NBER WORKING PAPER SERIES

HOW THE 1942 JAPANESE EXCLUSION IMPACTED U.S. AGRICULTURE

Peter Zhixian Lin
Giovanni Peri

Working Paper 33971
http://www.nber.org/papers/w33971

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
June 2025, Revised July 2026

We are grateful to Emmanuel Saez, Beau Bressler, Sarah Quincy, Reem Zaiour, Gueyon Kim and participants in the U.C. Davis Alumni Conference in 2024, the University of Copenhagen Workshop on Refugees in 2025, the Mountain West Economic History Conference, Seminar at UC Santa Cruz and the Society of Labor Economists (SOLE) annual meeting in 2026 for useful comments. Errors are ours. The views expressed herein are those of the authors and do not necessarily reflect the views of the National Bureau of Economic Research.

How the 1942 Japanese Exclusion Impacted U.S. Agriculture
Peter Zhixian Lin and Giovanni Peri
NBER Working Paper No. 33971
June 2025, Revised July 2026
JEL No. N42, N52, O15, Q15

ABSTRACT

Japanese American farmers represented a significant share of agriculture-specific human capital on the U.S. West Coast in 1940. In 1942, the U.S. forcibly relocated them to internment camps, and most never returned to farming. Using a triple-difference design on county panel data, we find that by 1960, counties in the exclusion zone experienced 12 percent lower farmvalue growth per percentage point of Japanese farm workers excluded, relative to non-exclusion counties. Value per farm, high-value crop sales, mechanization, and farm wages also declined. The pattern is consistent with Japanese farmers representing hard-to-replace human capital, not replaceable labor.

Peter Zhixian Lin
Western Kentucky University
Department of Economics
zhixian.lin@wku.edu

Giovanni Peri
University of California, Davis
Department of Economics
and NBER
gperi@ucdavis.edu

1 Introduction

U.S. agriculture from 1940 to the end of the twentieth century experienced large gains in productivity, increased specialization in high value-added production (such as fruits, vegetables, and horticulture), and rapid technological change through mechanization and automation (Alston et al., 2011; Alston and Pardey, 2020; Olmstead and Rhode, 2000).[1] In 1940, the United States was already an industrial nation but 20% of the labor force still worked in agriculture, and the sector was about to undergo a major transformation. The diffusion of machinery and fertilizers, the shift toward higher-value crops, and the resulting productivity gains depended on farmers' ability to learn and implement new practices. Research in both developed and developing countries has documented a strong link between farmer education and technology adoption; in a meta-analysis of 367 regressions, Ruzzante et al. (2021) finds that farmer education is among the most consistent predictors of agricultural technology adoption.

Americans of Japanese origin made up a disproportionately skilled segment of the West Coast agricultural workforce in 1940. According to the 1940 Population Census, about 40% of Japanese Americans worked as farmers or farm laborers—more than twice the share among the U.S.-born population.[2] Japanese-operated farms were highly productive: their advantage rested on higher education levels of farmers, longer working hours, mastery of crop-specific techniques, and specialization in high-value crops such as fruits and vegetables.

Shortly after Pearl Harbor, the U.S. government forcibly *evacuated*[3] more than 110,000 persons of Japanese ancestry from the Pacific Coast between March and October 1942. The exclusion encompassed both first-generation immigrants (Issei) and second-generation Japanese Americans (Nisei), effectively removing the entire Japanese-origin population from the exclusion zone between 1942 and 1945. Most were confined to relocation centers and never returned to their original occupations or homes. We study how the sudden, war-driven loss of skilled Japanese farmers affected farm value, output, technology adoption, employment, and land use in the affected counties.

The event provides a natural experiment to test whether the removal of Japanese farmers reflected the loss of specialized agricultural human capital—with lasting effects on productivity and technology—or merely a reduction in substitutable labor offset by replacement workers. We

[1] Between 1948 and 2017, agricultural output grew at 1.53% annually while total input grew by only 0.07% (Wang et al., 2020).

[2] See Chapter 4 of *Japanese Americans During World War II: Relocation and Internment, Personal Justice Denied* (1982).

[3] The government officially termed the policy an "evacuation." We instead use "exclusion" throughout, as it more accurately describes a forced removal rather than a protective relocation.

formalize the distinction in a simple model of local agricultural production in an open economy: a loss of homogeneous, elastically supplied labor implies very different long-run effects from a loss of productivity-enhancing human capital. We test the two scenarios on a range of outcomes—farm value, productivity, technology adoption, and county-level employment—over the 15 years following 1942.

We assemble a county-level panel from the U.S. Censuses of Agriculture and Population covering 1925–1959. The empirical strategy is a triple-difference design interacting three sources of variation: pre- versus post-1942 census years, exclusion-zone versus non-exclusion-zone counties, and the 1940 share of Japanese farm workers. Under the human-capital interpretation, counties outside the exclusion zone (where Japanese farmers remained) with higher 1940 Japanese shares should have grown faster after 1942, while counties inside the zone (where they were removed) should have lost the advantage. The corresponding double-difference coefficient should be positive and the triple-difference coefficient negative. Instead, if Japanese farmers were easily substitutable, both effects should be absent, i.e., insignificantly different from 0.

We conduct extensive robustness and placebo tests. In the most demanding specification, we compare only counties located directly along the border of the exclusion zone, where exclusion status is determined almost arbitrarily by an imaginary east–west cutoff. We also examine whether the shares of non-Japanese Asian and Axis-country farm workers—similar in some respects to Japanese but not subject to exclusion—show comparable treatment effects. All checks confirm the robustness of our findings.

In our preferred specification, the exclusion of Japanese farmers reduced the growth of total farm value—the most consistently measured outcome and a proxy for the present discounted value of land and farm income—between 1940 and 1960. A county with one percentage point more Japanese farm workers in 1940 experienced about 12% lower total farm value growth if located inside the exclusion zone, relative to a similar county outside the zone. Counties with a high pre-war Japanese share outside the exclusion zone instead experienced faster postwar growth of similar magnitude. The opposite signs of the double- and triple-difference coefficients show that the exclusion eliminated the local productivity advantage of skilled Japanese farmers.

Counties losing more Japanese farmers experienced slower growth in value per farm rather than in the number of farms, indicating that Japanese farms continued to operate but with less productive operators. They shifted away from the high-value crops, including fruits and vegetables, that Japanese farmers had dominated and adopted motor trucks, tractors, automobiles, and commercial fertilizers more slowly, even as U.S. agriculture was undergoing rapid technological transformation (Alston and Pardey, 2020; Alston et al., 2011). Hired farm employment and wages both fell, ruling out a pure labor-supply alternative under which wages would have risen. The decline concentrates on the high-school-educated and managerial segments of the pre-war Japanese workforce, consistent with the loss of specific human capital rather than generic farm labor. Finally, the productivity decline also translated into slower growth in agricultural and non-agricultural employment and total population, consistent with complementarities between agricultural and non-agricultural sectors (Bustos et al., 2016).

This paper contributes to three branches of the literature. First, we add to research on the economic consequences of forced repatriation or deportation of immigrant workers in the locations they leave. Lee et al. (2017) study the 1930s Mexican Repatriation Policy and find reduced employment and occupational downgrading of native workers, with no benefit to native farm workers. Clemens et al. (2018) examines the 1960s bracero exclusion, finding no positive labor-market effect on native farm workers but significant changes in crop types and mechanization. Hornbeck and Naidu (2014) find that emigration of low-wage Black labor following the 1927 Mississippi Flood increased capital intensity in agriculture. Our paper differs in that the affected Japanese farmers represented an important segment of agricultural human capital, rather than non-differentiated workers. In this respect, the analysis is closer to studies of specialized human-capital loss—notably the flight of Jews from Europe (Waldinger, 2012, 2016; Huber et al., 2021), which produced substantial negative effects on European innovation, science, and entrepreneurship.

Second, we contribute to the literature on the economic consequences of Japanese American internment. Prior work focuses on outcomes of the internees: Caudill and Mixon Jr (2012) find that internees increased investment in their children's human capital due to heightened risks of holding physical capital; Chin (2005) documents worse long-term labor-market outcomes attributable to lost labor-market experience; and other work finds negative effects on educational attainment and political engagement (Saavedra, 2015; Shoag and Carollo, 2016; Komisarchik et al., 2020), while Arellano-Bover (2022) reports a positive income effect. We complement this work by examining the impact on *local economies*, specifically agriculture in the regions that lost a substantial portion of their Japanese American population.

Finally, we contribute to a broader literature on agricultural productivity as a driver of local economic growth. Productivity gains in agriculture both raise local demand for other goods and services and free workers to move into those sectors, and so can serve as a catalyst of overall growth

(Chu et al., 2022; Gollin et al., 2002; Bustos et al., 2016; Vollrath, 2011; Lagakos and Waugh, 2013). Our paper studies this mechanism in a period when U.S. industrial growth was already underway, emphasizing the role of agricultural productivity as a complement to local economic growth.

2 Historical Background

The Japanese exclusion of 1942 abruptly removed Japanese Americans from a large area along the West Coast where they were heavily concentrated in agriculture. This section describes the exclusion policy, the pre-policy role of Japanese American farm workers in West Coast agriculture, and the immediate disruption that followed their removal.

2.1 The Japanese Exclusion in WWII

The United States entered World War II after Japan's attack on Pearl Harbor on December 7, 1941. To protect military installations along the Pacific Coast, the U.S. War and Justice Departments moved to exclude persons considered security threats from strategic areas. The effort culminated in Executive Order 9066, signed by President Franklin D. Roosevelt on February 19, 1942. The order authorized the Commanding General of the Western Defense Command[4] to establish military zones and remove all persons of Japanese ancestry from these areas.[5] On March 2 and March 14, 1942, the Commanding General issued two public proclamations establishing the exclusion zone. All individuals of Japanese ancestry, regardless of citizenship status, were subject to mandatory removal.

Exemptions were rare. Only individuals who were hospitalized, gravely ill, or Japanese children in orphanages were deferred or exempted. Very few persons of mixed Japanese and non-Japanese heritage were exempted if they were deemed assimilated.[6] A small number of Japanese residents relocated before the forced removal: according to the Wartime Civil Control Administration, 4,889 left the exclusion area voluntarily and registered a change of residence, most commonly to Colorado (1,963), Utah (1,519), and Idaho (305) DeWitt (1943).

[4]The Western Defense Command (WDC) was a U.S. Army command established in March 1941, covering the seven Pacific and Mountain states—Washington, Oregon, California, Idaho, Montana, Nevada, Utah, and Arizona—and Alaska. It was responsible for military mobilization, troop training, and civilian control along the Pacific theater during the war, and its administrative footprint was substantially larger than the eventual exclusion zone, which was confined to areas of California, Oregon, Washington, and southern Arizona, closer to the West Coast.

[5]We use "Japanese" to encompass all Japanese Americans, both first-generation Japanese immigrants and people of Japanese ancestry. All were subject to the exclusion.

[6]According to the final report, mixed-marriage families included only 465 individuals: 206 entered a relocation center and were released later, while 259 were granted deferments or exemptions from removal DeWitt (1943).

The exclusion zone covered western Washington and Oregon, all of California, and the southern portion of Arizona (red line in Appendix Figure A.1). In total, 117 counties were fully or partially designated as the exclusion area.[7] The removal began in Winslow, Washington on March 24, 1942, and concluded by October 31, 1942. More than 117,000 individuals of Japanese ancestry were forcibly removed, most sent to detention centers and then to internment camps (DeWitt, 1943).[8]

The Japanese American population was heavily concentrated in the exclusion zone (Appendix Figure A.1). The 1940 Census recorded 126,947 individuals of Japanese ancestry in the continental U.S., 95.4% of whom resided within the zone. Of those in Arizona, California, Oregon, and Washington, 64% were U.S.-born second-generation citizens (Nisei), while most adults (age 18 and over) were foreign-born first-generation immigrants (Issei). After implementation, the policy reduced their presence in the exclusion area effectively to zero.[9]

Counties in the exclusion zone differed systematically from non-exclusion counties along a number of baseline characteristics (Appendix Table A.1). They were larger in area and had a substantially larger foreign-born share of the population (10.3% versus 3.6%) and of the farm workforce (21.5% versus 5.5%). Average farm value per farm was 0.77 log points higher, consistent with the more intensive, commercial nature of West Coast agriculture in 1940. By construction, the share of Japanese farm workers was also much higher in the zone (2.2% on average, versus 0.03% outside).

2.2 Japanese Farm Workers and the West Coast Agriculture

Japanese Americans were heavily concentrated in agriculture, especially on the West Coast. By 1940, within the exclusion area, 42.3% of working-age Japanese Americans (age 14 and over) worked in agriculture, compared with 11.2% of the general population. Of these, 13.4% were farmers and farm managers, and 25.4% were farm laborers (hired or unpaid family). Nationwide, 37.8% of Japanese Americans worked on farms, compared with 10.6% of the general population.

Despite this concentration, Japanese Americans remained a minority group in farming. In the exclusion area, Japanese farm workers were 4.45% of all farm workers—3.58% of farmers and farm managers, and 5.08% of farm laborers. Their share was even lower outside the exclusion area. However, Japanese farm workers were substantially more educated than their counterparts in other

[7] Because our data are at the county level and do not distinguish within-county exclusion status, we classify all partially included counties as exclusion counties.

[8] According to the final report, between March 24 and June 6, 1942, over 100,000 Japanese individuals were removed from Military Area No. 1. An additional 9,000 were removed from Military Area No. 2 in California between July 4 and August 11, 1942 DeWitt (1943).

[9] Although four of the ten internment camps were located within the exclusion zone, the incarcerated Japanese Americans were removed from civic life in their original communities.

groups. By 1940, 31.3% had completed high school, compared with 12.2% of White farm workers and 1.4% of Black farm workers. College education was also more common: 3.3% had completed at least two years of college, and 1.2% had completed at least four years (see Appendix Table A.2 for a comparison of Japanese and non-Japanese farm workers).

Japanese farm workers also spent more time on farms. The average Japanese farm worker put in 41.3 weeks per year and 43.6 hours per week, totaling over 1,925 hours annually—more than White (1,871 hours) and Black (1,531 hours) farm workers. Their education and work ethic helped them adopt innovative farming methods and advanced technologies.

Japanese-operated farms outperformed others despite their small share of farms and farmland. Appendix Table A.3 compares Japanese-operated and non-Japanese farms in California, Oregon, and Washington from 1920 to 1940. By 1940, the 6,118 Japanese farms in these states were 2.2% of all farms but only 0.4% of the farmland. The average Japanese farm was valued at \$11,867, comparable to the \$11,714 value of (larger) non-Japanese farms, and the average land value per acre was \$246 for Japanese farms versus about \$40 for non-Japanese farms. Mechanization was also higher: implements and machinery averaged \$1,120 per Japanese farm, compared with \$840 on non-Japanese farms. A typical Japanese farm was smaller in acreage but, through specialized production methods and machinery, more valuable and productive.

This productivity advantage rested on a distinctive specialization in intensive, high-value crops. Japanese farmers concentrated in fruits, vegetables, and other commercial truck crops, where managerial skill, family labor, and intensive techniques produced large yields per acre (Iwata, 1962; Higgs, 1978; Modell, 1977; Iwata, 1992). By the early 1940s, they accounted for a disproportionate share of California production in many of these categories. Appendix Table A.4 lists the major specialty crops in which Japanese farmers held dominant or near-dominant shares.

The success of Japanese farms and their unique production methods was recognized by the War Department. The final report stated:

"*The Japanese people were the most important racial minority group engaged in agriculture in the Pacific Coast region. Their systems of farming, types of crops, and conditions of land tenure were such that their replacement by other farmers would be extremely difficult. ... Since Japanese production was predicated upon the intensification of farming methods, frugality and economy of operation, minimization of water consumption, family labor, and special and peculiar skill, substituted operation on a practical basis at first seemed a difficult if not an insurmountable obstacle from a production preservation standpoint.*" DeWitt (1943).

2.3 Interruption of Agricultural Production by the Exclusion Policy

The exclusion disrupted agricultural production immediately, given its mandatory and rapid implementation. The most direct consequence was the forced transfer of farms from Japanese to non-Japanese operators. The transfer was unusually complex because of the 1913 Alien Land Law, which prohibited first-generation Japanese immigrants from owning land: 70% of Japanese farmers on the Pacific Coast were classified as tenants, while the remainder held land through minors or third parties as nominal owners (DeWitt, 1943).

To facilitate the transfers, the U.S. Department of Agriculture established the Farm Security Administration at the request of the Commanding General. Its mission was to register all Japanese farms, along with their owners and tenants, and to oversee a fair and orderly transfer. The compressed timeline left Japanese farmers with very weak bargaining power, making it nearly impossible to negotiate prices that reflected fair market value.

In the first ten days after March 24, 1942, 734 transactions were completed. By April 3, one week later, the number had risen to 1,776. By May 31, more than 6,000 transactions had been finalized. By August 8, 1942, 7,311 farms and 256,741 acres of farmland had been relinquished (DeWitt, 1943), transferring ownership or control from Japanese to non-Japanese hands. These transfers represented approximately 2.8% of all farms and 0.45% of all farmland in the affected counties. A transfer of this scale and speed was unlikely to ensure the "best substituted operation" that the War Department and the Department of Agriculture claimed.

A second source of disruption was the disposal of farm machinery. The War Department reported that "the preservation, distribution, and transfer of farm machinery presented such difficulties that the adoption of a firm policy was necessary to prevent waste, destruction, or sale for scrap" (DeWitt, 1943). The Wartime Civil Control Administration launched a campaign to preserve farm equipment, but new ownership and unfamiliar operators made it nearly impossible to maintain pre-exclusion productivity.

The short-run disruptions from farm transfers and machinery disposal likely reduced agricultural value. This paper asks whether the loss of human capital—the skills, experience, and managerial expertise of Japanese farmers and farm workers—caused even larger and persistent long-run damage. The final report acknowledged that "some reduction in production will have been experienced by reason of the loss of the peculiar skill and experience of the Japanese, his capacity for labor, and his employment of intensive farming methods" (DeWitt, 1943), but it did not consider more permanent losses—implicitly assuming Japanese farmers could be replaced in the medium run. Internment camps closed at the end of the war, but only 30 to 50% of Japanese Americans returned to their original states, and even fewer reclaimed their farms or re-entered agriculture. Many took up new occupations such as domestic service or work in the garment industry.

