which created the federal-state unemployment compensation program that persists to this day.[32] The Act contains grants and strong incentives to encourage states to set up an unemployment insurance program, subject to certain requirements, and all states complied. Some states took longer to begin paying benefits than others, and the timing of the first benefit payments varied by state. The first state in which benefits became payable was Wisconsin, in July 1936; the final two states were Illinois and Montana, in July 1939.[33] Using the census data, we look at how the introduction of UI is related to the likelihood of a 1935 nonfarm resident moving to a farm by 1940. We estimate the following equation for individual i located in county c and state s in 1935:

$$y_{ics} = \alpha + \text{UI\_share}_s + \epsilon_{ics}$$

where UI_share_s represents the proportion of months between 1935 and 1940 that UI benefits are being paid in state s, so that the value is larger for states that begin paying benefits earlier. The outcome y_{ics} is an indicator variable for whether person i lives on a farm in 1940, and the sample is restricted to 1935 nonfarm residents. The results are displayed in Table 8, and indicate that having UI benefits available earlier reduces the probability that a nonfarm resident moves to a farm.

We take these results as suggestive evidence that access to formal social insurance reduces the movement back to farms during times of crisis, and thus substitutes for informal means of insurance. We say *suggestive* since the empirical strategy suffers from some important limitations. Most notably, our variation is only at the state level, and we should not expect the timing of benefit payments to have been randomly assigned across states. In addition, the period 1935-1940 comes well after the deep downturn of the early 1930s and the large wave of migration to farms; and while there is a deep recession in 1937, there are also periods of recovery from 1935-1937 and 1939-1940.

7.2 Macroeconomic implications of social insurance

In this section, we consider the ways in which individual strategies to cope with shocks could have spillovers on the broader economy and the depth of the economic downturn. The results in Section 6 suggest two effects worth considering: (1) the movement to farms appears to facilitate a withdrawal from the market economy; and (2) the availability of nearby farmland has notable effects on wages in the nonfarm sector. We discuss both of these effects below. To guide the discussion, we contrast the

32. Changes have been made over time, of course. For more information on the structure and setup of the UI compensation program, see Baicker, Goldin, and Katz (1998).

33. The dates on which benefits were first payable come from the General Notes section of the *Unemployment Insurance Financial Data Handbook* of the U.S. Department of Labor, available at the following url: http://workforcesecurity.doleta.gov/unemploy/hb394/notes.asp. If you are reading this from the future and the link no longer works, try the Wayback Machine: http://web.archive.org/web/20130513150353/http://workforcesecurity.doleta.gov/unemploy/hb394/notes.asp.

observed outcomes with two counterfactuals: How would the provision of unemployment insurance payments change the results? And what if there were no available farmland for people to migrate to?

7.2.1 The movement to farms and market withdrawal

Our earlier regression results suggested that the movement to farms caused a drop in sales and employment in the local nonfarm sectors. But this does not necessarily mean that there was a corresponding decline in *total* consumption or even hours worked. This is because we are lacking detailed data on non-market consumption and production, as well as detailed information on consumption and work in the agricultural sector. It might even be the case that individuals moving to farms are able to increase their overall consumption levels relative to other available alternatives — which is likely to be the point of moving to the farm, after all. What we do know, however, is that there appears to be a decline in market-based consumption and employment and a corresponding rise in home production.

So how should we think about the effects of this shift away from market-based demand towards home production? Is the main importance simply that a portion of the consumption in rugged areas has shifted into sectors for which statistics are harder to collect? In fact, there is good reason to believe that this result matters for more than accounting purposes. This reason is that there are likely to be spillovers associated with changes in market demand — spillovers that are not counteracted by a corresponding increase in non-market consumption.

In the most simple and general terms, if we assume that there are some sort of agglomeration economies within the market sector which are not present in the non-market sector, then a movement from the market to the non-market sector could have a greater than one-for-one impact on market-based output and lead to a drop in total output.

Another way to think about this is in terms of a textbook Keynesian model of the macroeconomy. In a simple Keynesian framework, a reduction in aggregate demand has an associated multiplier effect, leading to a further decline in output and employment. If the dynamics of the multiplier effect are different for market versus non-market consumption, then we would expect a "diversion" of a unit of consumption away from the market to have spillover effects.

To clarify, suppose that market-based demand declines by 1 unit, resulting in a decline in output of $1 + \epsilon$, for $\epsilon > 0$, where ϵ represents the additional decline in output due to a multiplier effect. In addition, suppose non-market consumption increases by 1 unit, but that there are no multiplier effects associated with non-market consumption. As a result, aggregate output — the sum of market and non-market output — declines by ϵ, as the losses to the market sector are larger than the gains in the non-market sector.

Now we ask how the observed outcomes might differ under two counterfactual scenarios, be-

ginning with the effects of formal social insurance payments like unemployment compensation. If unemployed workers receive cash payments, they are likely to increase their market-based consumption. They may also be less likely to move to farms — consistent with the results from Section 7.1 — and instead remain in towns and cities, and thus less likely to engage in home production.

Suppose an individual receives cash payments and that these payments keep him from migrating to a farm. Suppose further that the payments are just equivalent to what he would consume by moving to a farm, such that his overall income and consumption are identical in either scenario. By diverting consumption towards the market sector, these payments could have spillovers on aggregate demand, leading to increased output, even though they have no effect on the recipient's overall level of consumption. The point here is that the movement to farms can have negative spillovers on the market economy by facilitating a "withdrawal" from the market, and social insurance payments counteract this effect.

What about the second counterfactual scenario? Suppose that there were no farmland for people to migrate to. Our regressions compare places with nearby rugged farmland to places with flatter land nearby, and the results show that non-rugged areas see a relative increase in their urban population and their nonfarm employment. In areas with non-rugged land nearby, there is less opportunity to move to farms, and as a result either fewer people leave nonfarm employment or more people try to obtain jobs in the nonfarm sector. Therefore, in the absence of available farmland there does seem to be less "market withdrawal." At the same time, we see a big decline in relative wages, such that aggregate wages fall further in the non-rugged areas, suggesting that the lack of available farmland for out-migration can also have negative effects on the nonfarm economy. The next section explores this further.