The 1942 exclusion was an unanticipated and permanent negative shock to the supply of skilled, productive (Japanese) farmers in the affected counties. The policy deprived these regions of a crucial segment of agricultural human capital on the eve of two decades of productivity growth, mechanization, and technological advancement. While the immediate production losses—simply from less labor on the land—were likely considerable, the authorities did not account for the more persistent dynamic effects of removing skilled farm managers during a period of technological transition. The remainder of the paper examines these longer-run consequences empirically.

3 Theoretical Framework and Empirical Implications

We develop a simple model, in the spirit of Hornbeck and Keskin (2015), to distinguish the implications of two shocks, which could proceed from the loss of Japanese farm workers: (1) the loss of hard to replace human capital, embodied in Japanese farmers, which carries a productivity component; and (2) a pure reduction in the local supply of undifferentiated farm labor, with no productivity component. The two shocks generate different combinations of equilibrium responses in employment, factor prices, technology adoption, and output, which we use to identify the mechanism consistent with the observed decline.

3.1 Agricultural Production and Input Demand and Supply

We specify the agricultural production function in Cobb–Douglas form:

$$Y = A(HL)^{\alpha}T^{\beta} \tag{3.1}$$

where Y is agricultural output, A is productivity, and the three inputs are labor (L), human capital (H), and land (T, the cultivated area). We interpret A as the level of adopted technology. The coefficients α and β are the output elasticities of labor and land, with $\alpha, \beta \in (0, 1)$ and $\alpha + \beta \leq 1$, so the production function exhibits non-increasing returns to scale. We omit physical capital for simplicity, since it would enter similarly to land.

Human capital enters in a labor-augmenting form (HL) and complements the other inputs. We further assume that human capital enhances technology A, as in Lucas (1988); Moretti (2004a,b); Iranzo and Peri (2009), and specify A as a function of H and non-human-capital factors θ:

$$A = \theta H^{\eta} \tag{3.2}$$

Equating the wage and rent to the marginal products of labor and land and taking log differentials yields the demand shifters:

$$d \ln w = d \ln A + \alpha \, d \ln H + (\alpha - 1) \, d \ln L + \beta \, d \ln T \tag{3.3}$$

$$d \ln r = d \ln A + \alpha \, d \ln H + \alpha \, d \ln L + (\beta - 1) \, d \ln T \tag{3.4}$$

We then collect the common human-capital-driven component of equations (3.3)–(3.4) into a composite demand shifter Ξ:

$$\begin{aligned} \Xi &\equiv d \ln A + \alpha \, d \ln H \\ &= (\eta + \alpha) \, d \ln H \end{aligned} \tag{3.5}$$

where the second equality follows from equation (3.2) with $d \ln \theta = 0$ (isolating the human-capital-induced change in technology). The term $\alpha \, d \ln H$ is the direct complementarity effect of human capital on factor demand; $\eta \, d \ln H$ is the indirect effect operating through technology.

Labor and land supply take parallel upward-sloping forms:

$$L = \mu \, w^{\sigma} \tag{3.6}$$

$$T = \delta \, r^{\epsilon} \tag{3.7}$$

where μ and δ are non-price supply shifters (e.g., mobility frictions, mass mobilizations, land conversion costs, or natural disasters), and $\sigma, \epsilon \geq 0$ are supply elasticities. The limit $\sigma \to \infty$ is the open-economy benchmark: the local wage is pinned at the national level and any quantity of workers can be supplied at it. Log differentiation yields:

$$d \ln L = d \ln \mu + \sigma \, d \ln w \tag{3.8}$$

$$d \ln T = \epsilon \, d \ln r \tag{3.9}$$

We set $d \ln \delta = 0$ throughout (no land supply shocks) and retain $d \ln \mu$ as the primitive labor supply shock: a physical removal of workers without any productivity change. It is the natural counterfactual to the human capital shock Ξ.

3.2 Equilibrium Changes in response to a Human capital or Labor supply Change

Combining the log-differential demand equations (3.3)–(3.4) with the supply equations (3.8)–(3.9) yields the equilibrium responses:

$$d\ln L = \frac{\sigma(1+\epsilon)\,\Xi + [1+\epsilon(1-\beta)]\,d\ln\mu}{D'} \tag{3.10}$$

$$d\ln T = \frac{\epsilon(1+\sigma)\,\Xi + \epsilon\alpha\,d\ln\mu}{D'} \tag{3.11}$$

$$d\ln w = \frac{(1+\epsilon)\,\Xi - D\,d\ln\mu}{D'} \tag{3.12}$$

$$d\ln r = \frac{(1+\sigma)\,\Xi + \alpha\,d\ln\mu}{D'} \tag{3.13}$$

where the determinant of the system, D', and the auxiliary constant D are defined as

$$D' \equiv 1 + \sigma(1-\alpha) + \epsilon(1-\beta) + \sigma\epsilon(1-\alpha-\beta), \tag{3.14}$$

$$D \equiv (1-\alpha) + \epsilon(1-\alpha-\beta). \tag{3.15}$$

Both expressions are strictly positive given $\alpha, \beta \in (0,1)$, $\alpha+\beta \le 1$, and $\sigma, \epsilon \ge 0$. The system is symmetric in the two factor elasticities up to the roles of α and β; in the limit $\sigma \to \infty$, $D'/\sigma \to D$ and the perfectly-elastic labor case is recovered.

The equilibrium log change in output is then

$$d\ln Y = \frac{(1+\epsilon)\big[(1+\sigma)\,\Xi + \alpha\,d\ln\mu\big]}{D'}. \tag{3.16}$$

3.3 Testable Implications

We now compare four scenarios along two dimensions: (i) whether the removal of Japanese farm workers carries a human capital component ($d\ln H < 0$, hence $\Xi < 0$) or operates only as a labor supply shock ($d\ln\mu < 0$); and (ii) whether local labor supply is upward sloping (σ finite) or perfectly elastic ($\sigma \to \infty$).

Scenario 1: Pure labor supply shock, upward-sloping labor supply. Set $\Xi = 0$, $d\ln\mu < 0$, and σ finite. Substituting into the equilibrium expressions yields

$$d\ln L < 0, \quad d\ln T < 0, \quad d\ln w > 0, \quad d\ln r < 0, \quad d\ln Y < 0, \quad d\ln A = 0. \tag{3.17}$$

The inward labor supply shift raises the equilibrium wage and reduces employment. Cobb–Douglas complementarity then implies that less labor lowers the marginal product of land, so rent and cultivated area both fall; output declines through the contraction of both inputs. Technology is unaffected since human capital is intact ($d\ln H = 0$ implies $d\ln A = 0$).

Scenario 2: Pure labor supply shock, perfectly elastic labor supply. Set $\Xi = 0$, $d\ln\mu < 0$, and $\sigma \to \infty$. The equilibrium changes collapse to

$$d\ln L = d\ln T = d\ln w = d\ln r = d\ln Y = d\ln A = 0. \tag{3.18}$$

With perfectly elastic labor supply, any worker removed is instantly replaced by an inflow at the prevailing wage; the shift in μ has no equilibrium consequence. The labor supply channel alone cannot generate a local decline when labor is sufficiently mobile.

Scenario 3: Combined shock, upward-sloping labor supply. Set $\Xi < 0$, $d\ln\mu < 0$, and σ finite. Both channels operate. The equilibrium responses of quantities, rent, output, and technology are all negative,

$$d\ln L < 0, \quad d\ln T < 0, \quad d\ln r < 0, \quad d\ln Y < 0, \quad d\ln A < 0. \tag{3.19}$$

The two channels reinforce each other on these margins: the human capital channel lowers the marginal product of every input (directly through complementarity and indirectly through the technology decline), while the supply shift further reduces the workforce at any given wage. The wage is the one margin where the two channels push in opposite directions: the human capital channel pulls the wage down, while the supply contraction pulls it up. The net wage falls if and only if the human capital channel dominates.

Scenario 4: Combined shock, perfectly elastic labor supply. Set $\Xi < 0$, $d\ln\mu < 0$, and $\sigma \to \infty$. Perfectly elastic labor supply absorbs the shift in μ one-for-one, so $d\ln\mu$ drops out of every equilibrium expression and only the human capital channel remains active:

$$d\ln L < 0, \quad d\ln T < 0, \quad d\ln w = 0, \quad d\ln r < 0, \quad d\ln Y < 0, \quad d\ln A < 0. \tag{3.20}$$

Labor mobility anchors the local wage, but the human capital channel still depresses labor demand at that wage through both the direct complementarity ($\alpha\, d\ln H$) and the technology channel ($\eta\, d\ln H$). With the wage fixed, employment clears the market and firms hire fewer workers at the unchanged wage. Less labor and lower productivity reduce the marginal product of land, rent falls, and idle land leaves cultivation; output declines through the productivity loss and the contraction of both inputs.

The four scenarios generate distinct empirical implications. The following propositions summarize them and identify which combinations are consistent with the data we examine below.

Proposition 1. Total farm value (the product of land quantity and rent) declines in Scenarios 1, 3, and 4, and is unchanged in Scenario 2. An observed decline in farm value therefore rules out Scenario 2 (pure labor supply shock with perfectly elastic labor supply).

Proposition 2. Employment declines in Scenarios 1, 3, and 4 ($d \ln L < 0$) and is unchanged in Scenario 2. The local wage varies across scenarios: it rises under a pure labor supply shock with upward-sloping supply (Scenario 1), is unchanged in Scenarios 2 and 4, and falls in Scenario 3 if and only if the human capital channel dominates. An observed employment decline without an accompanying rise in the local farm wage is therefore inconsistent with Scenario 1.

Proposition 3. Only scenarios with a human capital shock generate a technology decline: $d \ln A = \eta \, d \ln H < 0$ in Scenarios 3 and 4. To the extent that technology is embodied in mechanization, fertilizer use, and other measurable adoption decisions, observed declines in those margins identify the human capital channel and rule out the pure labor supply scenarios (1 and 2).

Proposition 4. The ratio of output decline to employment decline differs across scenarios. In Scenario 1, $|d \ln Y / d \ln L|$ is bounded above by $\alpha/(1-\beta) \leq 1$, since the only operative force is the reallocation of factors. In Scenario 4, the human capital channel adds the productivity multiplier η through $\Xi = (\eta + \alpha) \, d \ln H$, giving $|d \ln Y / d \ln L| = 1$; in Scenario 3 the ratio can exceed one when the human capital channel dominates. An output decline large relative to the employment decline therefore provides additional magnitude-based identification of the human capital channel.

Taken together, the four propositions imply that a combination of (i) a decline in farm value, (ii) a decline in employment without a rise in the farm wage, (iii) a decline in measured technology adoption, and (iv) a large output response per unit of employment loss is jointly inconsistent with both pure labor supply scenarios. Such a combination is best rationalized by Scenario 3 or 4, in which the human capital channel drives the equilibrium decline. The two scenarios differ on the wage margin: Scenario 4 implies an unchanged farm wage, while Scenario 3 (incomplete labor mobility, with a residual role for the supply shock) implies a wage decline when the human capital channel dominates. The empirical analysis in the rest of the paper evaluates each of these margins.

4 Data

We use two publicly available datasets: (1) the full-count 1940 Population Census, to measure the spatial variation of Japanese farm workers before the exclusion; and (2) the U.S. Agricultural Census from 1925 to 1959, to measure detailed agricultural outcomes. The Agricultural Census was conducted every five years over this period, yielding eight observations per county (1925, 1930, 1935, 1940, 1945, 1950, 1954, and 1959). The Agricultural Census reports outcomes only at the county level—so counties are our unit of analysis. The rest of this section describes the data sources and the construction of our key variables.

4.1 Share of Japanese Farm Workers in 1940

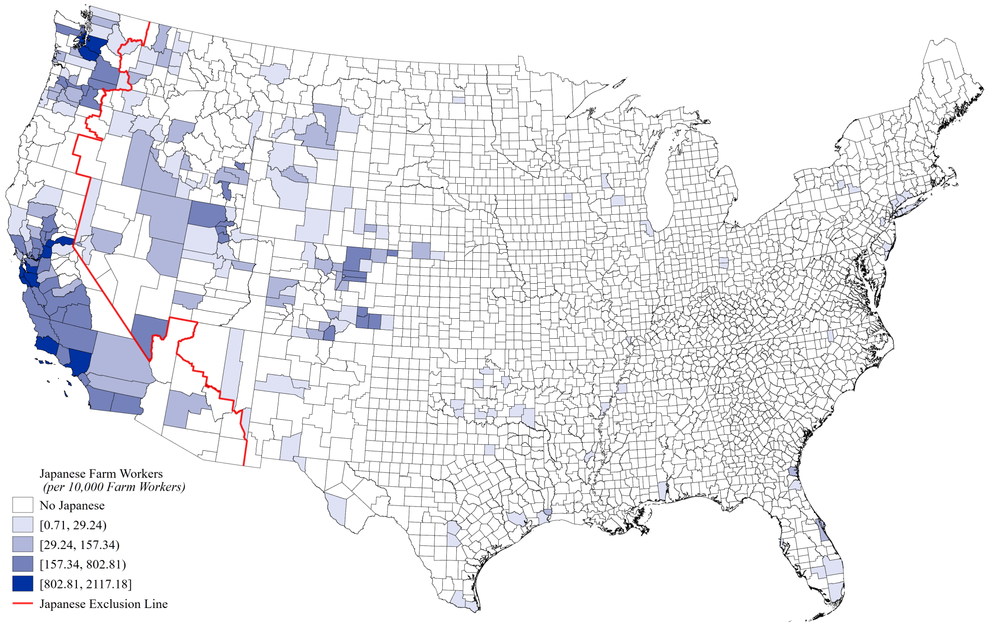
We measure exposure to the exclusion policy using the share of Japanese among farm workers in each county in 1940, the latest pre-exclusion observation. We aggregate microdata from the full-count 1940 Population Census, accessed through the Integrated Public Use Microdata Series (IPUMS) (Ruggles et al., 2024). We classify individuals as farm workers if they reported any of the following occupations: farmer, farm manager, farm foreman, farm laborer (wage worker), or farm laborer (unpaid family worker).[10] We identify Japanese farm workers by their racial classification as "Japanese" in the Census, and compute the percentage of Japanese among all farm workers at the county level.

Figure 1 maps the spatial variation of Japanese farm-worker shares across continental U.S. counties in 1940. We exclude Hawaii and Alaska due to limited agricultural data during the study period.[11] Although the overall share was low across continental U.S. counties, geographic variation was substantial, with the highest concentrations in western counties. Placer County, California, had the highest share at 21.2% of farm laborers, followed by King County, Washington (14.9%), Sacramento (14.8%), and Los Angeles (14.7%). Japanese farm workers also had a meaningful presence in areas outside the exclusion zone—notably the Mountain states (Idaho, Nevada, Utah, Colorado) and parts of the Southwest (Arizona, New Mexico, Texas). This out-of-zone variation supports our triple-difference identification strategy.

[10] We use the 1950 Census Bureau occupational classification system for comparability across census years.

[11] Hawaii presents an interesting contrast: despite being the site of the attack, Japanese residents there were exempt from internment because they comprised roughly 40% of the population, and their removal would have devastated the local economy and been logistically infeasible. They were subject to martial law and strict controls instead.

Figure 1. Share of Japanese Farm Workers by U.S. Counties in 1940



Note: This figure illustrates the spatial distribution of Japanese farm workers across U.S. counties in 1940, measured by the number of Japanese farm workers per 10,000 total farm workers. Data comes from the full-count 1940 Population Census, provided by IPUMS (Ruggles et al., 2024). A Japanese farm worker is identified as (1) being a Japanese, based on the coded race in 1940 Census, and (2) reporting one of the following occupations: farmer (including farm owner or tenants), farm manager, paid farm laborer, and unpaid family farm laborer. The red line marks the boundary of exclusion zone. See notes of Figure A.1 for details.

4.2 Agriculture Outcomes between 1925 and 1959

County-level agricultural outcomes come from the U.S. Agricultural Censuses between 1925 and 1959, obtained from the United States Agriculture Data, 1840–2012 collection (No. 35206) hosted by the Inter-university Consortium for Political and Social Research (ICPSR) (Haines et al., 2018). We focus on this period for two reasons. First, standardized data became consistently available only from 1925 onward, after the Census Bureau adopted five-year intervals. We exclude 1920 because some farms smaller than 3 acres were included in 1920 but dropped from 1925 onward, which would have produced inconsistent farm counts in counties with many small farms. Second, ending in 1959 gives us more than 15 years of post-policy data—long enough to capture medium-term effects of the exclusion—and covers the 1940s and 1950s, when U.S. agriculture underwent substantial transformation. The resulting sample is balanced, with four pre-policy years (1925, 1930, 1935, 1940) and four post-policy years (1945, 1950, 1954, 1959).

Our primary outcome is the logarithm of total farm value (land and buildings) at the county level. This variable, reported by farm owners or managers, is consistently measured across all census years from 1925 to 1959. It proxies the expected future revenue from the land, and hence the average productivity of the farm. To separate the extensive margin (number of farms) from the intensive margin (value per farm), we also collect the total number of farms and compute the average value per farm, a cleaner proxy for farm productivity.

A second set of outcomes is the value of farm products sold by product type, with attention to high-value crops such as vegetables, fruits, and commercial truck crops. Sales data are available for 1930, 1940, 1945, 1950, 1954, and 1959. Despite only two pre-policy observations, these data are useful for tracking production of the high-value crops most closely tied to farm productivity.

Dollar-valued outcomes such as farm value and products sold can shift with either real quantities or relative prices. To separate the two, we digitize 1939 farm-gate prices and national production totals for individual crops from the USDA *Agricultural Statistics 1941* yearbook (U.S. Department of Agriculture, 1941), and pair them with the county-level physical quantities reported in the Agricultural Censuses to construct a fixed-price output index—output valued at constant 1939 prices, and therefore immune to relative-price movements. Appendix A.1 provides further details on the basket of 55 crops plus 29 vegetable categories and the unit-conversion procedure.

A third set of outcomes covers farm labor and wages. The Agricultural Censuses report the number of family and hired workers during peak seasons, and farm expenditures on cash wages, which we use to compute the average wage per hired laborer. The number of hired workers proxies total labor demand, and the average wage proxies the marginal productivity of farm labor.

Finally, we collect data on two technology channels that diffused widely during the 1940s and 1950s: farm mechanization—motor trucks, tractors, automobiles, and telephone access—and commercial fertilizer use, measured as tons applied per farm.

4.3 Exclusion Status and County Boundary Change

We classify counties as part of the exclusion zone by geocoding the map published in the *Final Report of Japanese Evacuation from the West Coast 1942* (DeWitt, 1943). A county is in the exclusion zone if any portion of its area lies west of the exclusion line. Because the line does not precisely follow county boundaries, this rule produces a clean control group of counties entirely outside the zone. The sample includes 117 "exclusion counties" (10 in Arizona, 58 in California, 24 in Oregon, and 25 in Washington) out of 3,064 total.

County boundaries changed over time, complicating panel construction. We harmonize all counties to 1940 boundaries, since 1940 is the reference year for the Japanese farm-worker share and falls roughly in the middle of our study period. For each census year, we overlay that year's boundaries on the 1940 baseline, compute the area of intersection between historical and 1940 boundaries for affected counties, and redistribute outcome variables proportionally by intersected area before re-aggregating to 1940 boundaries. Boundary data come from the IPUMS National Historical Geographic Information System (NHGIS) (Manson et al., 2024).

4.4 Control Variables and Non-agriculture Outcomes

We construct a set of control variables from the 1940 Population Census to capture pre-policy heterogeneity across counties: log farm population, share of foreign-born population, share of foreign-born farm workers, and share of non-Japanese Asian immigrants. Each is interacted with the post-1942 indicator in our baseline specifications.

For the mechanism analysis, we further split the 1940 share of Japanese farm workers by education level (with and without a high-school degree) to measure the loss of human capital. For the spillover analysis, we collect county-level total employment by industry and total population from the full-count Population Censuses of 1930, 1940, and 1950, and the 5% sample of the 1960 Census. All Census data are sourced from IPUMS (Ruggles et al., 2024).

5 Identification Strategy

5.1 Empirical Strategy

We identify the causal impact of the exclusion policy on agricultural outcomes with a triple-difference (DDD) estimator. The strategy exploits three sources of variation: (1) over-time variation before and after 1942; (2) cross-county variation in exclusion status; and (3) cross-county variation in the pre-policy share of Japanese farm workers. A county experiences meaningful exposure only if it lies in the exclusion zone *and* had a non-negligible share of Japanese farm workers by 1942. Our baseline specification is:

$$\begin{aligned} F_{it} =& \alpha + \beta_0 J_{i,1940} \times Excl_i \times Post_t + \beta_1 Excl_i \times Post_t \\ &+ \beta_2 J_{i,1940} \times Post_t + \eta_i + \sigma_t + \epsilon_{it} \end{aligned} \tag{5.1}$$

F_{it} is an agricultural outcome for county i in year t (log farm value in the baseline). $J_{i,1940}$ is the percentage of farm workers in county i of Japanese ethnicity in 1940, a continuous measure of treatment intensity for exclusion-zone counties. $Excl_i$ is a dummy for whether county i lay in the exclusion zone, and $Post_t$ equals one for census years after 1942. The equation also includes the two relevant two-way interactions ($Excl_i \times Post_t$ and $J_{i,1940} \times Post_t$), county fixed effects η_i that absorb time-invariant county characteristics, year fixed effects σ_t for national trends, and an error term ϵ_{it}. The triple-difference coefficient β_0 is the parameter of interest.

For an exclusion county ($Excl_i = 1$) with Japanese share $J_{i,1940} = j$, the average pre–post change in outcomes is:

$$\begin{aligned} E(F_{it}|J_{i,1940} = j, Excl_i = 1, Post_t = 1) - & E(F_{it}|J_{i,1940} = j, Excl_i = 1, Post_t = 0) \\ = & \alpha + \beta_0 j + \beta_1 + \beta_2 j \end{aligned} \tag{5.2}$$

For a non-exclusion county ($Excl_i = 0$) with the same Japanese share, the pre–post change is:

$$\begin{aligned} E(F_{it}|J_{i,1940} = j, Excl_i = 0, Post_t = 1) - & E(F_{it}|J_{i,1940} = j, Excl_i = 0, Post_t = 0) \\ = & \alpha + \beta_2 j \end{aligned} \tag{5.3}$$

The difference between equations 5.2 and 5.3 yields $\beta_0 j + \beta_1$, capturing how the differential change between exclusion and non-exclusion counties varies with the Japanese share. The coefficient β_1 is the baseline difference in trends at $j = 0$, independent of Japanese presence. The triple-difference coefficient β_0 captures how Japanese presence modifies this differential trend, and identifies the causal impact of exclusion—since the policy removed Japanese farmers in exclusion-zone counties but not elsewhere.

An alternative interpretation compares counties by Japanese share rather than by exclusion status. For counties with a high Japanese share ($J_{i,1940} = J_h$), the pre–post change is:

$$\begin{aligned} E(F_{it}|J_{i,1940} = J_h, Post_t = 1) - & E(F_{it}|J_{i,1940} = J_h, Post_t = 0) \\ = & \alpha + \beta_0 J_h \times Excl_i + \beta_1 Excl_i + \beta_2 J_h \end{aligned} \tag{5.4}$$

For counties with a low Japanese share ($J_{i,1940} = J_l$):

$$\begin{aligned} E(F_{it}|J_{i,1940} = J_l, Post_t = 1) - & E(F_{it}|J_{i,1940} = J_l, Post_t = 0) \\ = & \alpha + \beta_0 J_l \times Excl_i + \beta_1 Excl_i + \beta_2 J_l \end{aligned} \tag{5.5}$$

The difference between equations 5.4 and 5.5 yields $\beta_0(J_h - J_l) \times Excl_i + \beta_2(J_h - J_l)$, capturing how outcome changes around 1942 vary with the pre-policy Japanese share. The coefficient β_2 is the marginal differential change associated with the Japanese share outside the exclusion zone—the counterfactual change that would have occurred without the policy. The coefficient β_0 captures the additional differential change within the exclusion zone: the causal effect of removing Japanese farmers.

Two assumptions are required for β_0 to identify the causal impact of the exclusion. Unlike the standard parallel-trends assumption in a difference-in-differences setup, which requires parallel evolution of outcome *levels*, the triple-difference design only requires parallel trends in *differences*. More specifically, the following two assumptions are required:

Assumption I: Prior to the exclusion policy (i.e., before 1942), differential changes in agricultural outcomes between exclusion and non-exclusion counties must be parallel for counties with high and counties with low Japanese share (as measured in 1940).

Assumption II: Prior to the exclusion policy (i.e., before 1942), differential changes in agricultural outcomes between counties with different levels of Japanese share (as measured in 1940) must be parallel for counties inside and outside the exclusion zone.

5.2 Testing Identification Assumption

To test Assumption I, we separate counties into two groups: those with no Japanese farm workers in 1940 ($J_{i,1940} = 0\%$) and those with a high share ($J_{i,1940} \geq 0.29\%$). The 0.29% threshold is the median share among counties with any Japanese farm-worker presence. For each group, we estimate the following event-study specification with the logarithm of farm value ($\ln(FV_{it})$) as the dependent variable:

$$ln(FV_{it}) = \gamma_0 + \sum_{t \neq 1940} \gamma_t Excl_i \times Year_t + \eta_i + \sigma_t + \epsilon_{it} \tag{5.6}$$

$Year_t$ is a dummy for census year t with 1940 omitted as the reference. Conditional on county and year fixed effects, γ_t captures the differential change in log farm value in year t (relative to 1940) between exclusion and non-exclusion counties. Under Assumption I, the pre-1942 γ_t trends should be similar for the no-Japanese and high-Japanese groups, even if the coefficients themselves are not zero.

Panel A of Figure 2 plots the γ_t coefficients with 95% confidence intervals for 1925 to 1960, separately for the no-Japanese group (navy) and the high-Japanese group (maroon). The pre-1942 coefficients are statistically indistinguishable between the two groups in every year, supporting Assumption I. Both groups show a mild upward trend, indicating that exclusion-zone counties performed slightly better than non-exclusion counties before 1942.

The upward trend is stronger before the Great Depression (1925–1930) and roughly flat or slightly declining during and after the Depression (1930–1940). The parallel trend breaks sharply after 1942. By 1945, the two groups diverge in the expected direction: exclusion counties with high Japanese shares lose their earlier growth advantage relative to non-exclusion counties with high Japanese shares, while exclusion counties with no Japanese begin to outperform their no-Japanese counterparts outside the zone.

We test Assumption II analogously, separating counties by exclusion status and estimating the following event-study specification for each group:

$$ln(FV_{it}) = \theta_0 + \sum_{t \neq 1940} \theta_t HighJap_{i,1940} \times Year_t + \eta_i + \sigma_t + \epsilon_{it} \tag{5.7}$$

$HighJap_{i,1940}$ is a dummy for high Japanese share in 1940, defined by the same cutoff ($J_{i,1940} \geq 0.29\%$) as for Assumption I. The coefficients θ_t capture the differential change in log farm value in year t (relative to 1940) between high-Japanese and no-Japanese counties. Under Assumption II, the pre-1942 θ_t trends should be parallel across exclusion and non-exclusion counties.

Panel B of Figure 2 plots θ_t from 1925 to 1960, separately for exclusion counties (maroon) and non-exclusion counties (navy). The pre-1942 coefficients show similar trends in both groups: high-Japanese counties outperformed low-Japanese counties during 1925–1930 and underperformed during 1930–1940, and these trends were similar inside and outside the exclusion zone. After 1942, the gap stays flat within the exclusion zone while widening outside it: high-Japanese counties begin to significantly outperform their no-Japanese counterparts only among non-exclusion counties. The post-1942 divergence is consistent with Assumption II—the Japanese "advantage" in farm value materializes only where Japanese farmers were not removed.

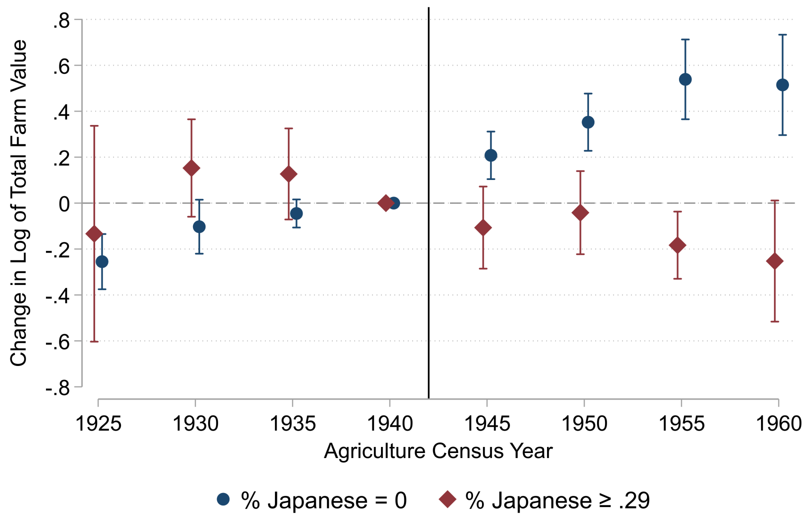
The two identification tests validate the triple-difference strategy. Before 1942, the differential change between exclusion and non-exclusion counties followed similar trends in counties with and without Japanese presence, and the differential change between high- and no-Japanese counties followed similar trends inside and outside the exclusion zone. After 1942, the pattern diverges sharply: high-Japanese counties continue to outperform their no-Japanese counterparts outside the exclusion zone, while within the zone this advantage disappears.

6 Results

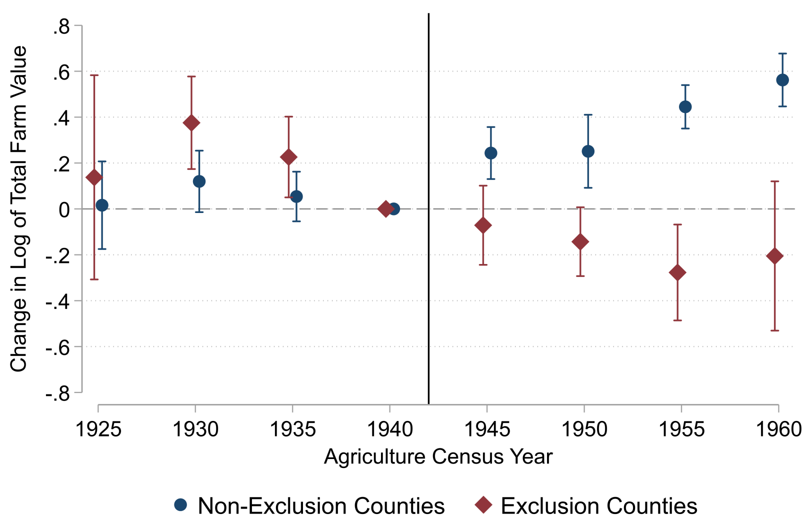
In this section, we present the triple-difference estimates of the impact of Japanese exclusion on total farm value, our primary outcome, based on specification 5.1. We then assess the robustness

Figure 2. Log Change of Total Farm Values by Treatment

(a) Change by Share of Japanese Farm Workers



(b) Change by County Exclusion Status



Note: Panel (a) tests Assumption I: it plots the coefficients γ_t from equation 5.6, where navy circles are counties with no Japanese farm workers in 1940 and maroon diamonds are counties with $J_{i,1940} \geq 0.29\%$. Panel (b) tests Assumption II: it plots the coefficients θ_t from equation 5.7, where navy circles are non-exclusion counties and maroon diamonds are exclusion counties. The dependent variable in both panels is the logarithm of total farm value. Vertical bars are 95% confidence intervals; the solid vertical line marks 1942.

of these estimates and address potential confounders including relative-price movements, wartime federal spending, and pre-policy downstream buyers network density.

6.1 Main Results on Farm Value

Table 1 reports our baseline triple-difference estimates of the impact of Japanese exclusion on the logarithm of total farm value (the market value of land and buildings) at the county level. The regressions include all counties in the continental United States. The first row reports the coefficient β_0 on the triple interaction term from equation 5.1.

The four columns present progressively richer specifications. Column (1) is the baseline model with the triple interaction and the two relevant two-way interactions, plus county and year fixed effects. Column (2) adds interactions of the post-policy dummy with 1940 socioeconomic covariates (log farm population, foreign-born population share, foreign-born farm-worker share, non-Japanese Asian share) to mitigate omitted-variable concerns. Column (3) adds the interaction of log county area with the post-policy dummy to absorb differential post-1942 trends by county size. Column (4) adds farming-type-indicator interactions with the post-policy dummy, using the USDA's 1940 classification of dominant crops, farming practices, and climate.

Across all specifications, the exclusion policy has a statistically significant and negative effect on total farm value, with coefficients ranging from -0.119 (column 4) to -0.231 (column 2). In our most conservative specification (column 4), the exclusion of each percentage point of Japanese farm workers caused an 11.9 percent decline in average total farm value over the postwar period (1945–1960). Since the median Japanese share among affected exclusion counties was 1.8 percent, the typical exclusion county lost about 25 percent in total farm value—an economically meaningful effect that is robust across specifications.

The two-way interaction coefficients are also informative. The second row of Table 1 reports the coefficient on the interaction between the 1940 Japanese share and the post-policy dummy; the estimates are positive and significant across all specifications. Outside the exclusion zone, counties with higher Japanese shares grew faster after 1942 (in column 4, an additional 8.8 percent for every one percentage point of Japanese farm-worker share). The pattern is consistent with Japanese farmers as valuable human capital driving postwar agricultural growth where they remained, while exclusion eliminated their positive contribution in the treated counties. Notice, additionally that the point estimates in the second row are similar in value (and opposite in sign) to those of the triple differences in the first row. This is what one would expect if the advantage of having Japanese farmers was completely undone in the exclusion zone by their full removal. The third row reports the coefficient on the interaction between the exclusion dummy and the post-policy dummy; the

Table 1. Effect of Japanese Exclusion on Total Farm Value

	Dependent Variable: Log Total Farm Value			
	(1)	(2)	(3)	(4)
%Japanese×Excl.×Post	-0.227***	-0.231***	-0.175***	-0.119***
	(0.043)	(0.045)	(0.035)	(0.032)
%Japanese×Post	0.203***	0.202***	0.150***	0.088***
	(0.042)	(0.042)	(0.033)	(0.030)
Excl.×Post	0.378***	0.437***	0.256***	0.323***
	(0.091)	(0.066)	(0.059)	(0.071)
Log Farm Pop.×Post		0.053	-0.022	0.047
		(0.044)	(0.035)	(0.040)
%FB Pop.×Post		-0.030***	-0.027***	-0.005
		(0.008)	(0.008)	(0.009)
%FB Farm Workers×Post		0.002	0.001	-0.005
		(0.004)	(0.004)	(0.005)
%Non-Jap. Asian ×Post		0.099***	0.158***	0.121***
		(0.036)	(0.045)	(0.037)
Log County Area×Post	No	No	Yes	Yes
Farming Type×Post	No	No	No	Yes
Obs.	24,508	24,508	24,508	24,508
Num. of Counties	3,064	3,064	3,064	3,064
Sample Year	1925-59	1925-59	1925-59	1925-59

Notes: The dependent variable in all columns is the logarithm of total farm value at the county level. % Japanese denotes the share of farm workers (farmers and farm laborers) of Japanese ethnicity in 1940; Excl. is a dummy for counties in the exclusion zone; Post is a dummy for census years after 1942. All regressions include county and year fixed effects and are weighted by 1940 county population. Column (1) is the base model; column (2) adds interactions of the post-policy dummy with 1940 socioeconomic covariates (log farm population, foreign-born population share, foreign-born farm-worker share, non-Japanese Asian share); column (3) adds the log-county-area × post interaction; column (4), our baseline, adds farming-type-indicator × post interactions. Standard errors clustered at the county level are reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

estimates are also positive across all specifications, suggesting that exclusion-zone counties without Japanese farm workers grew faster than similar non-exclusion counties without Japanese workers—likely reflecting the West Coast's comparative advantage in high-value crops and faster postwar agricultural innovation.

The pattern in Table 1 mirrors the pre-trend evidence in Figure 2. Before 1942, counties with high Japanese shares were on similar growth trajectories inside and outside the exclusion zone; after 1942, counties that lost Japanese farmers deteriorated relative to similar counties where they remained.