7.2.2 Wage deflation and surplus labor

As we have seen, the rugged farm areas absorb a large number of in-migrants. The people moving to rugged farms are coming from nearby towns and cities, as well as from farther away counties and states. But our presumption is that migration costs are related to distance, so that people with available farmland nearby are more able to move to farms — and our results bear this out. Towns that are located in rugged areas perform differently from towns in less-rugged areas.

One of the most striking differences is the performance of the local nonfarm sector. There is a large relative increase in retail and wholesale employment in less-rugged areas, but a corresponding decline in aggregate wages. In a competitive labor market framework, this result implies a relative increase in nonfarm labor supply in areas with less farmland available, and that this effect on supply depresses wages. In the context of a deflationary contraction like that of the U.S. from 1929-1933, further downward pressure on wages could have depressing effects on employment and output.

We cannot work out the aggregate implications of these several competing effects without more

assumptions and a fully-specified structural model. But it is nonetheless useful to consider again our two counterfactual scenarios. This time we begin with the question: What if there were no available farmland to migrate to? The migration to farms appears to be absorbing a large portion of the population, and presumably a disproportionate share of the unemployed or underemployed population. We can think of the rugged farm sector as absorbing surplus labor in a demand-constrained economy. If there were no farms at all, more people would be trying to gain employment in the nonfarm sector, putting upward pressure on employment and downward pressure on wages. The net effect on output and welfare is unclear, as it is possible that the deflationary pressure from lower wages or increased aggregate supply pushes the economy further into depression.

What about the second counterfactual — providing unemployment compensation to laid-off workers? We discussed above how unemployment insurance payments could reduce the movement to farms and corresponding withdrawal from the market. Here we note that cash payments may also reduce the deflationary pressure in the nonfarm labor market: in the same way that nearby farmland leads to a reduction in labor supply and an increase in aggregate wages in the nonfarm sector, we might expect to observe similar outcomes as a result of formal insurance payments.

***

There are several effects to consider when evaluating the overall impact of the movement to farms on the aggregate economy, and while the aggregate impacts are not identified in our regressions, the results are nonetheless informative. People are moving to farms for a means of subsistence, such that the welfare effects for individuals in distress are of first-order importance. There may also be negative spillovers on the market economy due to the shift away from market-based trade. And there could be positive spillovers on the market economy as the farm sector absorbs surplus labor, providing subsistence to the unemployed and pushing back against deflationary pressures. One implication that is especially interesting is that the provision of formal insurance payments may push back against negative spillovers from both of these effects: it can reduce the movement to farms and associated drop in market-based demand; and it can reduce the deflationary wage pressure in the nonfarm labor market by reducing search intensity.

7.3 Agriculture and the causes of the Great Depression

As mentioned earlier, our findings are relevant to the literature examining the effects of the shock to agriculture on the downturn in the global economy. The commercial agricultural sector was in deep distress, shedding jobs and population. And these losses seem to be related to both technology and the distribution of ownership over productive resources.

There is one more thing to note, however. The movement of large numbers of unemployed people into subsistence agriculture is likely to have had important effects on the price level of agricultural products. As people substitute into home production, we can think of this as either an

increase in total production of agricultural goods, or a drop in the market-based demand for these goods. Either way, the impact on prices is unambiguous: agricultural prices are likely to fall.

This effect is especially worth considering given the attention paid to the potential role of the agricultural price decline in exacerbating the depth of the downturn (Ohlin, 1931) and contributing to the international transmission of the Great Depression (Madsen, 2001). Several recent models suggest that this downward pressure on agricultural prices could deepen the downturn. For example, Delli Gatti et al. (2012) argue that the shock to the agricultural sector could lead to a drop in overall aggregate demand, depressing output and employment. More generally, the decline in agricultural prices puts downward pressure on the overall price level. If the monetary authority is unable or unwilling to combat this deflationary pressure, the resulting increase in the expected real interest rate can reduce aggregate employment and output (Eggertsson, 2010).

8 Conclusions

> It was an old place and the land had been owned by Haldmarnes since the Civil War, but when we came no one had been living there for years... The land was stony, but with promise...
>
> Josephine Winslow Johnson, *Now in November*, 1934

The results in this paper have important implications for our understanding of the longer-run processes of economic development. Economic models of structural transformation contain assumptions about the process by which individuals transition from one sector into another. Explicitly studying this transition process over relatively short-term time scales and using micro-level data, as we do in this paper, can help us develop a better understanding of the transition dynamics influencing longer-run structural transformation. Our results therefore allow us to consider the assumptions contained within popular models of growth and development. We comment on two such models: models that emphasize the so-called food problem; and models that emphasize the presence of surplus labor.

A class of models in the literature around the transition from an agriculture-based economy to an industrialized economy emphasizes the so-called "food problem": the idea that poor countries are largely agrarian because of low productivity in the agricultural sector, which requires a large portion of the population to be engaged in agriculture in order to meet the food needs of the population (Schultz, 1953). In these models, agriculture is "special" because it produces a special output — food — which has the unique characteristic that it's a basic good that everybody needs, but people only need so much (i.e., its share of expenditure falls as income rises). Industrialization occurs as agricultural productivity increases, because fewer farm workers are needed in order to meet the nation's food requirements, and so workers transition into nonfarm industries. Our paper presents a challenge to this class of models: not only does the glut of cheap farm products during the crisis

fail to spur industrial growth, but also a large number of the people thrown off farms as a result of productivity improvements actually move into lower-productivity agriculture, rather than into the modern sector.

We also bring renewed attention to the concepts of surplus labor and access to land for the poor and dispossessed. The early development literature on the dual economy focused attention on the distinction between the traditional sector and the modern sector. The traditional sector was often talked about in the context of agriculture, but authors were careful to note that the two were not necessarily synonymous (Lewis, 1954; Ranis and Fei, 1961); some parts of the agricultural sector look particularly "modern" and some nonfarm employment looks more traditional.

In many developing countries, available farmland is scarce: there is no abundance of unused land that is well-suited for agriculture. In a dual economy framework, the fixed amount of available farmland is split between the modern agricultural sector and the traditional agricultural sector. As more land is converted into the modern sector, it means that less is available for the traditional sector. The results in this paper emphasize that this is an important distinction to take into account. We find that the traditional agricultural sector shows a remarkable ability to absorb surplus labor during a crisis. But in the modernized agricultural sector, precisely the opposite is true: people are driven off the land during crisis, either to nearby towns or to be absorbed by the less modernized farm areas.

And so the process of modernization in agriculture has a direct impact on the ability of the countryside to provide "farm-financed social welfare" (Owen, 1966). If back-to-farm migration is one of the few sources of insurance available, then a heavily modernized agricultural sector could lead to large welfare losses during an economic crisis, insofar as it restricts the ability of this land to provide insurance. At the same time, we have shown how back-to-farm migration could exacerbate the downturn in the market economy, reducing output in the formal or nonfarm sectors. Thus, formal social insurance could be welfare-improving, to the extent that it provides similar consumption insurance as informal migratory mechanisms but avoids negative spillovers on the market economy.

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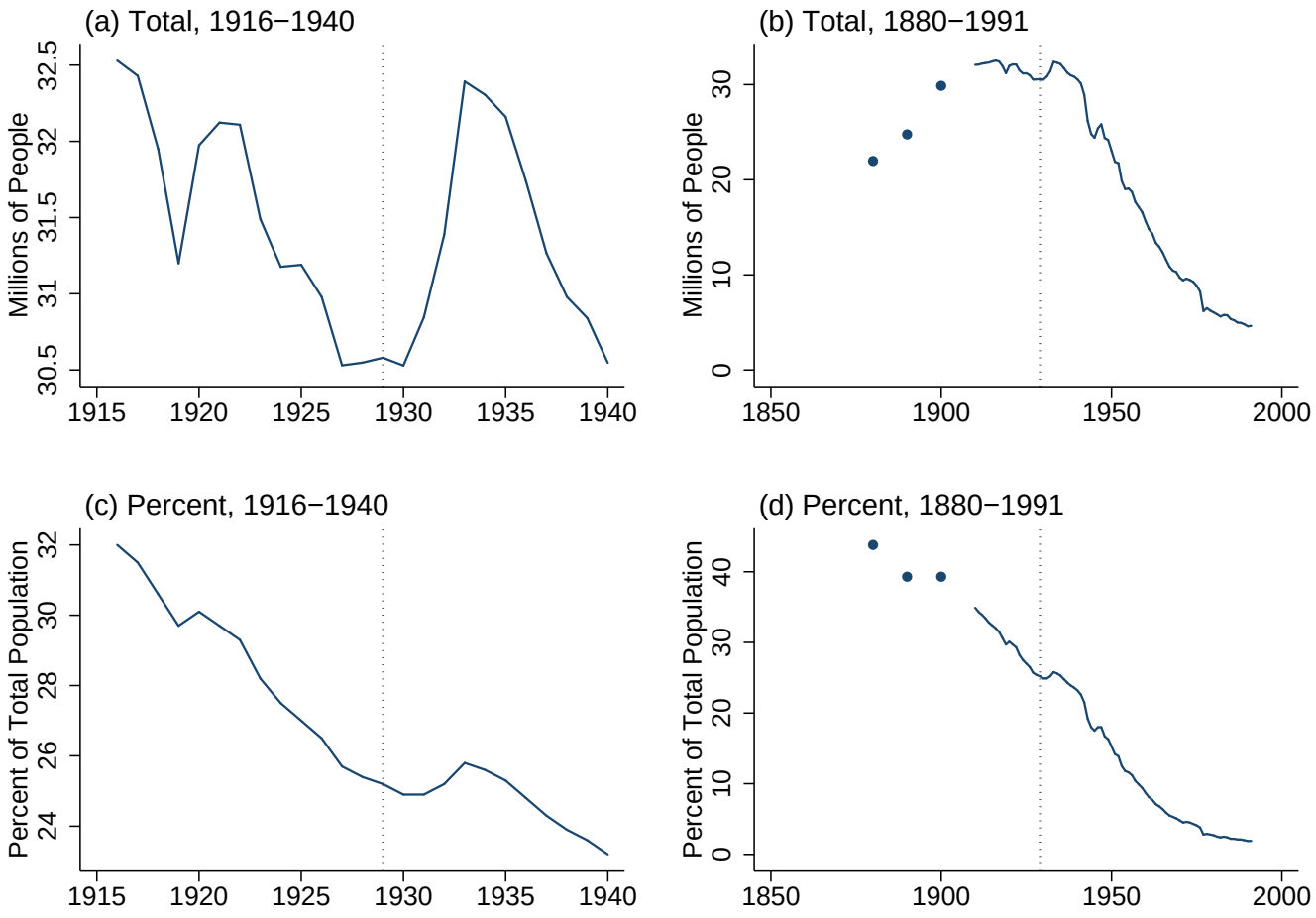
Figure 1: U.S. Farm Population

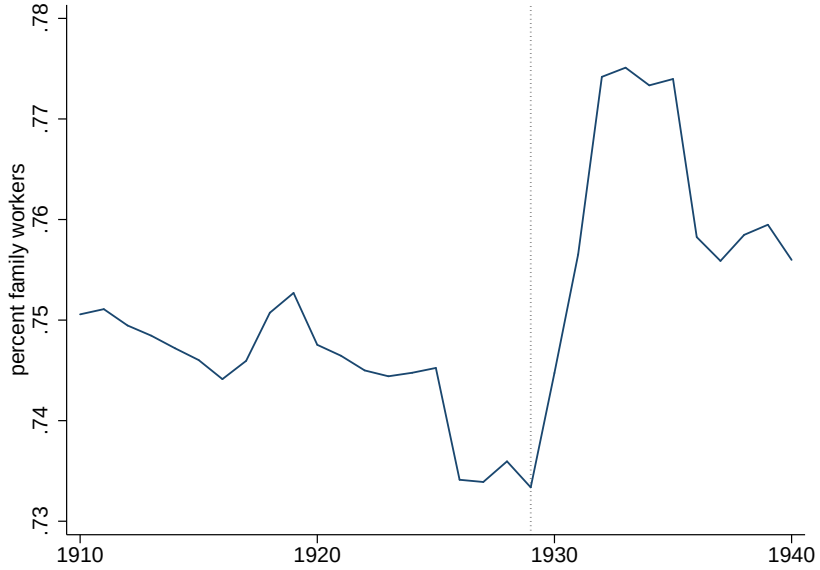


Notes: The figures display the total U.S. farm population over time, and the farm population as a share of total population. Data is available for 1880, 1890, and 1900, and then for each year beginning in 1910. Panels (a) and (c) restrict the series to the years 1916-1940. The dotted vertical line is placed at 1929 to indicate the onset of the Great Depression. The farm population reached its peak level in 1916. *Source:* Series Da1, Da2, Da14, and Da15 from Olmstead and Rhode (2006).