To unpack the average post-policy effect into year-by-year dynamics, we estimate an event-study version of the baseline triple-difference model, replacing the post-1942 dummy with a full set of year dummies (1940 omitted as the reference):

$$\ln(FV_{it}) = \alpha + \sum_{t\neq 1940} \beta_t \, J_{i,1940} \times Excl_i \times Year_t$$
$$+ \sum_{t\neq 1940} \gamma_t \, Excl_i \times Year_t + \sum_{t\neq 1940} \theta_t \, J_{i,1940} \times Year_t \tag{6.1}$$
$$+ \mathbf{X}_i' \boldsymbol{\lambda}_t \times Year_t + \eta_i + \sigma_t + \epsilon_{it}.$$

The vector $\mathbf{X}_i$ contains the same 1940 county-level controls as in Table 1, here interacted with year dummies (rather than with the post-1942 dummy) so the controls absorb any year-by-year differential trends correlated with their levels. The year-specific triple-difference coefficients β_t are our primary parameters of interest.

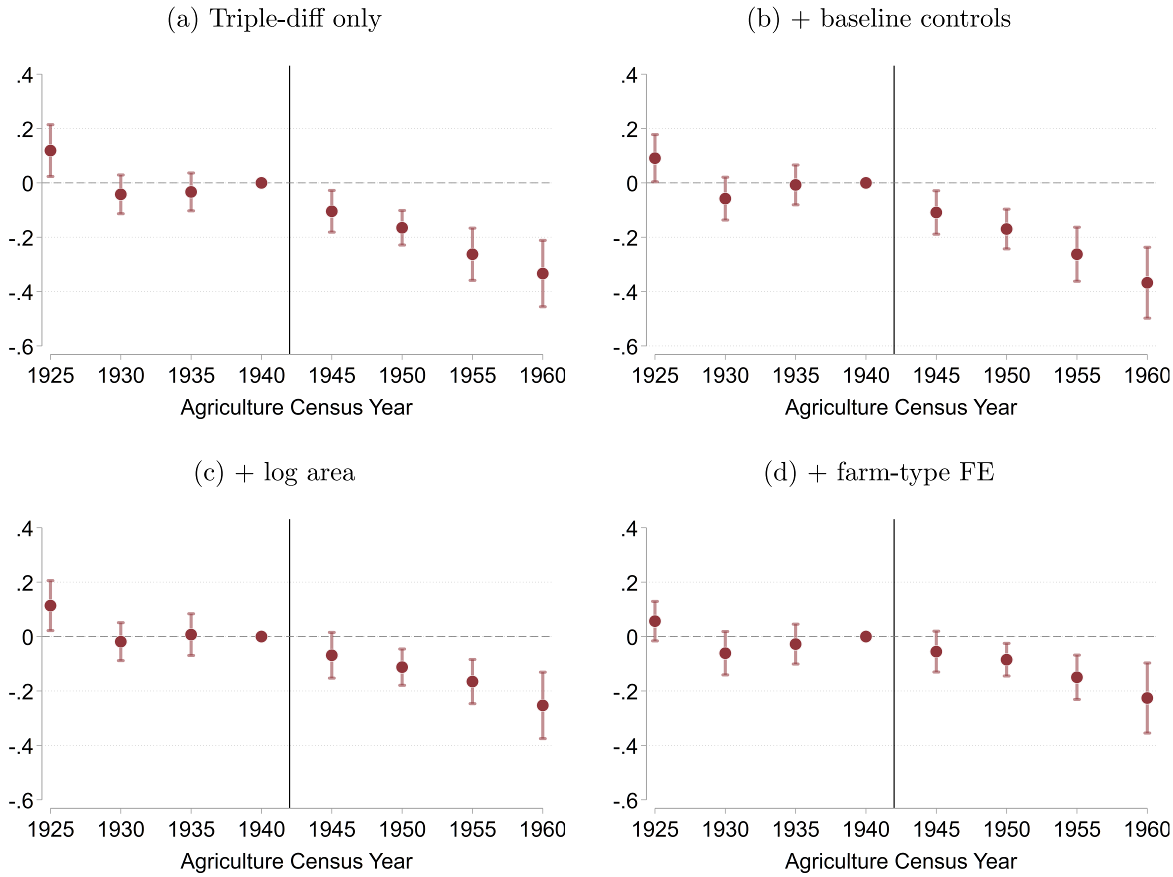
Figure 3 reports the estimated β_t across four panels, where panels (a)–(d) cumulatively add the same groups of controls as columns (1)–(4) of Table 1. Two patterns emerge consistently across all four panels. First, the pre-1942 coefficients lie near zero and are not statistically distinguishable from zero, further confirming the parallel-trends assumption documented in Section 5. Second, the post-1942 coefficients are negative and grow steadily in magnitude over time, reaching approximately -0.2 to -0.4 (depending on the set of controls) by 1960. This widening over the post-policy period indicates that the negative effect of Japanese exclusion on farm value emerged gradually as the loss of skilled Japanese farmers was capitalized into the cross-county distribution of farm value over the postwar period.

6.2 Robustness Checks

We assess the robustness of the baseline estimate against three concerns: the result may be driven by (i) a small set of special counties, (ii) unobserved geographic heterogeneity in farming practices inside and outside the exclusion zone, or (iii) our choice of weights and clustering. All checks use column (4) of Table 1 as the baseline; Appendix Figure A.2 summarizes the coefficients.

The first concern is that a few exceptional counties drive the result. Five counties in the treated area had Japanese shares above 10% in 1940: Placer (21.2%), King (14.9%), Sacramento (14.8%), Los Angeles (14.7%), and Santa Cruz (10.7%). Dropping these five reduces the coefficient slightly to -0.089, close to the baseline of -0.119. A related concern is that California, which housed the largest Japanese community and the 1913 Alien Land Act forcing Japanese farmers into tenancy, drives the result through a distinctive modality of land transfer upon exclusion. Dropping all California counties yields -0.077. A third concern involves the 11 counties that hosted War

Figure 3. Dynamic Effects of Japanese Exclusion on Log Total Farm Value



Notes: The vertical axis in each panel is the year-specific triple-difference coefficient β_t from equation (6.1). The dependent variable is the logarithm of total farm value. Each panel adds one block of controls—interacted with year dummies—to mirror columns (1)–(4) of Table 1: (a) no controls; (b) 1940 socioeconomic controls; (c) adds log county area; (d) adds farm-type fixed effects. 1940 is the omitted reference year; the solid vertical line marks 1942. Vertical bars are 95% confidence intervals based on county-clustered standard errors. The 1954 and 1959 census years are plotted at 1955 and 1960 for visual alignment with the 5-year grid.

Relocation Authority internment camps, where internees often participated in local agriculture and several camps fell inside the exclusion zone. Dropping these 11 counties leaves the coefficient virtually unchanged. The estimated effect is therefore not driven by a few population hubs, by California, or by counties hosting internment camps.

Three sample restrictions further address the concern that unobserved geographic heterogeneity drives the result. A first concern is that the effect may be limited to areas specializing in fruits, vegetables, and other truck crops where Japanese farmers were concentrated. Dropping all counties the USDA's 1940 Agricultural Census classified as best suited for "Fruit, Truck, and Mixed Farming"—which include 41 California counties as well as 37 in Florida, 13 in Louisiana, 16 in

New Jersey, and 12 in New York—yields a coefficient of -0.083, similar to the baseline. The effect therefore extends beyond high-value-crop regions to other agricultural activities. A second concern is that counties far from the West Coast may differ systematically in farming practices and wartime exposure. Restricting the sample to the 1,572 counties within 2,500 kilometers of the Pacific Coast yields -0.085. The most demanding restriction keeps only the 55 counties that straddle the exclusion line, where exclusion status is determined almost arbitrarily by position relative to an imaginary east–west cutoff. The coefficient on this narrow sample is -0.179, larger in magnitude than the baseline; the corresponding two-way coefficient on the Japanese share is $+0.204$, and the two-way on the exclusion side is small and insignificant. Among agriculturally similar counties, being on either side of the exclusion line did not matter for post-1942 performance—having a larger share of Japanese farmers did.

Finally, we verify that the result does not hinge on the choice of regression weights or clustering. The baseline weights observations by 1940 county population and clusters standard errors at the county level. Replacing the weights with no weight at all, with the 1940 farm count, or with the 1940 farm-worker count produces estimates from -0.051 to -0.088, all negative and statistically significant. Clustering standard errors at the state level instead of the county level leaves the point estimate unchanged and the confidence interval tightly bounded below zero.

6.3 Placebo Tests

Two residual concerns warrant placebo tests. First, the 1940 Japanese share may proxy for other ethnic or immigrant groups that experienced unrelated post-1942 shocks. Second, the exclusion zone may overlap with broader West Coast geographies exposed to wartime mobilization. We address each by replacing either the treatment-intensity measure (with alternative ethnic farm-worker shares) or the treatment-geography indicator (WDC dummy or coastal-distance cutoffs). Appendix Figure A.3 reports all coefficients.

On the intensity side, three alternative groups stand out. Counties with higher Japanese shares also tended to have more Chinese, Filipino, and other Asian residents because the same labor-recruitment channels brought these groups to the same Pacific-coast counties before the war. If shared infrastructure, crop specialization, or pre-war discrimination drove the result, the non-Japanese Asian share should produce a similar effect. We also test German- and Italian-born farm workers: following Pearl Harbor, German and Italian nationals were classified as "enemy aliens" and subjected to curfews, travel restrictions, and selective internment, including bans from designated zones around military and industrial facilities on the West Coast. These measures were far narrower than Japanese exclusion—the Italian classification was lifted in October 1942 and German restrictions were progressively relaxed—but they targeted populations whose pre-war geographic distribution overlapped substantially with the exclusion zone (German-born and Italian-born farm workers were 1.19% and 2.25% of West Coast farm workers in 1940). Re-estimating the baseline with each of these as the treatment-intensity measure returns small and statistically insignificant coefficients in all three cases. The result reflects Japanese exclusion specifically, not a broader pre-war Asian presence or wartime hostility toward enemy nationals.

On the geography side, the exclusion zone lies entirely within the Western Defense Command (WDC), whose much larger administrative footprint was directly exposed to Pacific-theater mobilization. To avoid overlapping treatments, we restrict the sample to non-exclusion counties and replace the exclusion dummy with a WDC dummy. As a complementary test, we replace the WDC indicator with distance-to-Pacific-coast bands, using indicators for counties within 500 km (tighter than the WDC eastern boundary) and 1,000 km (similar to it). All three return small and statistically insignificant coefficients. The post-1942 differential decline is bound to the actual exclusion zone, not to any coastal-proximity geography.

6.4 Real Output vs. Price Effects

A concern with using total farm value as the primary outcome is that the post-1942 decline could partially reflect relative price declines for the crops Japanese farmers specialized in—truck vegetables, fruits, and berries—rather than declines in real output and productivity. The role of Japanese as consumers and the local nature of some markets could introduce such a confounder, affecting local prices. We address the concern by constructing a measure of agricultural output that holds prices mechanically constant across years and only accounts for variation in quantity of outputs.

The fixed-price output index multiplies the county-level physical quantity of each crop, reported in successive Censuses of Agriculture, by 1939 prices held constant across all years. We anchor the index to 1939 prices because the 1940 Census of Agriculture reports its county-level production data for the 1939 crop year, allowing us to check the basket against directly-reported Census aggregates at the 1940 baseline. The 1939 prices are drawn from *USDA Agricultural Statistics 1941* (U.S. Department of Agriculture, 1941). Formally, $FP_{c,t} = \sum_k Q_{c,k,t} \cdot \bar{P}^s_{k,1939}$, where $Q_{c,k,t}$ is the quantity of crop k in county c at year t and $\bar{P}^s_{k,1939}$ is the 1939 price held fixed. We construct two variants: a *national-priced* version with a uniform US-average price per crop, and a *state-priced* version with state-specific 1939 prices (national fallback for missing states). Because the price vectors do not vary across years, any change in $FP_{c,t}$ reflects only changes in physical quantities.

Our primary panel is four years (1930, 1940, 1950, 1959), dropping 1925 and 1935 (abbreviated mid-decade censuses missing crop categories), 1945 (wartime census missing specialty crops), and 1954 (for a clean two-period symmetric pre–post design; we report a five-year robustness adding 1954 below). The basket comprises 55 individual crops with consistent unit reporting plus 29 vegetable categories captured via a value-per-acre proxy (1939 vegetable revenue divided by 1939 vegetable acreage, multiplied by county acreage in each year). Appendix A.1 provides full details on the basket and unit-conversion procedure. A coverage check at the 1940 baseline shows the 84-item basket accounts for 95.6% of the total value of farm products sold reported in the 1940 Census, with a county-level Pearson correlation between $\ln FP_{c,1940}$ and log total products sold of 0.91 (Appendix Figure A.4).

Appendix Figure A.5 reports triple-difference estimates on eight outcomes, all using column (4) of Table 1. The top two rows use Census-direct total products sold, estimated first on the full six-year panel (-0.115) and then on the restricted four-year panel (-0.134), confirming that the panel restriction does not materially alter the result. The next four rows use the broader fixed-price baskets (national vs. state prices for "crop + vegetable" and "crop only"); coefficients lie between -0.114 and -0.140, all significant at 5 percent and indistinguishable from the products-sold benchmark. The bottom two rows restrict the basket to fruits, vegetables, and tree-fruit crops, the categories where Japanese specialization was strongest: -0.203 (national prices) and -0.243 (state prices), roughly 1.7 times the broader-basket magnitudes. The post-1942 decline survives when prices are held constant and is especially strong for a basket intensive in the crops Japanese farmers were most engaged in producing. Within each basket pair, the national- and state-priced coefficients differ by less than 0.05 log points, ruling out a related concern that geographic variation in price levels drives the result. All these checks contribute to supporting the idea that the negative effect is driven by a productivity (quantity) effect and not by price changes. The five-year robustness (Appendix Figure A.6), which adds 1954 and drops peanuts (not separately enumerated in 1954), produces a qualitatively identical pattern.

6.5 Wartime Federal Spending and Investment

A second potential confounder is wartime federal spending. The exclusion zone lies entirely within the Western Defense Command, and Pacific-coast counties received a disproportionate share of federal war contracts and military-facility investment (Higgs, 1992; Fishback and Cullen, 2013). The WDC placebo of Appendix Figure A.3 addressed this concern coarsely; a more direct test is to ask whether the post-1942 decline in farm value survives once we control directly for the wartime spending and investment each county received.

We augment the baseline (column 4 of Table 1) with two sets of county-level controls, capturing the wartime measures, each interacted with the post-1942 dummy. The first set, from Fishback and Cullen (2013), draws on the U.S. Department of War *County War Facilities* and *County War Contracts* files (1940–1945) and captures the federal-expenditure inflow into each county; we use four variants—log war contracts per capita, log war facilities per capita, log total war spending per capita, and log total war spending in absolute terms. The second set, from Jaworski (2017), draws on individual project records from the National Industrial Conference Board and captures the resulting capital-structures buildup, including private-sector investment that responded to wartime demand; we use five variants, all in log dollars—structures, equipment, public, private, and total investment. The two series are related but distinct: Fishback-Cullen captures the federal-expenditure inflow; Jaworski captures the broader industrial-capacity buildup.

Across all nine specifications including such control variables, the triple-interaction coefficient remains tightly clustered between -0.113 and -0.128 (Appendix Figure A.7), statistically indistinguishable from the baseline of -0.119. Exposure to wartime federal spending and industrial investment—whether by source (contracts vs. facilities), level (per capita vs. absolute), or financing (public vs. private)—was not correlated with (and hence does not account for) the differential post-1942 decline.

6.6 Pre-Policy Downstream Buyers Network Density

A third potential confounder for the estimated productivity effect could be the local density of downstream buyer networks. Japanese-American farmers were geographically concentrated in regions with extensive cooperative marketing structures, packinghouses, and farm-product wholesale and transformation companies on the Pacific coast (Iwata, 1962; Modell, 1977; Higgs, 1978; Iwata, 1992). Whether Japanese-American farmers themselves anchored these downstream networks or simply co-located with them, the post-1942 decline among high-Japanese-share exclusion counties could reflect the disruption of these downstream buyers caused by the war, rather than the loss of farmer-specific human capital. We test whether controlling for pre-policy buyers-network density absorbs the estimated effect.

We construct three pre-policy measures of county-level local buyers-network density, all expressed per 1940 farm. The first uses the 1940 Census of Manufactures (U.S. Bureau of the Census, 1942): the count of food-and-kindred-products plants per 1940 farm (Jaworski (2017) digitizes 21 states; we digitize the remaining 27 ourselves, including those of the exclusion zone). The other two use the full-count 1940 Population Census from IPUMS (Ruggles et al., 2024) and count non-farm workers in food and farm-product industries per 1940 farm. The *broad* measure includes 12 industries (meat, dairy, canning, grain-mill, and miscellaneous food preparations; food and farm-products wholesale; food and dairy retail; bakery, confectionery, and beverage industries). The *narrow* measure drops bakery, confectionery, and beverages (whose inputs are further removed from raw farm output) and is the theoretically cleaner proxy.

The top portion of Appendix Figure A.8 reports triple-difference estimates after controlling for each measure of downstream buyer density interacted with the post-policy dummy variable. Across all three specifications, the coefficient remains tightly clustered between -0.119 and -0.129, statistically indistinguishable from the baseline. Controlling for network density does not absorb the main effect—if anything, it pulls the coefficient slightly more negative. As a complementary exercise, we separate counties at the median density of downstream buyers (computed among the 117 exclusion-zone counties and applied uniformly) to see whether the effect differs between high- and low-downstream density counties. The treatment effect is consistently more negative in high-density counties across all three measures, suggesting that the productivity loss could have been larger in counties supplying agricultural products to more downstream businesses. However, the difference is only marginally significant at the 10% level (bottom portion of Appendix Figure A.8). The evidence for heterogeneity is suggestive rather than statistically conclusive.

7 Mechanisms and Spillover Effects

Section 6 documented a robust post-1942 decline in farm value in counties that lost Japanese farmers. This section examines the potential channels behind that decline, sharpening the human-capital loss explanation set out in Section 3. We proceed through the intensive- and extensive-margin decomposition of farm value, the composition of agricultural output, farm labor demand and wages, heterogeneity by Japanese farmers' skill and management, technology adoption, and spillovers to the non-agricultural sector.