Figure 2: Migration between farm and nonfarm residences

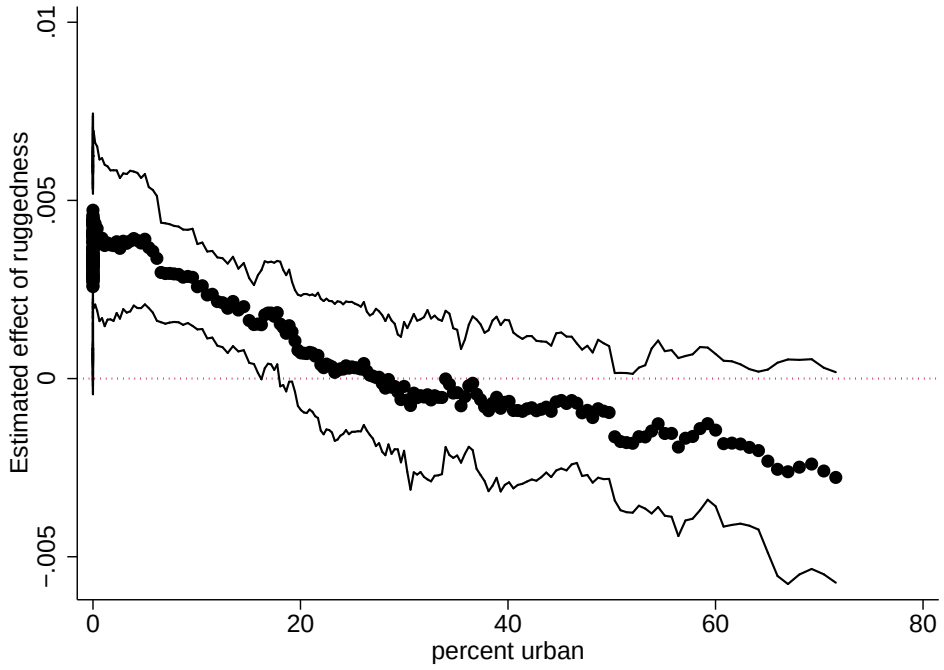
Notes: This figure shows the yearly change in the farm population resulting from internal migration between farms and nonfarm residences. The series labeled "from farms," for example, represents the number of people (in thousands) who move from a farm to a nonfarm residence in that year. *Source:* Series Ac416, Ac417 and Ac418 from Ferrie (2006).

Figure 3: Percent farm workers that are family members.



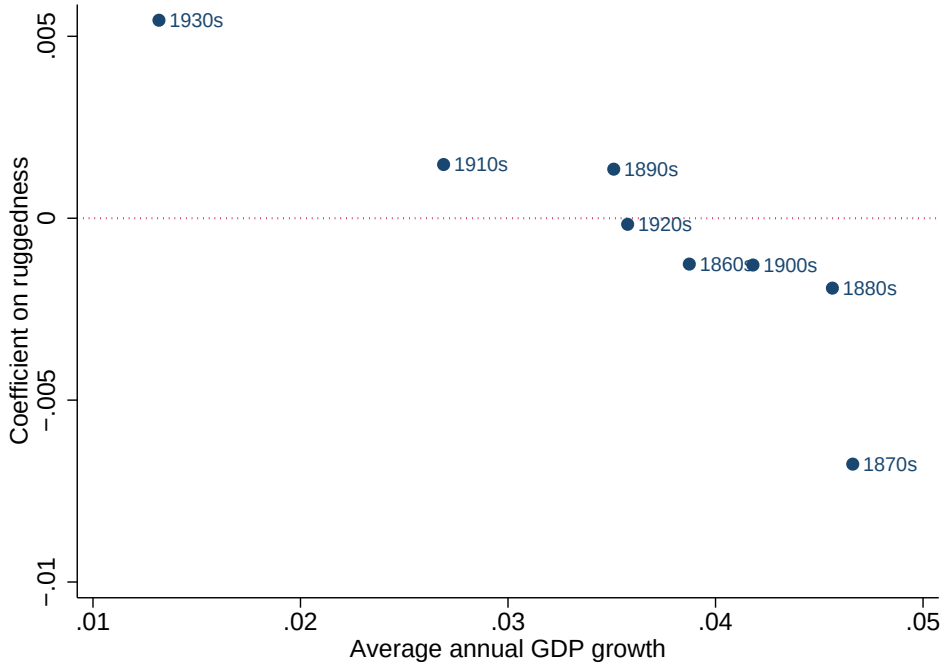
Notes: This figure displays the percentage of all workers on farms who are related to the farm operator. Workers are classified as either hired or family. This percentage increases during the early years of the Depression, as the total number of paid workers falls while the total number of family workers increases. *Source:* Farm Employment and Wage Rates 1910-1990. National Agricultural Statistics Service, Estimates Division, U.S. Department of Agriculture. Statistical Bulletin No. 822 (March 1991). Available at `http://usda.mannlib.cornell.edu/`.

Figure 4: Effect of ruggedness on change in county-level total population 1930-1940, by percent urban.



Notes: This figure reports the coefficients from a series of regressions of county-level log population in 1940 on ruggedness of nearby areas, controlling for log population in 1930. Counties are first ordered according to percent urban, and then a series of regressions are run using adjacent subsamples, ranging from the 400 least urban counties to the 400 most urban counties. The coefficient on ruggedness is then plotted against the average percent urban value of the 400 counties in the estimation sample. (There are actually 1578 counties that are 0% urban, hence the large collection of estimates at 0.) The ruggedness measure used here is the simple average of own-county ruggedness and the average of all neighboring counties, or $\frac{\text{own+nbr\_avg}}{2}$. The regression specification includes census division fixed effects, and standard errors are adjusted for clustering at the state level; 95% confidence intervals are displayed.

Figure 5: Effect of ruggedness (on rural population) vs. national GDP growth



Notes: The figure plots the estimated effect of ruggedness on the change in rural population in each decade between 1860 and 1940. The estimates are obtained from a pooled regression of 10-year changes in log rural population vs. the interaction between ruggedness and dummy variables for each decade, controlling for state and year fixed effects. Each point estimate is then plotted vs. the average annual GDP growth during the corresponding decade. Rugged areas see bigger relative losses in rural population during decades with faster GDP growth.

Table 1: Movement to farms vs. county-level manufacturing employment shock

	Δ Mfg Emp	Movers to Farms 1930-35			Log Farm Population 1935		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	1st stage			IV			IV
Δ Mfg Emp 1929-33			-0.00192	-0.0298**		-0.0139**	-0.0866***
			(0.00207)	(0.0129)		(0.00668)	(0.0323)
% Mfg in Durables	-0.538***	0.0148**			0.0287*		
	(0.0553)	(0.00611)			(0.0167)		
Bartik Shock 1930-40	0.405***	-0.0125			-0.129***		
	(0.0945)	(0.0151)			(0.0366)		
Observations	1990	2907	2002	1990	2907	2002	1990
R^2	0.146	0.461	0.497	0.459	0.976	0.974	0.971
F stat on instruments	51.26						

Notes: The dependent variable in column (1) is the change in manufacturing employment 1929-1933; in columns (2)-(4), it is the percentage of farms in the county reporting at least one to-farm migrant; in columns (5)-(7), it is the log farm population in 1935. All specifications include controls for log population and log farm population in 1930, as well as state fixed effects. A "to-farm migrant" is defined as a person living on a farm in 1935 who resided in a non-farm area 5 years earlier. "Δ Mfg Emp 1929-33" is the change in county-level log manufacturing employment between 1929 and 1933. "% Mfg in Durables" is the percentage of manufacturing employment in the county in 1930 in industries classified as producing durable goods. The "Bartik Shock 1930-40" is the predicted percentage change in employment based on the county-level industrial composition in 1930 and the national industry-level changes in employment between 1930 and 1940. "IV" in columns (4) and (7) indicates that these are insturmental variables specifications in which we instrument for the change in manufacturing employment using the durable percentage and the Bartik shock. Column (1) displays the "first stage" relationship between these instruments and the change in manufacturing employment. Robust standard errors in parentheses, adjusted for clustering at the state level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 2: Movement to farms vs. county-level agricultural characteristics

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
log value per acre 1930	-0.00818**						-0.000278
	(0.00343)						(0.00292)
log value farm equipment 1930		-0.0108***					0.00317
		(0.00391)					(0.00570)
log crop value per farm pop 1930			-0.0154***				-0.0178**
			(0.00525)				(0.00665)
soil average water capacity				-0.333***			-0.214***
				(0.0779)			(0.0790)
avg suitability, 6 crops					-0.0459***		-0.0324**
					(0.0134)		(0.0131)
yield rank 1900						-0.00431	0.00897
						(0.0103)	(0.0105)
Observations	2127	2127	2125	2072	2118	1918	1890
R^2	0.446	0.449	0.456	0.468	0.446	0.465	0.488

Notes: The dependent variable is the percentage of farms in the county in 1935 reporting at least one person living on the farm who had resided in a non-farm area 5 years earlier. All specifications include controls for log population and log farm population in 1930, as well as state fixed effects. The sample is restricted to rural counties only, defined as those with less than 30% of the population located in urban areas in 1930. Robust standard errors in parentheses, adjusted for clustering at the state level. * p $<$ 0.10, ** p $<$ 0.05, *** p $<$ 0.01.

Table 3: Agricultural Modernization and the Movement to Farms

(a) Ruggedness and water transport access

	% Farms w/ Tractors		Movers to Farms 1930-35		Log Farm Population 1935	
	(1)	(2)	(3)	(4)	(5)	(6)
ruggedness	-0.421***		0.139***		0.496***	
	(0.119)		(0.0312)		(0.0460)	
water transport access 1860		0.0132*		-0.0112***		-0.0210**
		(0.00761)		(0.00311)		(0.00887)
Observations	2072	1361	2072	1359	2072	1359
R^2	0.634	0.659	0.477	0.456	0.985	0.977
F statistic on instrument	12.53	3.016				

(b) Farm mortgage debt-to-value ratio

	% Farms w/ Tractors		Movers to Farms 1930-35		Log Farm Population 1935	
	(1)	(2)	(3)	(4)	(5)	(6)
Farm mtg debt-to-value	-0.000269	0.000784	-0.000709**	-0.00151	-0.00283***	-0.00675**
	(0.00104)	(0.00144)	(0.000267)	(0.00141)	(0.000724)	(0.00330)
Observations	3079	2450	3066	2450	3066	2448
R^2	0.563	-0.003	0.458	-0.020	0.358	-0.117
Fixed Effects?	state	county pair	state	county pair	state	county pair

Notes: The dependent variables are: the percentage of farms in the county reporting tractors in 1930; the percentage of farms in the county in 1935 reporting at least one person living on the farm who had resided in a non-farm area 5 years earlier; and the log of the county-level farm population in 1935. All specifications include controls for log population and log farm population in 1930, as well as state fixed effects. The sample is restricted to rural counties only, defined as those with less than 30% of the population located in urban areas in 1930. In panel (b), even-numbered columns include only those counties located along a state border as well as fixed effects for each cross-border county pair; in addition, the county-level debt is instrumented using the state-level value to ensure that the identifying variation comes from differences in state-level policies. Robust standard errors in parentheses, adjusted for clustering at the state level. For the county-pair regressions, standard errors are adjusted using multi-way clustering at the state and state-border-pair levels. * p $<$ 0.10, ** p $<$ 0.05, *** p $<$ 0.01.