7.1 Extensive vs. Intensive Margin of Farm Value

We first ask whether the farm-value decline operates through the extensive or intensive margin. The extensive margin captures changes in the number of farms; the intensive margin captures changes in value among farms that remain in operation. The distinction separates two mechanisms. If exclusion made farms nonviable, the number of farms should fall. If exclusion reduced operator-specific human capital, farms could continue to operate but perform worse under replacement operators.

The model in Section 3 predicts that if the human-capital channel prevailed and the exclusion replaced skilled Japanese operators with less-skilled ones, the decline operated mainly through the intensive margin. Existing farms could continue to operate but generate less value per farm. Average value per farm should fall while the number of farms should be largely unaffected.

Table 2 reports triple-difference estimates using the full specification of column (4) of Table 1. Column (1) shows no statistically significant effect on the number of farms, providing little evidence that the decline operated through farm exit. Column (2) shows a large and significant decline in value per farm: each percentage point of Japanese farm workers removed is associated with a 9.8 percent decline in average farm value after 1942. Together, columns (1) and (2) confirm that farms continued to operate after exclusion but at substantially lower value.

Columns (3) and (4) decompose the intensive-margin effect. Column (3) shows that cropland per farm falls by 8.3 percent. Column (4) shows no statistically significant effect on value per cropland acre. These results suggest that the decline in value per farm reflects a smaller scale of cultivated operations. They do not point to a broad decline in land value conditional on cultivated acreage. Appendix Figure A.9 presents the event-study analog for all four outcomes; pre-trends are parallel, and post-1942 patterns are consistent with the levels in the table.

Taken together, these results are consistent with the human-capital interpretation. Farms in affected counties did not disappear in large numbers after exclusion. Instead, they continued to operate at lower value and on a smaller cultivated scale. We interpret this pattern as evidence that exclusion reduced operator-specific human capital rather than the viability of farms.

7.2 Composition of Agricultural Output

The intensive-margin result narrows the channel but leaves open how the composition of output changed. If Japanese operators were concentrated in particular crops, their replacement should

Table 2. Effect of Japanese Exclusion on Farm Value: Extensive and Intensive Margins

	Log Total Number of Farms	Log Value per Farm	Log Cropland per Farm	Log Value per Cropland Acre
	(1)	(2)	(3)	(4)
%Japanese×Excl.×Post	-0.021	-0.098***	-0.082***	-0.015
	(0.018)	(0.028)	(0.032)	(0.020)
%Japanese×Post	0.012	0.076***	0.078**	-0.002
	(0.017)	(0.027)	(0.032)	(0.018)
Excl.×Post	0.204***	0.119*	-0.084	0.204***
	(0.059)	(0.066)	(0.052)	(0.072)
Obs.	24,508	24,508	24,508	24,508
Num. of Counties	3,064	3,064	3,064	3,064
Sample Year	1925-59	1925-59	1925-59	1925-59

Notes: The dependent variables are: log total farms (column 1), log farm value per farm (column 2), log cropland per farm (column 3), and log farm value per cropland acre (column 4). By construction, the coefficients in columns (3) and (4) sum to the coefficient in column (2). One acre is added to cropland in columns (3) and (4) to retain a few pure-rangeland counties in Texas that report zero cropland (none in the exclusion zone). All specifications use the same controls as column (4) of Table 1; control coefficients are omitted for compactness. Standard errors clustered at the county level are reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

shift production toward lower-value, less knowledge-intensive output. Japanese farmers specialized in commercial truck crops. For instance, around 1942 they accounted for 95 percent of snap bean production, 95 percent of celery production, and 75 percent of garlic production in California. Appendix Table A.4 lists additional crops they dominated. If the human-capital channel is responsible, the aggregate decline should concentrate in these high-value, fruit and vegetable categories rather than lower value crops.

Table 3 reports triple-difference estimates on total farm-product sales and on three major output categories. Column (1) reports the effect on log total value of farm products sold: each percentage point of Japanese farm workers removed lowers the aggregate by 11.5 percent. Column (2) restricts the outcome to log value of all crops; the effect is small and not statistically significant, because staple field crops account for most of crop-sales value and were largely unaffected. Column (3) narrows to fruits and vegetables, where the decline rises sharply to 23.2 percent. Column (4) extends to livestock and livestock products—where Japanese-American operators were concentrated in commercial poultry, egg, and dairy production in California (Modell, 1977; Iwata, 1992)—and shows an 8.8 percent decline, smaller than for fruits and vegetables but still significant.

Both significant declines—in fruits and vegetables and in livestock—occur where Japanese farm-

Table 3. Effect of Japanese Exclusion on Value of Farm Products Sold, by Category

	Log Total Farm Products Sold	Log All Crops Sold	Log Fruits and Vegetables Sold	Log Livestock Products Sold
	(1)	(2)	(3)	(4)
%Japanese×Excl.×Post	-0.115***	-0.040	-0.232***	-0.088***
	(0.029)	(0.034)	(0.049)	(0.034)
%Japanese×Post	0.092***	-0.012	0.158***	0.096***
	(0.029)	(0.035)	(0.048)	(0.032)
Excl.×Post	0.250***	0.392***	0.586***	-0.063
	(0.059)	(0.088)	(0.111)	(0.114)
Obs.	18,380	18,356	18,149	18,376
Num. of Counties	3,064	3,063	3,059	3,064
Sample Year	1930-59	1930-59	1930-59	1930-59

Notes: The dependent variables are log values of: total farm products sold (column 1), all crops sold (column 2), fruits and vegetables sold (column 3), and livestock and livestock products sold (column 4). Sales data are reported only for census years 1930, 1940, 1945, 1950, 1954, and 1959. All specifications use the same controls as column (4) of Table 1; control coefficients are omitted for compactness. Standard errors clustered at the county level are reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

ers were concentrated. Together with the within-farm value decline, this implies that exclusion did not simply lower output across the board, but rather shifted the composition of production away from the high-value, knowledge-intensive output in which Japanese farmers had comparative advantages.

7.3 Farm Labor Demand and Productivity

The intensive-margin and compositional results both point to a productivity channel; we now turn to the farm labor market itself. If Japanese farm workers embodied specific human capital, their loss should reduce the marginal productivity of generic farm labor, lowering both farm employment and the wage for remaining farm workers. Under the pure local labor-supply alternative, instead, farm employment would still fall, but the local farm wage would *rise* as the inward supply shift pushed against unchanged farm labor demand (Proposition 2). The workers' wage response, positive or negative, therefore provides additional evidence to separate the two channels, between loss of labor and loss of human capital.

Table 4 reports triple-difference estimates on four farm-labor outcomes. Column (1) shows that each percentage point of Japanese farm workers removed lowers hired farm employment by 17.1 percent. Column (2) reports a 14.9 percent decline in cash wage expenditure on hired farm labor, mirroring the contraction in hired farm employment. Column (3) reports an 8.1 percent decline in the wage rate per hired farm worker. Column (4) extends to unpaid family farm workers, with a small (-4.7 percent) and statistically insignificant effect.

Table 4. Effect of Japanese Exclusion on Farm Labor and Wages

	Log Hired Workers	Log Wage Expenditure	Log Wage Rate	Log Family Workers
	(1)	(2)	(3)	(4)
%Japanese×Excl.×Post	-0.171***	-0.149***	-0.081***	-0.047
	(0.042)	(0.049)	(0.031)	(0.029)
%Japanese×Post	0.162***	0.120**	0.071**	0.048*
	(0.042)	(0.049)	(0.031)	(0.025)
Excl.×Post	0.241**	0.422***	0.201***	0.098
	(0.105)	(0.070)	(0.065)	(0.132)
Obs.	24,442	24,498	24,441	24,475
Num. of Counties	3,064	3,064	3,064	3,064
Sample Year	1925-59	1925-59	1925-59	1925-59

Notes: The dependent variables are the logarithm of: total hired farm workers (column 1), total cash wage expenditure paid to hired farm labor (column 2), the wage rate per hired worker (column 3), and total family farm workers (column 4). The wage rate in column (3) is constructed as the ratio of average cash wages per wage-paying farm to average hired workers per worker-employing farm, since the two underlying reporting populations differ systematically. All specifications use the same controls as column (4) of Table 1; control coefficients are omitted for compactness. Standard errors clustered at the county level are reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

The combination of falling hired-farm employment and wages rules out a pure labor-supply shock. It is consistent with the human-capital channel, in which the loss of Japanese skill, complementary to labor, depressed the marginal productivity of remaining farm labor. The contrast between hired and family farm labor sharpens this reading: commercial hired farm labor, the margin most exposed to Japanese-led production, contracts sharply, while non-commercial family farm labor is essentially unaffected. Together with the within-farm value decline and the compositional shift toward lower-value output, the farm-labor results suggest a productivity loss concentrated on the commercial, skill-intensive segment of agriculture.

7.4 Mechanization and Technology Adoption

If skilled Japanese operators were the early adopters of new technology, exclusion could have slowed technology adoption in the treated counties (Proposition 3). The 1940s and 1950s were among the most transformative decades in U.S. agricultural technology. Tractor adoption, which had begun in the 1920s, became widespread between 1940 and 1960: the number of tractors tripled, and they nearly fully replaced horses, mules, and other draft animals on American farms (Olmstead and Rhode, 2000). Other power equipment—mechanical planters, cutters, huskers, manure spreaders, and hay dryers—experienced similar diffusion. Chemical inputs underwent a similar transformation: the postwar conversion of ammonium-nitrate plants from military to civilian production accelerated the diffusion of commercial fertilizers, raising yields across many crops. These changes favored more educated and experienced farmers, so the loss of Japanese farm workers could slow adoption in the treated counties.

Table 5 reports triple-difference estimates on the intensity of technology use. Columns (1)–(3) cover the log average number of motor trucks, tractors, and automobiles per farm reporting use; column (4) covers the log average commercial-fertilizer expenditure per fertilizer-using farm. All four triple-difference coefficients are negative and significant. Each percentage point of Japanese farm workers removed lowered the motor-truck stock by 4.4 percent, the tractor stock by 3.7 percent, the automobile stock by 1.1 percent, and fertilizer expenditure by 20.9 percent. Outside the exclusion zone, counties with higher Japanese presence saw faster intensification on the same margins, an advantage that exclusion eliminated in the treated counties. The breadth of adoption moved against the treated counties as well: Appendix Table A.7 reports the corresponding extensive-margin outcomes, and the shares of farms using motor trucks, tractors, automobiles, telephones, and commercial fertilizer all fall significantly.

Technology adoption is a very important test of the human-capital channel. Proposition 3 implies that only scenarios with a human-capital shock generate a decline in measured technology; pure labor-supply scenarios would leave adoption unchanged. The negative effects on mechanization and fertilizer use reinforce the notion that skilled (Japanese) farmers were critical to technological adoption in the subsequent decades and, through it, to productivity growth.

7.5 Heterogeneous Effects by Education and Management

The preceding subsections inferred the human-capital channel from outcome patterns; we now test it directly by splitting treatment intensity along two observable dimensions of human capital: education and managerial role. If the productivity decline was driven by the loss of those dimensions, the exclusion effect should be larger where the Japanese workforce was more educated and more involved in managerial roles. Table 6 reports two heterogeneous-treatment models on log total farm value. Panel A splits Japanese workers by educational attainment: high-school degree versus no high-school degree (the standard threshold in 1940). Panel B splits them by occupational role:

Table 5. Effect of Japanese Exclusion on Mechanization and Fertilizer Use

	Log Motor-trucks per Farm	Log Tractors per Farm	Log Automobiles per Farm	Log Fertilizer Expenditure per Farm
	(1)	(2)	(3)	(4)
%Japanese×Excl.×Post	-0.044***	-0.037**	-0.011**	-0.209***
	(0.009)	(0.016)	(0.005)	(0.067)
%Japanese×Post	0.042***	0.035**	0.007	0.133**
	(0.009)	(0.016)	(0.005)	(0.066)
Excl.×Post	0.033	0.004	0.021	0.441***
	(0.023)	(0.030)	(0.015)	(0.150)
Obs.	18,372	18,330	18,380	11,341
Num. of Counties	3,064	3,063	3,064	2,982
Sample Year	1930-59	1930-59	1930-59	1925-54

Notes: Columns (1)–(3) are log average motor trucks, tractors, and automobiles per farm reporting use. Column (4) is log average commercial-fertilizer expenditure (dollars) per fertilizer-using farm. The first three columns cover the census years 1930, 1940, 1945, 1950, 1954, and 1959; column (4) covers 1925, 1930, 1940, and 1954. Adoption-rate (extensive-margin) counterparts are reported in Appendix Table A.7. All specifications use the same controls as column (4) of Table 1; control coefficients are omitted for compactness. Standard errors clustered at the county level are reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

farmers and farm managers versus laborers.

In Panel A, the triple-difference coefficient on the share of high-school-educated Japanese workers is negative and significant across all four specifications. In our preferred column (4), each percentage point loss of high-school-educated Japanese workers implied lower log farm value by 12.5 percent. The coefficient on the share without a high-school degree is small (-0.025) and statistically insignificant. The two-way coefficients show the same asymmetry: outside the exclusion zone, the educated share accelerated farm-value growth, while the less-educated share has no significant effect.

Panel B repeats the exercise by occupational role. The triple-difference coefficient on the share of Japanese farmers and farm managers is negative and significant in all four columns. In column (4), each percentage point loss of Japanese farmers and farm managers lowers log farm value by 16.7 percent. The coefficient on the share of Japanese laborers is small (0.050) and not significant. Farmers and managers were the operators with decision-making and entrepreneurial responsibility, including over technology adoption. The asymmetry mirrors Panel A: the productivity loss tracks the loss of skill-rich roles, not generic farm labor.

Both panels show that the productivity loss correlates strongly with the skilled subset of the

Table 6. Effects of Japanese Exclusion on Farm Value, by Education and Management

	Dependent Variable: Log Total Farm Value			
	(1)	(2)	(3)	(4)
Panel A: By Education				
%Japanese (HS) × Excl. × Post	-0.308***	-0.257***	-0.199**	-0.125**
	(0.111)	(0.093)	(0.083)	(0.058)
%Japanese (HS) × Post	0.306***	0.263***	0.216***	0.141**
	(0.110)	(0.092)	(0.082)	(0.057)
%Japanese (non-HS) × Excl. × Post	0.068	0.012	0.001	-0.025
	(0.076)	(0.063)	(0.057)	(0.046)
%Japanese (non-HS) × Post	-0.098	-0.057	-0.057	-0.037
	(0.073)	(0.059)	(0.052)	(0.037)
Excl. × Post	0.377***	0.442***	0.260***	0.326***
	(0.092)	(0.065)	(0.057)	(0.070)
Panel B: By Managerial Role				
%Japanese (Farmer) × Excl. × Post	-0.188**	-0.233***	-0.187***	-0.167***
	(0.079)	(0.067)	(0.052)	(0.050)
%Japanese (Farmer) × Post	0.137*	0.160**	0.111**	0.070
	(0.077)	(0.064)	(0.050)	(0.048)
%Japanese (Laborer) × Excl. × Post	-0.031	0.009	0.017	0.050
	(0.078)	(0.064)	(0.052)	(0.040)
%Japanese (Laborer) × Post	0.055	0.032	0.031	0.012
	(0.077)	(0.062)	(0.049)	(0.034)
Excl. × Post	0.360***	0.410***	0.224***	0.279***
	(0.092)	(0.064)	(0.059)	(0.074)
Socioeconomic × Post	No	Yes	Yes	Yes
Log County Area × Post	No	No	Yes	Yes
Farm-Type FE × Post	No	No	No	Yes
Obs.	24,508	24,508	24,508	24,508
Num. of Counties	3,064	3,064	3,064	3,064

Notes: The dependent variable in both panels is log total farm value. Panel A splits Japanese workers by educational attainment (HS = high school graduate; non-HS = no high school degree); Panel B splits them by occupational role (Farmer = farmer or farm manager; Laborer = farm laborer). Each panel reports two triple-difference coefficients (one per subgroup), the corresponding two-way interactions with the post-1942 indicator, and the coefficient on the interaction between the exclusion dummy and the post-policy dummy. "Socioeconomic" includes log farm population, foreign-born population share, foreign-born farm-worker share, and non-Japanese Asian share, each interacted with the post-1942 indicator. All regressions include county and year fixed effects and are weighted by 1940 county population. Standard errors clustered at the county level are reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Japanese farm workforce. The headline triple-difference magnitudes survive in the educated and managerial subgroups, while the less-skilled subgroups show near-zero effects. The decline is therefore tied directly to the loss of human capital, not to generic farm labor.

7.6 Agricultural Productivity as a Catalyst of Local Growth

The productivity losses in agriculture driven by skill loss and slower technology adoption can generate spillovers to the non-agricultural sector through local agglomeration economies (Moretti, 2004b), complementarities between agricultural and non-agricultural production (Gollin et al., 2002), and the reallocation of surplus labor freed by labor-saving agricultural technologies. Bustos et al. (2016) formalizes the last of these channels: in a small open economy with complementarity between agricultural and non-agricultural goods, labor-saving improvements in agriculture release labor for the non-agricultural sector while raising demand for its output. A negative shock to agricultural human capital in this framework slows the reallocation and dampens non-agricultural employment growth in the affected counties.

Table 7 reports the triple-difference estimates on four labor-market and population outcomes: log total employment (column 1), log agricultural employment (column 2), log non-agricultural employment (column 3), and log total county population (column 4). All four triple-difference coefficients are negative and significant. The declines range from 9.6 percent on agricultural employment to 17.4 percent on total population per percentage point of Japanese farm workers in 1940. Both agricultural and non-agricultural employment are affected (columns 2 and 3), consistent with spillovers from agriculture to the rest of the local economy. The two-way coefficients on the Japanese share are again positive: outside the exclusion zone, counties with higher Japanese presence experienced faster employment and population growth, an advantage exclusion eliminated in the treated counties. The negative effects on non-agricultural employment and total population indicate that counties that lost more Japanese farmers experienced slower overall employment and population growth, consistent with agricultural productivity acting as a catalyst for broader local development (Gollin et al., 2002; Bustos et al., 2016; Vollrath, 2011; Lagakos and Waugh, 2013).