Table 4: Movement to farms vs. tractors and farm equipment

	Movers to Farms 1930-35				Log Farm Population 1935			
	(1) OLS	(2) IV	(3) OLS	(4) IV	(5) OLS	(6) IV	(7) OLS	(8) IV
% farms w/ tractors 1930	-0.0615***	-0.330***			-0.243***	-1.180***		
	(0.0201)	(0.0960)			(0.0361)	(0.372)		
log value farm equipment 1930			-0.0108***	-0.0485***			-0.0724***	-0.174***
			(0.00391)	(0.0183)			(0.0137)	(0.0330)
Observations	2127	2072	2127	2072	2127	2072	2127	2072
R^2	0.451	0.277	0.449	0.385	0.982	0.972	0.983	0.983
F statistic on ruggedness		12.53		23.75		12.53		23.75

Notes: The dependent variable in columns (1)-(4) is the percentage of farms in the county reporting at least one to-farm migrant and in columns (5)-(8) it is the log of the farm population in 1935. All specifications include controls for log population and log farm population in 1930, as well as state fixed effects. Even-numbered columns instrument for tractors or farm equipment using county-level ruggedness. The sample is restricted to rural counties only, defined as those with less than 30% of the population located in urban areas in 1930. Robust standard errors in parentheses, adjusted for clustering at the state level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 5: Population outcomes vs. ruggedness and non-farm employment shock

	1935		1940					
	(1) Movers	(2) Farm Pop	(3) Total Pop	(4) Rural Pop	(5) Urban Pop	(6) % Urban	(7) % Farm	(8) % Employed
ruggedness	0.127***	0.468***	0.256***	0.317***	-0.0745	-0.0527**	0.0603**	-0.102***
	(0.0318)	(0.0563)	(0.0856)	(0.0850)	(0.0614)	(0.0201)	(0.0270)	(0.0129)
% Mfg in Durables	0.0111**	0.0229*	-0.0000470	0.0341***	-0.0688***	-0.0219***	0.0207***	-0.0166***
	(0.00520)	(0.0128)	(0.0134)	(0.0125)	(0.0230)	(0.00503)	(0.00537)	(0.00289)
Bartik Shock 1930-40	-0.0133	-0.0898***	0.0949***	0.0726**	0.186***	0.0120	-0.0429***	0.0224**
	(0.0117)	(0.0317)	(0.0271)	(0.0312)	(0.0477)	(0.0120)	(0.00952)	(0.0102)
Observations	2838	2838	2838	2830	1613	2838	2837	2838
R^2	0.506	0.979	0.984	0.964	0.984	0.945	0.952	0.639

Notes: The dependent variable varies by column, as indicated. "Movers" in column (1) refers to the percent of farms reporting a to-farm mover; for columns (2)-(5), the dependent variable is in logs. The specifications in columns (2)-(8) control for the initial 1930 value of the outcome variable, and use the 1935 or 1940 value as the dependent variable. This table shows how rugged counties experience a relative increase in population; this increase is driven entirely by the gain in the farm population. All specifications include controls for log population and log farm population in 1930, as well as state fixed effects. Robust standard errors in parentheses, adjusted for clustering at the state level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 6: Home vegetable garden production and family farm labor in 1935 vs. ruggedness

	Value of Garden Vegetables		Family Labor	
	(1) log total	(2) per farm pop	(3) % farms	(4) % days
ruggedness	1.095**	3.620***	0.0429***	0.277***
	(0.427)	(1.320)	(0.00948)	(0.0464)
% Mfg in Durables	0.157**	0.208	0.00209	0.0202**
	(0.0661)	(0.196)	(0.00209)	(0.00930)
log farms 1930	-0.0537	0.0525	0.00797	0.158**
	(0.202)	(0.570)	(0.00742)	(0.0607)
value garden vegetables 1930	0.475***	1.176***		
	(0.0856)	(0.171)		
Observations	1914	1916	1918	1918
R^2	0.814	0.681	0.423	0.474

Notes: The dependent variables are (1) log of total county-level value (in dollars) of garden vegetables produced on farms for home use in 1935; (2) the value of garden vegetable production per 1935 farm persons; (3) the percentage of farms reporting using family labor out of all farms reporting family or hired labor; and (4) the percentage of farm labor days by family members out of of total days of (family or hired) farm labor. All specifications include controls for log population and log farm population in 1930, as well as state fixed effects. Robust standard errors in parentheses, adjusted for clustering at the state level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 7: Non-farm sectors performance (retail, wholesale, manufacturing) vs. ruggedness

(a) Retail and Wholesale Sectors

	Retail			Wholesale		
	(1) Total Sales	(2) Total Emp	(3) Total Wages	(4) Total Sales	(5) Total Emp	(6) Total Wages
Year=1933 × ruggedness	-0.125					
	(0.0870)					
Year=1935 × ruggedness	-0.217*	-0.390**	0.297***	-0.464***	-0.876***	0.429**
	(0.118)	(0.166)	(0.0867)	(0.156)	(0.207)	(0.172)
Year=1939 × ruggedness	-0.142	-0.187	0.478***	-0.768***	-0.750**	0.337*
	(0.164)	(0.173)	(0.165)	(0.273)	(0.333)	(0.191)
Observations	11938	8950	8942	8052	7930	7899
R^2	0.837	0.436	0.973	0.489	0.293	0.990
Number of counties	2994	2992	2990	2751	2746	2745

(b) Manufacturing

	(1) Total Emp	(2) Total Value Added	(3) Total Output	(4) Total Wages
Year=1931 × ruggedness	-0.149	-0.137	-0.0578	
	(0.169)	(0.201)	(0.177)	
Year=1933 × ruggedness	-0.452*	-0.262	-0.207	
	(0.225)	(0.332)	(0.289)	
Year=1935 × ruggedness	-0.288	-0.281	-0.357	-0.177
	(0.201)	(0.253)	(0.239)	(0.271)
Year=1937 × ruggedness	-0.0968	-0.0449	-0.265	
	(0.464)	(0.285)	(0.232)	
Year=1939 × ruggedness	0.0426	-0.166	-0.249	0.0831
	(0.617)	(0.411)	(0.289)	(0.610)
Observations	13367	12653	12652	6752
R^2	0.243	0.465	0.496	0.387
Number of counties	2486	2486	2486	2486

Notes: The dependent variable is (a) the log of county-level employment, sales, or total wages in the retail or wholesale sector, or (b) log of county-level employment, value added, total output, or total wages in the manufacturing sector. The specifications are panel regressions with county fixed effects and include data for 1929 in addition to the years displayed. The coefficients displayed are the estimates on the interaction between county-level ruggedness and year fixed effects; the first year is omitted, so coefficients should be interpreted as the change *relative to 1929*. All specifications include controls for log population and log farm population in 1930, as well as the initial 1929 level of the dependent variable, all of which are interacted with year fixed effects. Robust standard errors in parentheses, adjusted for clustering at the state level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

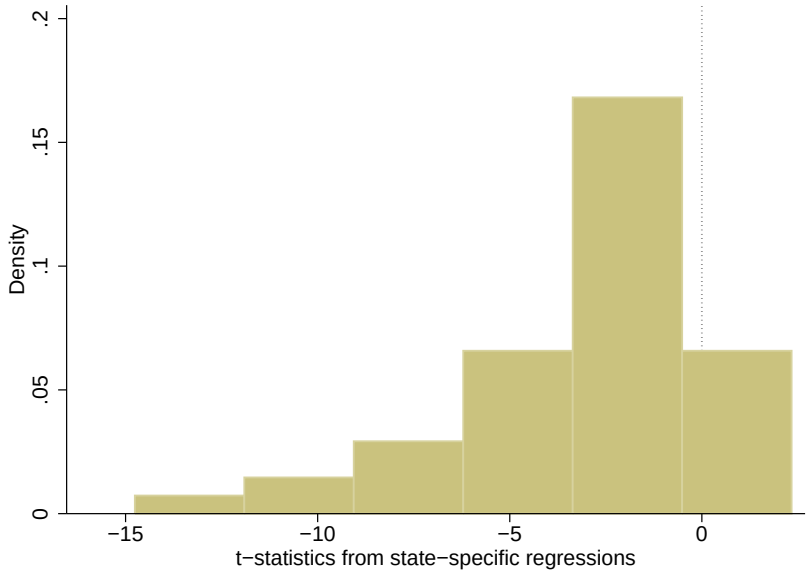
Table 8: Movers to farms *1935-40* vs. unemployment insurance availability in 1935 location.

	State Level	SEA Level		County-Level			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	All	All	All	All	All	Urban	Rural
UI Available	-1.208*	-0.805**	-0.287	-1.056**	-0.610**	-0.380	-0.861**
	(0.698)	(0.383)	(0.235)	(0.394)	(0.270)	(0.380)	(0.402)
N	49	465	465	2272	2272	820	1365
R^2	0.054	0.023	0.207	0.018	0.081	0.131	0.060
Fixed Effects?			division		division	division	division

Notes: The dependent variable is the fraction of people living in an area in 1935 who move from a non-farm residence to a farm residence by April 1940; the data are from the 1940 IPUMS 1% sample, and aggregated to the state, state economic area (SEA), or county level. "UI Available" is a (state-level) variable measured as the percentage of months between January 1935 and April 1940 that the state is paying out unemployment insurance benefits; it ranges from 0.14 to 0.71.

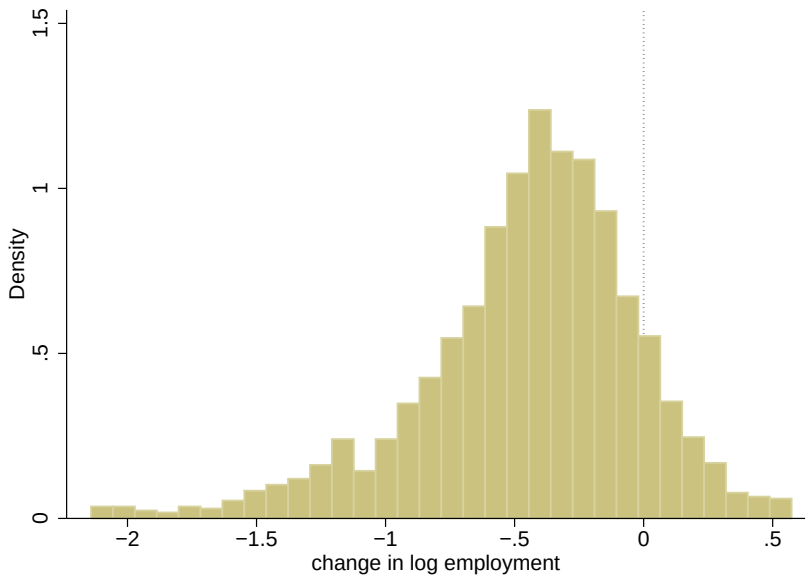
A Appendix

Figure A1: Tractors vs. ruggedness: t-statistics by state



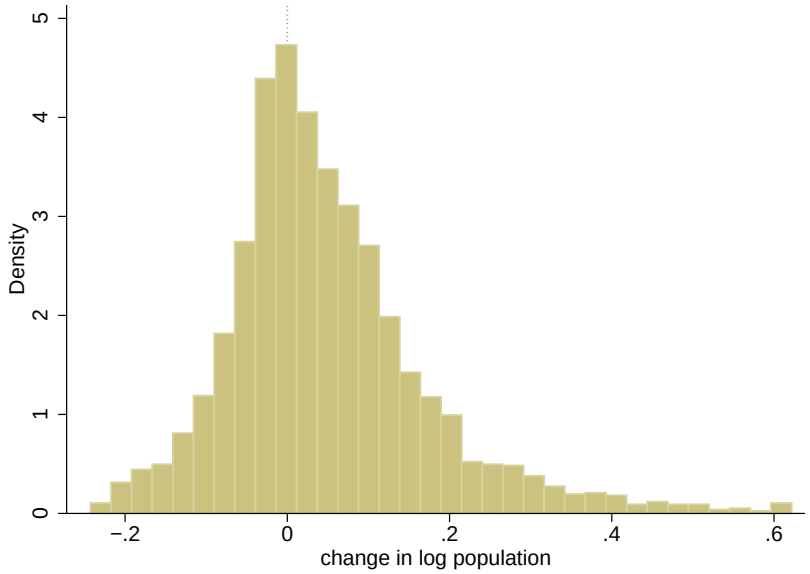
Notes: Histogram of t-statistics from 48 state-specific regressions of tractors on ruggedness. Separately for each state, we run a county-level regression of the percentage of farms reporting tractors in 1930 on the average ruggedness in the county. The t-statistic is the coefficient on ruggedness divided by its standard error. In 41 out of 48 regressions, the estimated relationship is negative. In 27 states, the t-statistic is less than -2, compared to only one state with a t-statistic above +2.