8 Concluding Remarks

This paper estimates the long-run consequences of the 1942 Japanese exclusion on the U.S. West Coast for agricultural productivity. Counties in the exclusion zone experienced a 12.8 percent gap

Table 7. Effect of Japanese Exclusion on Employment and Population

	Log Total Employment	Log Agricultural Employment	Log Non-Agricultural Employment	Log Total Population
	(1)	(2)	(3)	(4)
%Japanese×Excl.×Post	-0.153***	-0.096***	-0.128***	-0.174***
	(0.038)	(0.036)	(0.042)	(0.037)
%Japanese×Post	0.151***	0.076**	0.118***	0.165***
	(0.039)	(0.036)	(0.042)	(0.038)
Excl.×Post	0.123*	0.180***	0.127**	0.213***
	(0.063)	(0.065)	(0.062)	(0.059)
Obs.	12,245	12,245	12,245	12,241
Num. of Counties	3,062	3,062	3,062	3,061
Sample Year	1930-59	1930-59	1930-59	1930-59

Notes: The dependent variables are the logarithm of: total employment (column 1), agricultural employment (column 2), non-agricultural employment (column 3), and total county population (column 4). Employment is defined as individuals aged 20 or older who report an occupation and are currently employed; agricultural employment additionally requires reporting agriculture as the main industry. Data come from the full-count Population Censuses of 1930, 1940, and 1950 and the 5% sample of the 1960 Census, all provided by IPUMS (Ruggles et al., 2024). All specifications use the same controls as column (4) of Table 1; control coefficients are omitted for compactness. Standard errors clustered at the county level are reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

in farm-value growth between 1940 and 1960 for every percentage point of Japanese farm workers excluded, relative to non-exclusion counties. Counties *outside* the exclusion zone with larger pre-exclusion Japanese populations grew faster after the war. The decline operated through lower productivity and value per farm rather than through fewer farms, indicating that the loss of skilled Japanese farmers reduced the productivity of farms that continued to operate.

A model in which the loss of Japanese farmers represents a loss of agriculture-specific human capital, rather than generic farm labor, fits the observed pattern across four margins. First, exclusion counties shifted away from the high-value fruit and vegetable categories that Japanese farmers had dominated before the war. Second, they experienced slower adoption of mechanization and chemical fertilizers, the major agricultural technologies of the 1940s and 1950s. Third, both hired farm employment and wages fell, ruling out the pure labor-supply alternative under which wages would have risen. Fourth, the decline was associated with the loss of high-school-educated Japanese farmers and farm managers, rather than with the loss of less-educated Japanese laborers.

Japanese farmers were among the most educated, innovative, and hardworking farm operators on the West Coast in 1940. The 1942 exclusion policy that confined them to internment camps imposed severe economic, physical, and psychological costs on Japanese Americans (Saavedra, 2015; Shoag and Carollo, 2016; Komisarchik et al., 2020). This paper documents an additional cost imposed not on the displaced families, but on the counties they were removed from: the loss of agriculture-specific human capital depressed farm productivity, slowed technology adoption, and dampened local employment and population growth. These effects persisted for at least two decades.

The historical episode is extreme in its speed and scale. But the underlying mechanism—the abrupt removal of a skilled subpopulation embedded in a specific industry—recurs in contemporary policy debates over immigration enforcement, refugee resettlement, and forced relocation. Replacement workers can partially fill the immediate labor gap, but the human capital and technology that the displaced workers built up are not easily reproduced. Our estimates suggest that the productivity costs of such displacement can be substantial and persistent. Policies that treat specialized agricultural labor as interchangeable with generic labor understate these costs.

References

Alston, Julian M. and Philip G. Pardey, "Innovation, Growth and Structural Change in American Agriculture," NBER Working Papers 27206, National Bureau of Economic Research, Inc May 2020.

Alston, Julian, Matthew Andersen, Jennifer James, and Philip Pardey, "The Economic Returns to U.S. Public Agricultural Research," *American Journal of Agricultural Economics*, 10 2011, *93*, 1257–1277.

Arellano-Bover, Jaime, "Displacement, Diversity, and Mobility: Career Impacts of Japanese American Internment," *The Journal of Economic History*, 2022, *82* (1), 126–174.

Bustos, Paula, Bruno Caprettini, and Jacopo Ponticelli, "Agricultural Productivity and Structural Transformation: Evidence from Brazil," *American Economic Review*, 6 2016, *106* (6), 1320–65.

Caudill, Steven B and Franklin G Mixon Jr, "Human capital investment and the internment of Japanese Americans during WWII: A public choice approach," *International Journal of Applied Economics*, 2012, *9* (1), 1–14.

Chin, Aimee, "Long-Run Labor Market Effects of Japanese American Internment during World War II on Working-Age Male Internees," *Journal of Labor Economics*, 2005, *23* (3), 491–525.

Chu, Angus C., Pietro F. Peretto, and Xilin Wang, "Agricultural revolution and industrialization," *Journal of Development Economics*, 2022, *158*, 102887.

Clemens, Michael A., Ethan G. Lewis, and Hannah M. Postel, "Immigration Restrictions as Active Labor Market Policy: Evidence from the Mexican Bracero Exclusion," *American Economic Review*, 2018, *108* (6), 1468–87.

DeWitt, J. L., *Final Report Japanese Evacuation from the West Coast, 1942*, Washington, United States: United States Government Printing Office, 1943.

Fishback, Price V. and Joseph A. Cullen, "Second World War Spending and Local Economic Activity in U.S. Counties, 1939–58," *The Economic History Review*, 2013, *66* (4), 975–992.

Gollin, Douglas, Stephen Parente, and Richard Rogerson, "The Role of Agriculture in Development," *American Economic Review*, 5 2002, *92* (2), 160–164.

Haines, Michael, Price Fishback, and Paul Rhode, "United States Agriculture Data, 1840 - 2012.," Inter-university Consortium for Political and Social Research [distributor] https://doi.org/10.3886/ICPSR35206.v4 2018.

Higgs, Robert, "Landless by Law: Japanese Immigrants in California Agriculture to 1941," *The Journal of Economic History*, 1978, *38* (1), 205–225.

_ , "Wartime Prosperity? A Reassessment of the U.S. Economy in the 1940s," *The Journal of Economic History*, 1992, *52* (1), 41–60.

Hornbeck, Richard and Pinar Keskin, "Does Agriculture Generate Local Economic Spillovers? Short-Run and Long-Run Evidence from the Ogallala Aquifer," *American Economic Journal: Economic Policy*, May 2015, *7* (2), 192–213.

_ **and Suresh Naidu**, "When the Levee Breaks: Black Migration and Economic Development in the American South," *American Economic Review*, 2014, *104* (3), 963–90.

Huber, Kilian, Volker Lindenthal, and Fabian Waldinger, "Discrimination, Managers, and Firm Performance: Evidence from "Aryanizations" in Nazi Germany," *Journal of Political Economy*, 2021, *129* (9), 2455–2503.

Iranzo, Susana and Giovanni Peri, "Schooling Externalities, Technology, and Productivity: Theory and Evidence from U.S. States," *Review of Economics and Statistics*, 2009, *91* (2), 420–431.

Iwata, Masakazu, "The Japanese Immigrants in California Agriculture," *Agricultural History*, 1962, *36* (1), 25–37.

_ , *Planted in Good Soil: A History of the Issei in United States Agriculture*, New York: Peter Lang, 1992.

Jaworski, Taylor, "World War II and the Industrialization of the American South," *The Journal of Economic History*, 2017, *77* (4), 1048–1082.

Komisarchik, Mayya, Maya Sen, and Yamil Velez, "The Political Consequences of Ethnically Targeted Incarceration: Evidence from Japanese-American Internment During WWII," Working Paper RWP20-021, Harvard Kennedy School 2020.

Lagakos, David and Michael E. Waugh, "Selection, Agriculture, and Cross-Country Productivity Differences," *American Economic Review*, April 2013, *103* (2), 948–80.

Lee, Jongkwan, Giovanni Peri, and Vasil Yasenov, "The Employment Effects of Mexican Repatriations: Evidence from the 1930's," Working Paper 23885, National Bureau of Economic Research 2017.

Lucas, Robert E., "On the mechanics of economic development," *Journal of Monetary Economics*, 1988, *22* (1), 3–42.

Manson, Steven, Jonathan Schroeder, David Van Riper, Katherine Knowles, Tracy Kugler, Finn Roberts, and Steven Ruggles, "IPUMS National Historical Geographic Information System," Version 19.0 [dataset]. Minneapolis, MN: IPUMS http://doi.org/10.18128/D050.V19.0 2024.

Modell, John, *The Economics and Politics of Racial Accommodation: The Japanese of Los Angeles, 1900–1942*, Urbana: University of Illinois Press, 1977.

Moretti, Enrico, "Estimating the Social Return to Higher Education: Evidence from Longitudinal and Repeated Cross-Sectional Data," *Journal of Econometrics*, 2004, *121* (1), 175–212. Higher education (Annals issue).

_ , "Workers' Education, Spillovers, and Productivity: Evidence from Plant-Level Production Functions," *American Economic Review*, June 2004, *94* (3), 656–690.

Olmstead, Alan L. and Paul W. Rhode, "The Diffusion of the Tractor in American Agriculture: 1910-60," NBER Working Papers 7947, National Bureau of Economic Research, Inc October 2000.

Ruggles, Steven, Matt A. Nelson, Matthew Sobek, Catherine A. Fitch, Ronald Goeken, J. David Hacker, Evan Roberts, and J. Robert Warren, "IPUMS Ancestry Full Count Data: Version 4.0 [dataset]," Minneapolis, MN. https://doi.org/10.18128/D014.V4.0 2024.

Ruzzante, Sacha, Ricardo Labarta, and Amy Bilton, "Adoption of agricultural technology in the developing world: A meta-analysis of the empirical literature," *World Development*, 2021, *146*, 105599.

Saavedra, Martin, "School quality and educational attainment: Japanese American internment as a natural experiment," *Explorations in Economic History*, 2015, *57*, 59 – 78.

Shoag, Daniel and Nicholas Carollo, "The Causal Effect of Place: Evidence from Japanese-American Internment," Working Paper Series 16-022, Harvard University, John F. Kennedy School of Government 2016.

U.S. Bureau of the Census, *Sixteenth Census of the United States, 1940. Census of Manufactures: 1939, Volume III: Reports for States and Outlying Areas*, Washington, DC: United States Government Printing Office, 1942.

U.S. Department of Agriculture, *Agricultural Statistics 1941*, Washington, D.C.: U.S. Government Printing Office, 1941.

U.S. Department of Agriculture, Economic Research Service, "Weights, Measures, and Conversion Factors for Agricultural Commodities and Their Products," Agricultural Handbook 697, U.S. Department of Agriculture, Washington, D.C. 1992.

Vollrath, Dietrich, "The agricultural basis of comparative development," *Journal of Economic Growth*, 2011, *16* (4), 343–370.

Waldinger, Fabian, "Peer Effects in Science: Evidence from the Dismissal of Scientists in Nazi Germany," *The Review of Economic Studies*, 2012, *79* (2), 838–861.

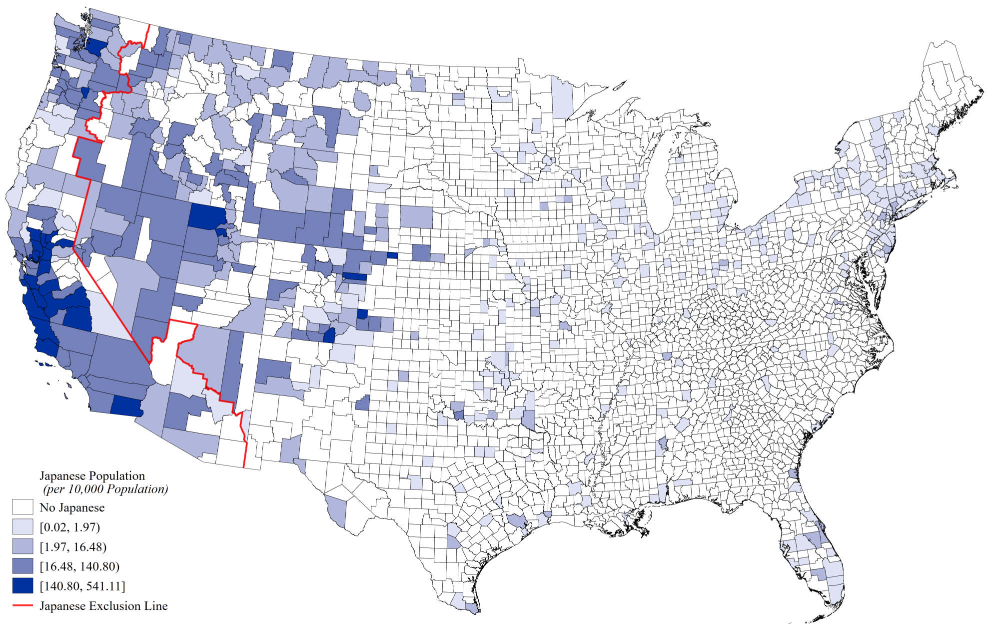
_ , "Bombs, Brains, and Science: The Role of Human and Physical Capital for the Creation of Scientific Knowledge," *The Review of Economics and Statistics*, 12 2016, *98* (5), 811–831.

Wang, Sun Ling, Roberto Mosheim, Richard Nehring, and Eric Njuki, "Agricultural Productivity in the United States," Data Product, Economic Research Service, U.S. Department of Agriculture 2020.

Appendix

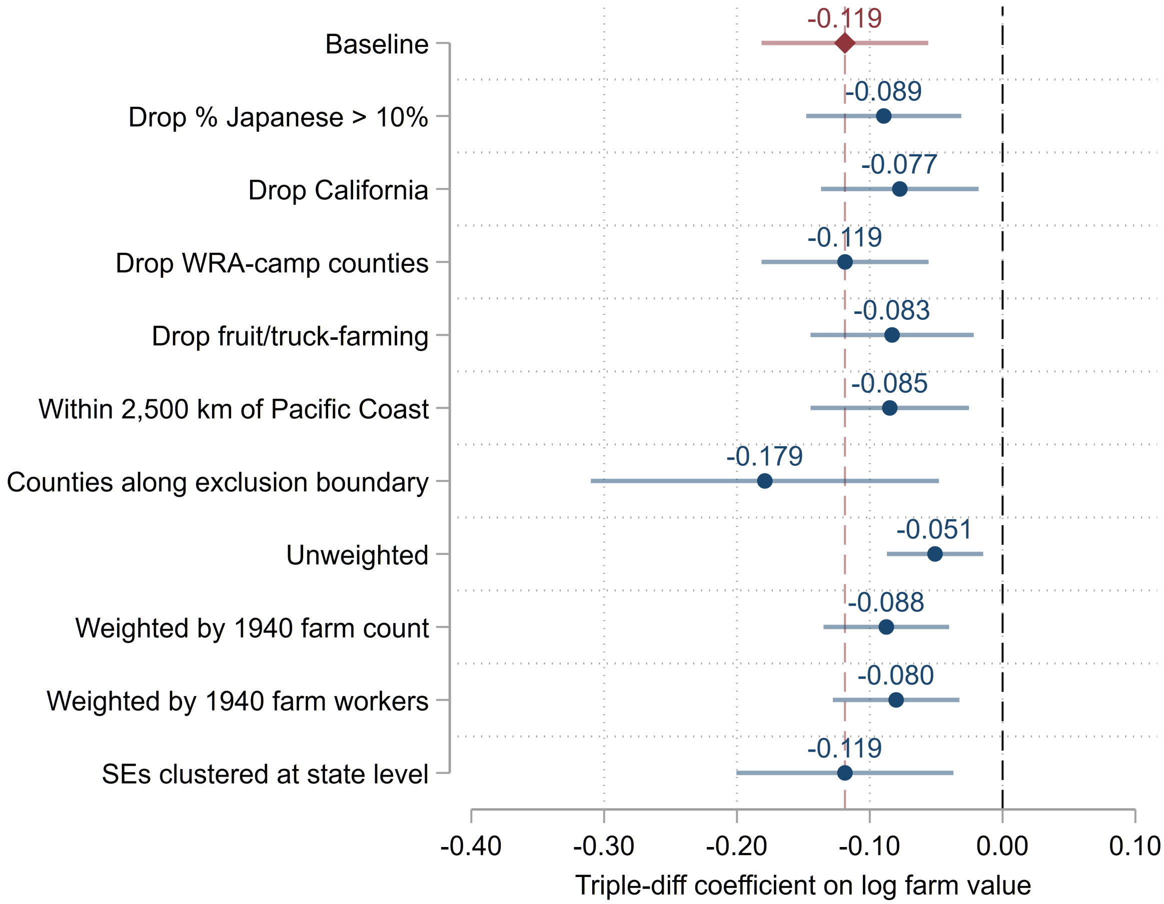
Additional Figures

Figure A.1. Exclusion Zone and Japanese Population Share by U.S. Counties in 1940



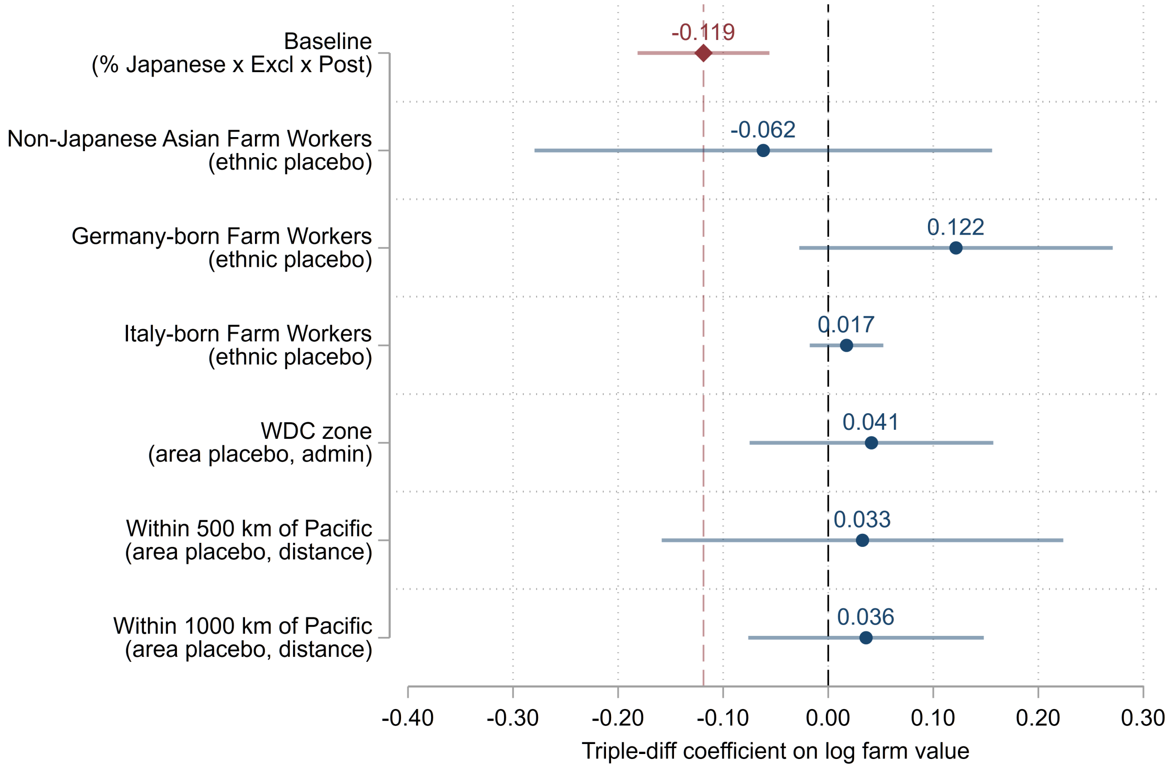
Note: This figure illustrates the spatial distribution of the Japanese population across U.S. counties in 1940, measured as the number of Japanese residents per 10,000 total population. The data are drawn from the full-count 1940 Population Census provided by IPUMS (Ruggles et al., 2024), with Japanese individuals identified based on the race variable coded in the 1940 Census. The figure also displays the boundary of the exclusion zone, designated by the Commanding General under Executive Order No. 9066, signed by President Franklin D. Roosevelt. The boundary has been digitized from the original map included in the Final Report: Japanese Evacuation from the West Coast (DeWitt, 1943). Counties that were only partially included in the exclusion zone are treated as fully included for the purposes of this map.