Figure A2: County-level change in log manufacturing employment, 1929-1933



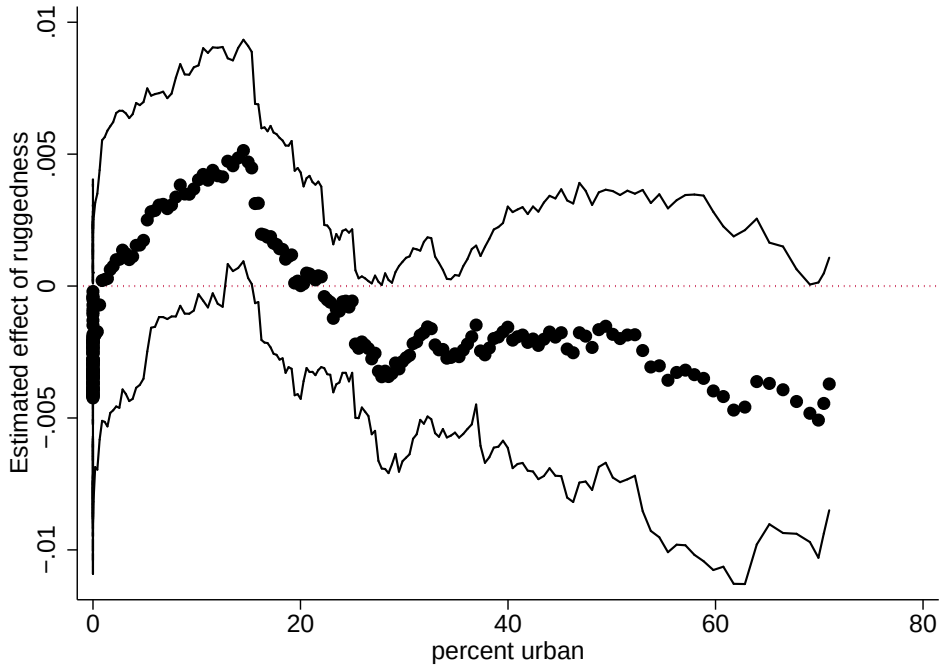
Notes: Histogram of the county-level changes in log manufacturing employment between 1929 and 1933 — that is, log employment in 1933 minus log employment in 1929. Most counties witness a decline in manufacturing employment, but there is substantial variation in the size of the shock. The upper and lower 1% of counties are dropped (trimmed).

Figure A3: County-level change in log farm population, 1930-1935



Notes: Histogram of the county-level changes in log farm population between 1930 and 1935 — that is, log farm population in 1935 minus log farm population in 1930. While many counties witness an increase in their farm population over this time period, a substantial portion (37%) see a decline. The upper and lower 1% of counties are dropped (trimmed).

Figure A4: Effect of ruggedness on change in county-level total population 1920-1930, by percent urban.



Notes: This figure shows the effect of ruggedness during the 1920s; compare to Figure 4, which shows the effect during the 1930s. This figure reports the coefficients from a series of regressions of county-level log population in 1930 on ruggedness of nearby areas, controlling for log population in 1920. Counties are ordered here by their percent urban in 1920. See the notes for Figure 4 for more details. Unlike Figure 4, there is generally no relationship between ruggedness and changes in county-level population during the 1920s, and there is also no systematic relationship between that estimated effect and the county-level percent urban.

Table A1: Out-migration in the 1920s

	Out-migrants	Farm Out-migrants		Log Farm Population 1930	
	(1)	(2)	(3)	(4)	(5)
ruggedness	0.0723	0.129	-0.114	-0.195	-0.330
	(0.0862)	(0.109)	(0.0961)	(0.159)	(0.202)
log population 1920				0.139***	0.423***
				(0.0175)	(0.0370)
log farm population 1920				0.757***	0.514***
				(0.0262)	(0.0389)
Observations	61339	61339	20050	2957	2043
R^2	0.032	0.108	0.041	0.886	0.906
Sample includes	All individuals	All individuals	Individuals on farms	All counties	Rural counties

Notes: The specifications in columns (1)-(3) are individual-level regressions using census data linked between 1920 and 1930. Columns (4) and (5) are county-level regressions. The dependent variable in column (1) is an indicator for whether the person moved to a different county between 1920 and 1930; in columns (2)-(3), it is whether the person was located on a farm in 1920 *and* moved to a different county by 1930; in columns (4)-(5) it is the log county-level farm population in 1930. The results indicate no differential out-migration from rugged areas prior to the depression. All specifications include state fixed effects. Robust standard errors in parentheses, adjusted for clustering at the state level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A2: Movement to farms vs. land ownership and tenancy

	Movers to Farms 1930-35		Log Farm Population 1935	
	(1)	(2)	(3)	(4)
farms operated by owner, % of all farms 1930	0.0603***		0.170***	
	(0.0108)		(0.0481)	
tenant farms, % of all farms 1930		-0.0598***		-0.169***
		(0.0113)		(0.0477)
Observations	2127	2127	2127	2127
R^2	0.456	0.455	0.982	0.982

Notes: The dependent variable in columns (1)-(2) is the percentage of farms in the county reporting at least one to-farm migrant and in columns (3)-(4) it is the log of the farm population in 1935. All specifications include controls for log population and log farm population in 1930, as well as state fixed effects. Rural counties only. Robust standard errors in parentheses, adjusted for clustering at the state level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A3: Farm labor

	Farm Labor		Movers to Farms 1930-35		Log Farm Population 1935	
	(1) 1930	(2) 1935	(3)	(4)	(5)	(6)
ruggedness	-4.118***	-0.0673		0.128***		0.309***
	(0.398)	(0.315)		(0.0340)		(0.0588)
days of farm labor employed 1930		0.591***				
		(0.0427)				
cash expenditure on farm labor 1930			-0.00723**	-0.00261	-0.0511***	-0.0455***
			(0.00300)	(0.00288)	(0.00863)	(0.00875)
Observations	2072	2072	2126	2072	2126	2072
R^2	0.633	0.795	0.450	0.478	0.983	0.986

Notes: The dependent variable in column (1) is the log of total cash expenditure on farm labor in 1930, in column (2) it is the log of total number of persons hired to work on farms in the first week of January 1935, in (3)-(4) it is the percentage of farms in the county reporting at least one to-farm migrant, and in columns (4)-(6) it is the log of the farm population in 1935. All specifications include controls for log population and log farm population in 1930, as well as state fixed effects. Robust standard errors in parentheses, adjusted for clustering at the state level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.