Figure A.2. Robustness Checks on Log Farm Value



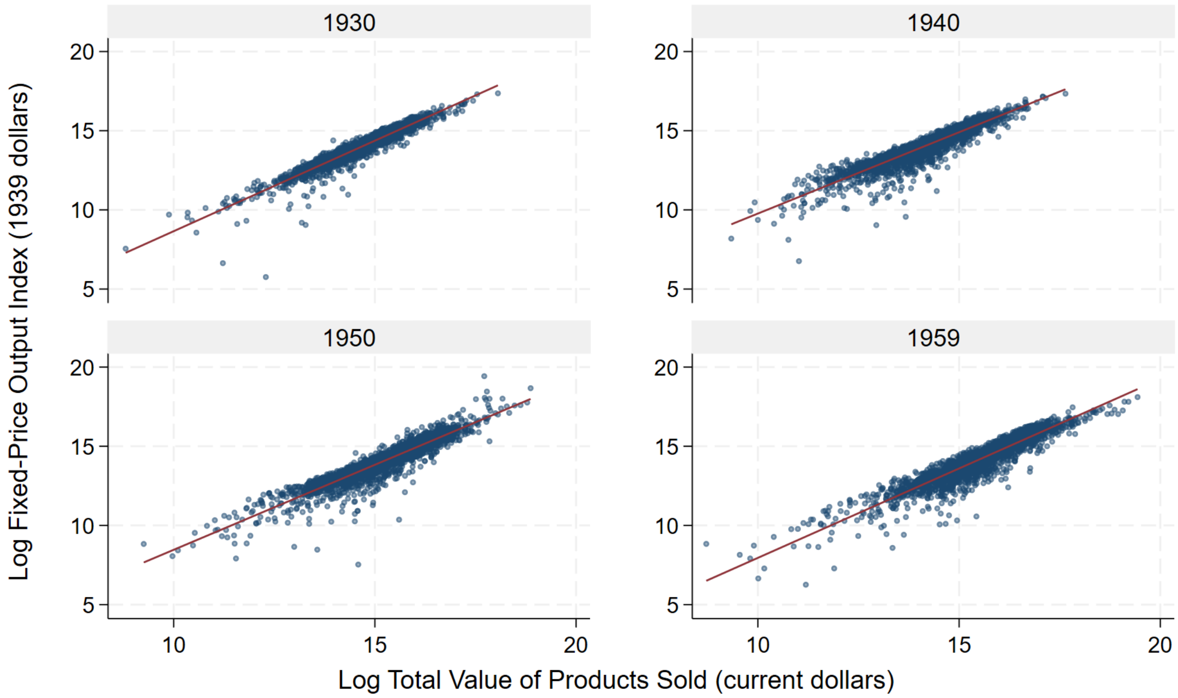
Notes: The figure plots the triple-difference coefficient (% Japanese × Excl × Post on log farm value) under a series of robustness specifications. The maroon diamond at top reproduces the baseline estimate from column (4) of Table 1: weighted by 1940 county population, standard errors clustered at the county level, full sample. The first six navy circles apply sample restrictions to the baseline: dropping counties with more than 10% Japanese farm workers; dropping California; dropping the eleven counties that hosted War Relocation Authority (WRA) internment camps; dropping counties classified by the USDA as "Fruit, Truck, and Mixed Farming"; restricting to counties within 2,500 kilometers of the Pacific coast; and restricting to counties along the exclusion boundary. The last four navy circles vary the regression weighting (unweighted; weighted by the 1940 number of farms; weighted by the 1940 number of farm workers, i.e., operators plus laborers) or the level of clustering for inference (state instead of county; the point estimate is unchanged by construction). All specifications retain the full set of baseline controls (column (4) of Table 1). The vertical dashed maroon line marks the baseline coefficient; the vertical dashed black line marks zero. Horizontal segments show 95% confidence intervals.

Figure A.3. Placebo Tests on Log Farm Value



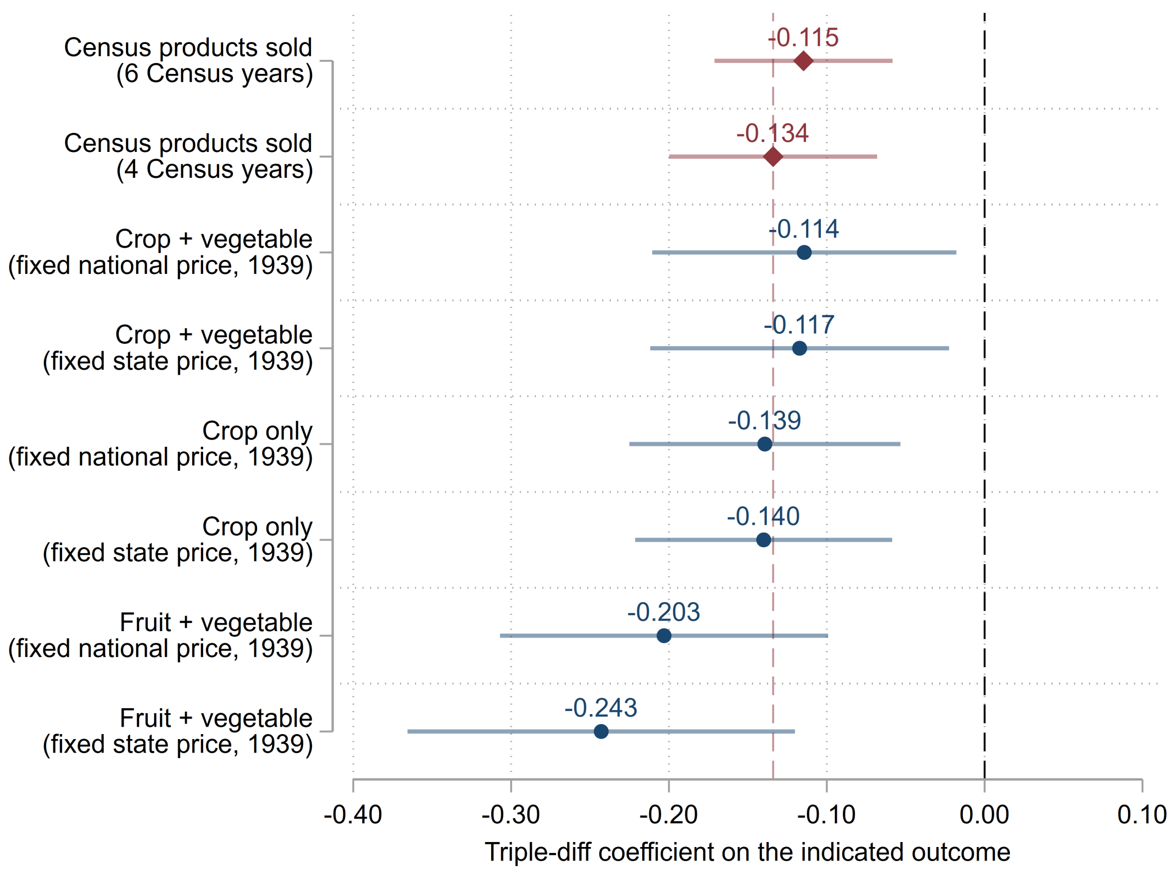
Notes: The figure plots the triple-difference coefficient from each placebo specification. The maroon diamond at top reproduces the baseline estimate from column (4) of Table 1, i.e. % Japanese × Excl × Post on log farm value. The navy circles below report placebo coefficients. The three ethnic-placebo rows replace the share of Japanese with an alternative farm-worker share constructed from the IPUMS 1940 full-count U.S. Census of Population, estimated on the full sample. "Non-Japanese Asian Farm Workers" is the share of farm workers whose self-reported race is Chinese or "other Asian or Pacific Islander," capturing Chinese, Filipino, Korean, and other Asian agricultural workers and excluding Japanese. "Germany-born Farm Workers" and "Italy-born Farm Workers" are the corresponding shares of farm workers whose birthplace is Germany or Italy. Each share is computed as a percentage of total farm workers in the county. The three area-placebo rows replace the exclusion indicator with an alternative "fake-treated" geography and restrict the sample to non-exclusion counties ($excl = 0$): the WDC-zone placebo uses the administrative boundary of the Western Defense Command, while the two distance placebos use indicators for counties within 500 or 1,000 kilometers of the Pacific coast. The 500-kilometer cutoff is tighter than the eastern boundary of the WDC; the 1,000-kilometer cutoff is similar to it. All specifications retain the full set of baseline controls (column 4 of Table 1). The vertical dashed maroon line marks the baseline coefficient; the vertical dashed black line marks zero. Horizontal segments show 95% confidence intervals based on county-clustered standard errors.

Figure A.4. Fixed-Price Output Index vs. Census-Reported Total Value of Products Sold



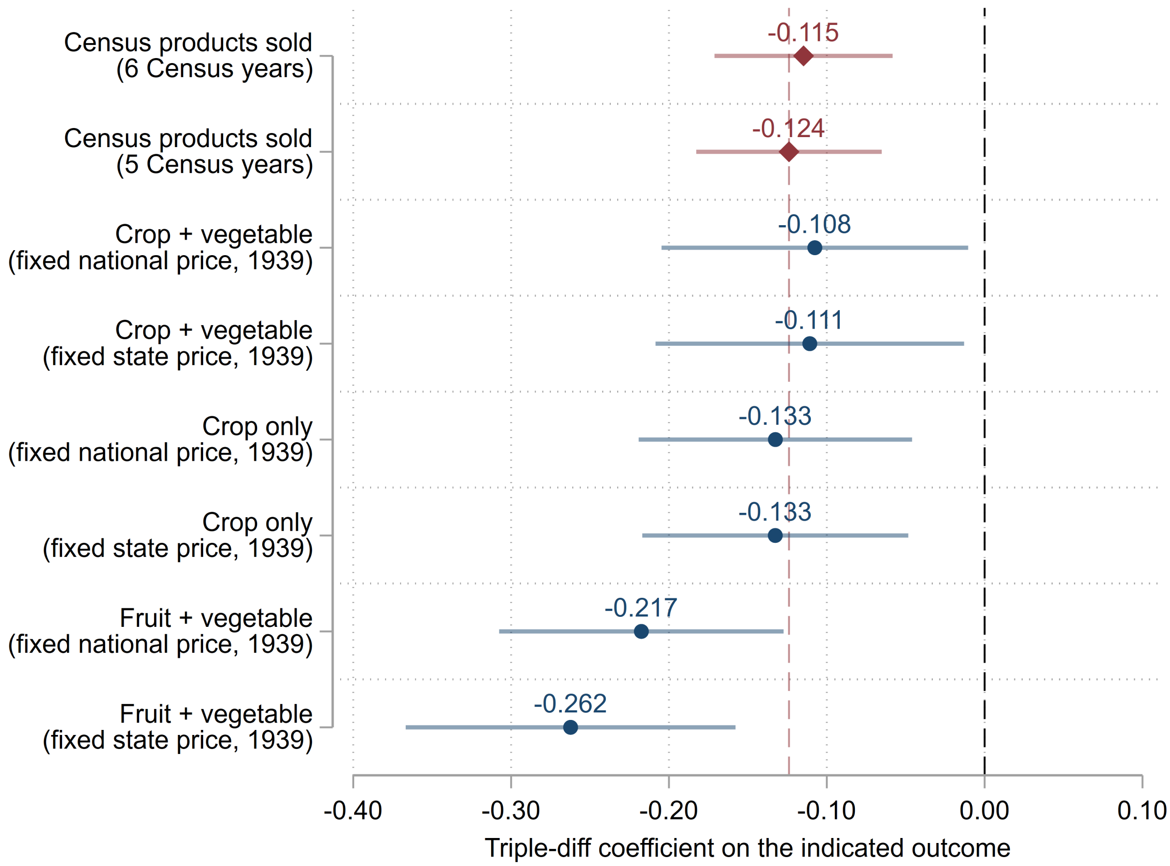
Notes: Each panel corresponds to one Census year of the four-year panel (1930, 1940, 1950, 1959). Each navy dot is one county; the red line is the within-year linear fit. The vertical axis is the logarithm of our fixed-price output index (55 crops + 29 vegetables, valued at 1939 prices held constant across all years), and the horizontal axis is the logarithm of the directly-reported Census total value of products sold in current dollars. The 1940 panel is the apples-to-apples comparison year, since both axes are valued at 1939 prices. The other panels show level shifts driven by inflation in the products-sold series (1929, 1949, and 1959 dollars on the horizontal axis), but within-year linear fits remain tight: the Pearson correlation r between the two log series ranges from 0.91 to 0.95 across the four years (pooled $r = 0.85$). At the national-aggregate level, the 84-item basket accounts for 95.6% of 1940 total products sold.

Figure A.5. Effect of Japanese Exclusion on Fixed-Price Output



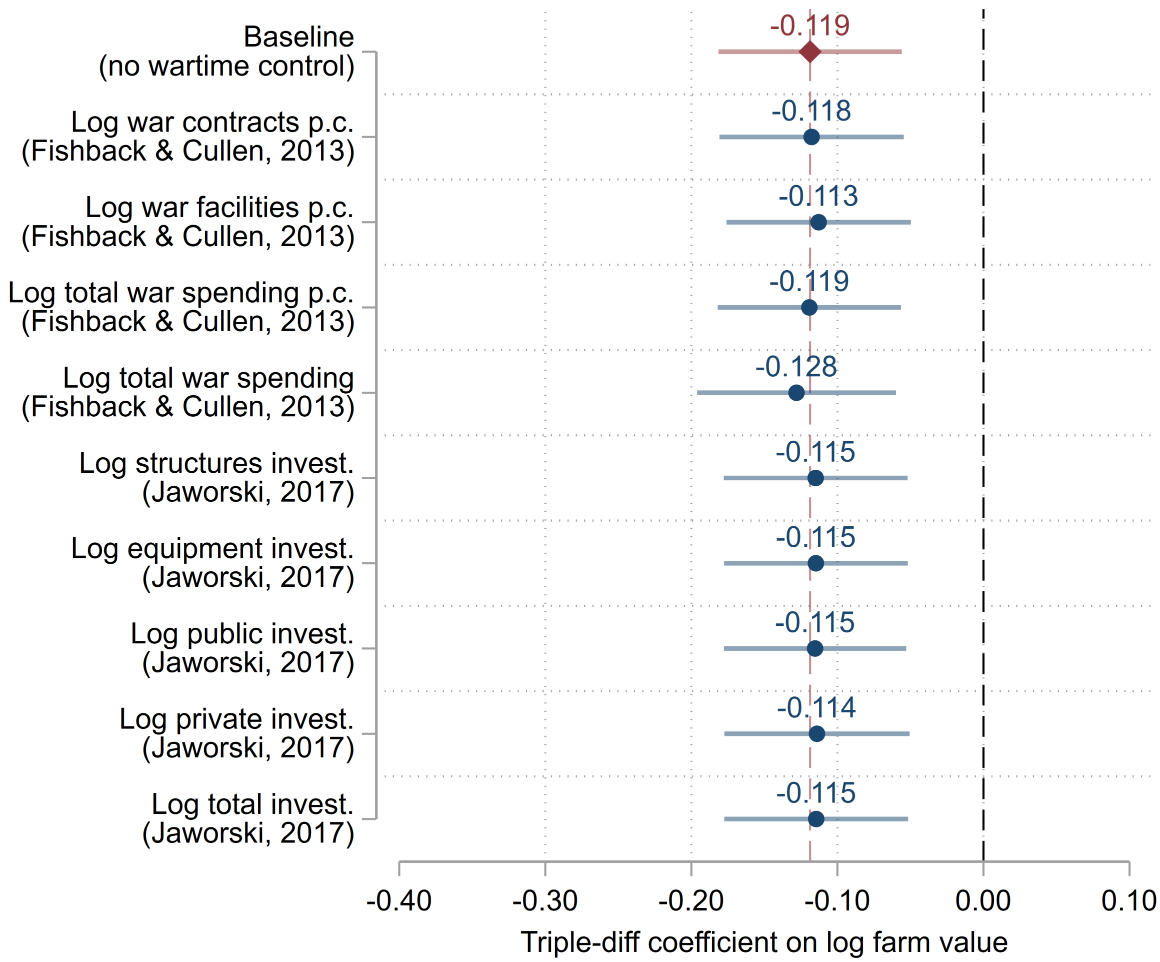
Notes: Each marker is the triple-difference coefficient on $\%\,Japanese \times Excl. \times Post$ from a specification of equation (5.1); horizontal lines are 95% confidence intervals (county-clustered standard errors). All regressions include the same controls as column (4) of Table 1. The two maroon diamonds at top use the logarithm of total farm products sold (Census-reported, in current dollars) as the dependent variable: the first on the six-Census-year panel (1930, 1940, 1945, 1950, 1954, 1959) used for the main results, the second on the restricted four-Census-year panel (1930, 1940, 1950, 1959) used for the fixed-price baskets below; comparing the two shows that the panel restriction does not materially alter the baseline coefficient. The vertical maroon dashed line marks the 4-year baseline coefficient (the direct benchmark for the fixed-price specifications); the vertical black dashed line marks zero. The six navy circles use the logarithm of a fixed-price output index constructed by multiplying county-level crop quantities reported in each Census of Agriculture by 1939 prices held constant across all years (drawn from the USDA *Agricultural Statistics 1941* yearbook (U.S. Department of Agriculture, 1941)). "Crop + vegetable" is a basket of 55 crops and 29 vegetable categories (vegetables included via a 1939 value-per-acre proxy because physical quantity is not separately reported); "Crop only" drops the vegetables; "Fruit + vegetable" restricts the basket to fruit, vegetable, and tree-fruit crops where Japanese farmers specialized. Within each basket pair, "national price" uses a uniform 1939 price per crop while "state price" uses a 1939 state-specific price (with national fallback when no state-level price was reported). Appendix A.1 documents basket construction, source tables, and unit conversions.

Figure A.6. Effect of Japanese Exclusion on Fixed-Price Output, 5-Year Panel



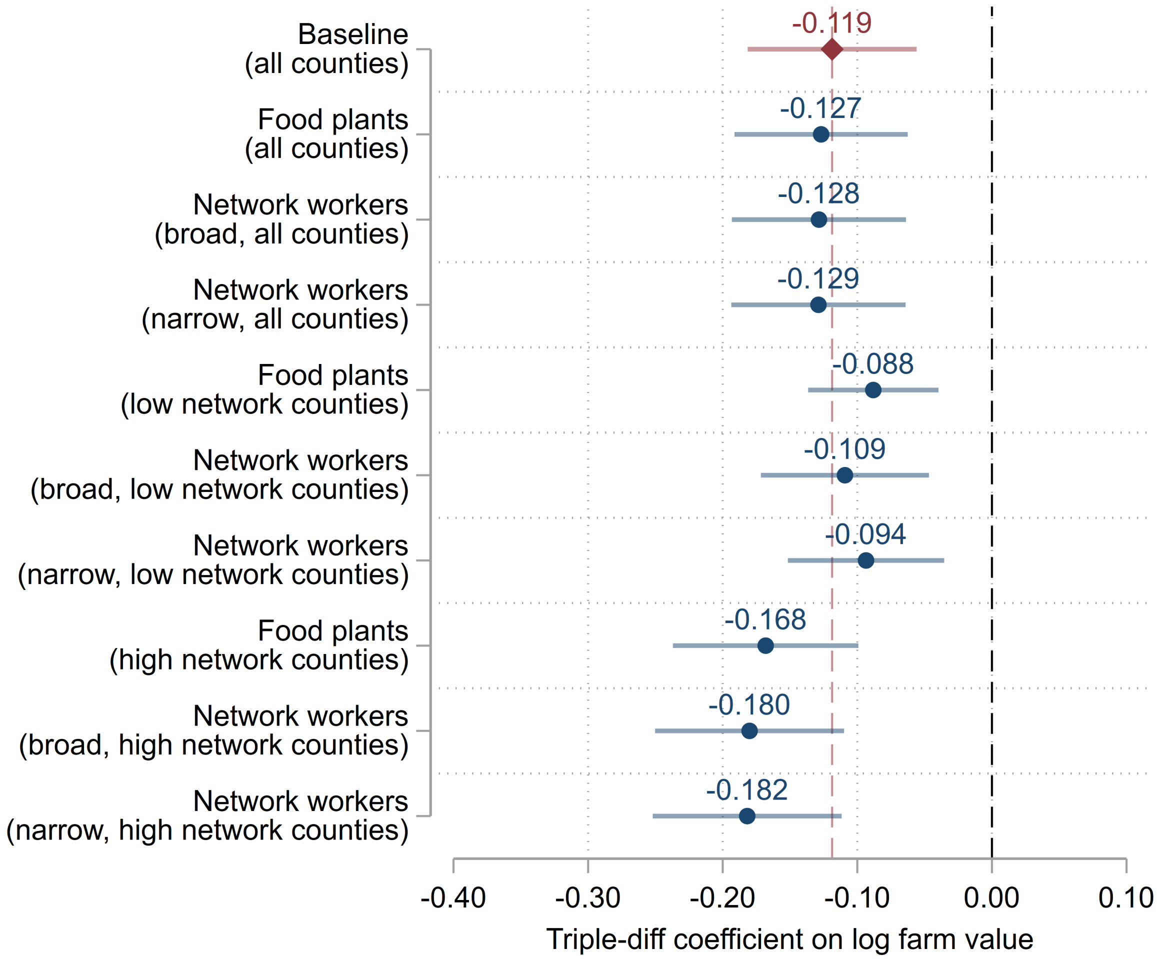
Notes: This figure replicates Appendix Figure A.5 on the five-Census-year panel (1930, 1940, 1950, 1954, 1959). The basket excludes peanuts (not enumerated separately in 1954) and otherwise comprises the same 54 crops and 29 vegetables as in the four-year panel. The two maroon diamonds at top use the logarithm of total farm products sold as the dependent variable: the first on the headline six-Census-year panel (1930, 1940, 1945, 1950, 1954, 1959), the second on the restricted five-Census-year panel used for the fixed-price baskets below; comparing the two shows that the panel restriction does not materially alter the baseline coefficient. The vertical maroon dashed line marks the 5-year baseline coefficient; the vertical black dashed line marks zero. Each marker is the triple-difference coefficient on % *Japanese* $\times$ *Excl.* $\times$ *Post*; horizontal lines are 95% confidence intervals (county-clustered standard errors). All other variable definitions follow Appendix Figure A.5.

Figure A.7. Robustness to Wartime Federal Spending and Investment



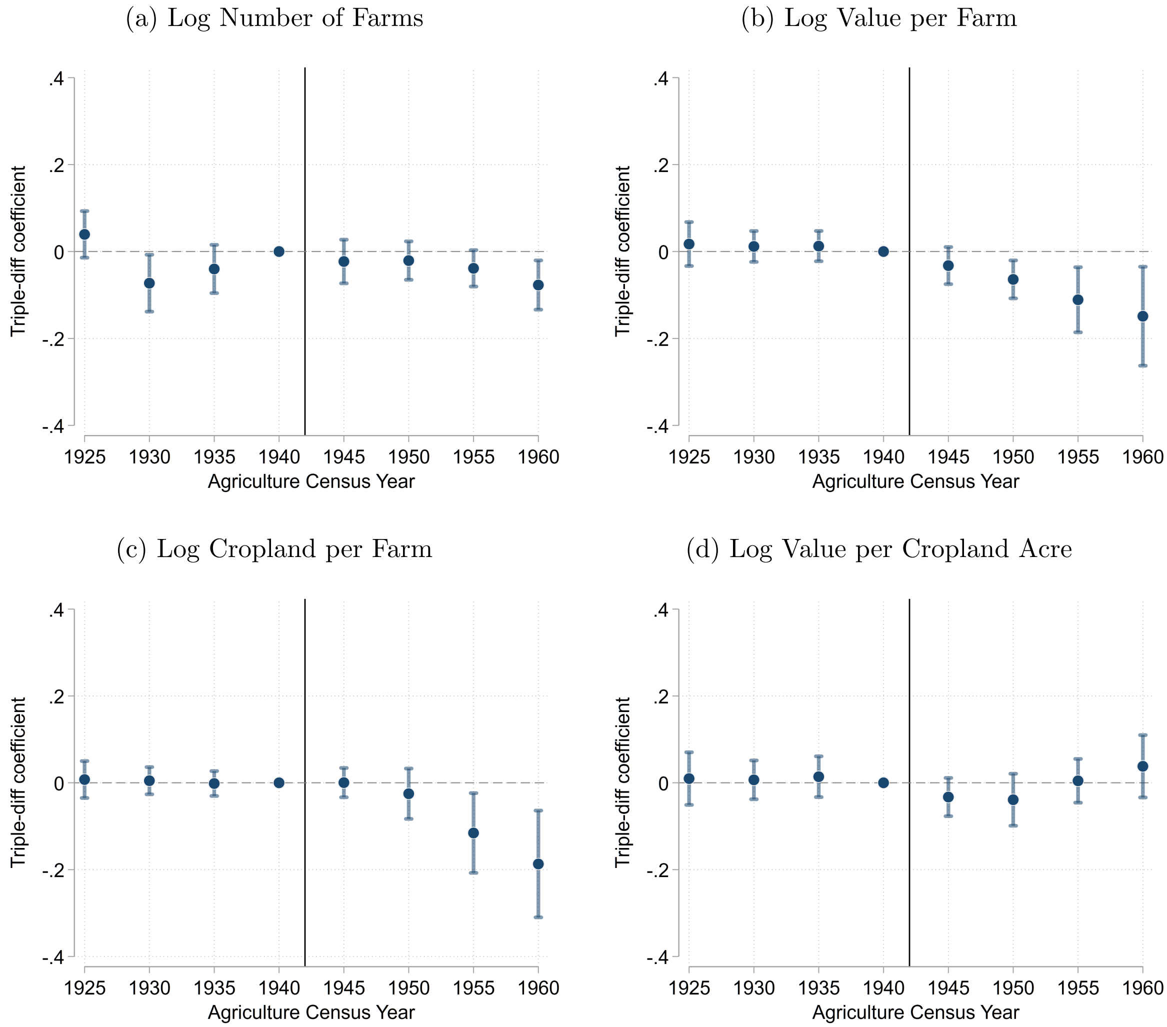
Notes: Each marker is the triple-difference coefficient on % $\textit{Japanese} \times \textit{Excl.} \times \textit{Post}$ from a specification of equation (5.1) estimated on the logarithm of total farm value; horizontal lines are 95% confidence intervals (county-clustered standard errors). The maroon diamond at top is the baseline (column 4 of Table 1); the vertical maroon dashed line marks the baseline coefficient (-0.119); the vertical black dashed line marks zero. Each subsequent row augments the baseline specification with one wartime-exposure measure interacted with *Post*. The first four specifications use the federal-expenditure series of Fishback and Cullen (2013): "Log war contracts p.c." is the log of one plus federal procurement contracts per capita; "Log war facilities p.c." is the log of one plus federal expenditure on war-production facilities per capita; "Log total war spending p.c." combines the two; "Log total war spending" is the same in absolute (not per-capita) form. The next five specifications use the wartime industrial-investment series of Jaworski (2017): "Log structures invest." is the log of one plus the total dollar value of plant and structures built during the war (public and private combined); "Log equipment invest." is the analogous quantity for equipment investment; "Log public invest." is the log of one plus all federally-financed investment (structures and equipment); "Log private invest." is the log of one plus all privately-financed investment; "Log total invest." is the grand total.

Figure A.8. Robustness and Heterogeneity by Pre-Policy Sales-Network Density



Notes: Each marker is the triple-difference coefficient on % *Japanese* × *Excl.* × *Post* in a specification of equation (5.1) with the logarithm of total farm value as the dependent variable. Horizontal lines are 95% confidence intervals (county-clustered standard errors). The maroon diamond at top is the baseline (column 4 of Table 1); the vertical maroon dashed line marks the baseline coefficient (−0.119); the vertical black dashed line marks zero. "Food plants" is the count of food-and-kindred-products plants per 1940 farm, taken from the 1940 Census of Manufactures (U.S. Bureau of the Census, 1942) (where county-level totals come from Jaworski, 2017 for 21 states and our own digitization for the remaining 27 states, including those of the Pacific-coast exclusion zone). "Network workers (broad)" is the count of workers per 1940 farm in 12 ag-network industries (food manufacturing, food and farm-product wholesale, food retail), excluding farm occupations, from the full-count 1940 Population Census (Ruggles et al., 2024). "Network workers (narrow)" uses 9 of those industries, dropping bakery, confectionery, and beverages—industries whose inputs are further removed from raw farm output. The annotation "(all counties)" marks the three robustness specifications in which each measure is interacted with *Post* and added as an additional control to the baseline. The annotations "(low network counties)" and "(high network counties)" mark the six split-sample specifications, in which the baseline is re-estimated on subsamples of counties at or below, respectively above, the median value of the corresponding network measure among the 117 exclusion-zone counties (the same cutoff is then applied to all 3,064 counties).

Figure A.9. Dynamic Effects of Japanese Exclusion: Extensive and Intensive Margins



Notes: This figure plots the year-specific triple-difference coefficients β_t from the event-study specification (6.1). Each panel uses a different outcome, corresponding to columns (1)–(4) of Table 2: (a) the logarithm of the total number of farms; (b) the logarithm of farm value per farm; (c) the logarithm of cropland per farm; (d) the logarithm of farm value per cropland acre. In panels (c) and (d), one acre is added to cropland to retain a small number of Texas counties with zero reported cropland; the adjustment is negligible for counties with meaningful cropland. All four panels use the full set of controls—log farm population, foreign-born population share, foreign-born farm-worker share, non-Japanese Asian share, log county area, and farm-type fixed effects—each interacted with year dummies, mirroring column (4) of Table 1. The year 1940 is the omitted reference year. The solid vertical line marks 1942, the year of Executive Order 9066. The dashed horizontal line marks zero. Vertical bars are 95% confidence intervals based on standard errors clustered at the county level. The 1954 and 1959 census years are plotted at 1955 and 1960 for visual alignment with the 5-year grid.

Additional Tables

Table A.1. County Characteristics by Exclusion Status in 1940

	Non-Exclusion Counties	Exclusion Counties	Group Diff.
	(1)	(2)	(2)-(1)
Japanese Farm Workers (%)	0.03	2.22	2.19
	(0.24)	(3.86)	(0.36)
Japanese Farmers (%)	0.03	2.04	2.01
	(0.27)	(3.54)	(0.33)
Japanese Farm Laborers (%)	0.02	2.42	2.40
	(0.28)	(4.38)	(0.40)
Log Total Farm Value	15.77	16.42	0.65
	(0.94)	(1.19)	(0.11)
Log Total Number of Farms	7.32	7.20	-0.12
	(0.86)	(1.13)	(0.11)
Log Farm Value per Farm	8.45	9.21	0.77
	(0.81)	(0.64)	(0.06)
Log Farm Population	8.91	8.71	-0.20
	(0.89)	(1.19)	(0.11)
Foreign-born Population (%)	3.59	10.27	6.68
	(4.57)	(4.40)	(0.42)
Foreign-born Farm Workers (%)	5.53	21.48	15.95
	(7.97)	(12.63)	(1.18)
Non-Jap. Asian Immigrant (%)	0.04	0.48	0.44
	(0.07)	(0.81)	(0.07)
Log County Area (km square)	21.27	22.24	0.97
	(0.71)	(0.96)	(0.09)
Number of Counties	2,947	117	

Notes: This table presents summary statistics of county characteristics in 1940, disaggregated by exclusion status. Mean demographic characteristics are calculated from the full-count 1940 Population Census, provided by IPUMS (Ruggles et al., 2024). Farm-related variables—including total farm value, number of farms, and average value per farm—are calculated from the 1940 Agricultural Census, available through the ICPSR data project (Haines et al., 2018). All statistics are computed at the county level. Means and standard deviations (reported in parentheses below the means) are shown for each group. Column (3) reports the difference in means between exclusion and non-exclusion counties, along with the corresponding standard errors (in parentheses). A county is defined as an "exclusion county" if any portion of its geographic area fell within the official exclusion zone established under Executive Order 9066 in 1942.

Table A.2. Mean Characteristics of Farm Workers by Race in 1940

	Japanese	White	Black	Other Asian
	(1)	(2)	(3)	(4)
Residing in Exclusion County (%)	92.9	5.6	0.3	95.6
	(25.8)	(23.0)	(5.1)	(20.6)
Female (%)	19.7	4.9	19.4	1.0
	(39.8)	(21.5)	(39.5)	(10.2)
Age	40.2	40.8	36.4	36.6
	(16.2)	(16.6)	(16.1)	(9.7)
High School Completion (%)	31.3	12.2	1.4	6.0
	(46.4)	(32.8)	(11.9)	(23.7)
College Completion (2 Years) (%)	3.3	2.2	0.4	1.1
	(17.9)	(14.8)	(5.9)	(10.5)
College Completion (4 Years) (%)	1.2	0.9	0.1	0.5
	(10.9)	(9.5)	(3.8)	(6.7)
Weeks Worked per Year	41.3	41.1	38.7	33.0
	(16.2)	(17.8)	(16.7)	(12.5)
Hours Worked per Week	43.6	40.9	35.5	37.1
	(21.8)	(25.2)	(21.6)	(21.5)
Hours Worked per Year	1,925.4	1,871.2	1,531.0	1,305.3
	(1,231.3)	(1,366.1)	(1,142.4)	(958.6)
Population	22,360	7,494,323	1,544,437	18,981

Notes: This table compares the mean characteristics of farm workers by race in 1940. The data are calculated from the full-count 1940 Population Census provided by IPUMS (Ruggles et al., 2024). Farm workers in this table include individuals aged 15 and older who reported their occupation as farmers (owners or tenants), farm managers, or farm laborers (including both wage workers and unpaid family workers). Race is based on enumerator-reported race in the 1940 Census. In column (4), we group all non-Japanese Asian farm workers, including individuals of Chinese and Pacific Islander descent. Standard deviations are reported in parentheses beneath the means. Residence in an exclusion county is determined based on the individual's reported county of residence in the 1940 Census and whether the county was fully or partially included in the exclusion zone. Educational attainment—high school completion and college completion (two- or four-year)—is based on the highest grade completed, as reported in the 1940 Census. Weeks worked per year refers to the number of weeks the respondent reported working in the calendar year prior to the census, and hours worked per week are based on the self-reported hours worked in the week preceding the census enumeration. Total hours worked per year are calculated as the product of weeks worked and hours worked per week.

Table A.3. Japanese and Non-Japanese Farms in California, Oregon, and Washington, 1920-1940

Item	1940	1930	1920
Number of farms			
Japanese	6,118	4,744	6,075
Non-Japanese	270,055	256,989	228,089
Percent Japanese	2.2	1.8	2.6
All land in farms (acres)			
Japanese	258,074	212,064	394,696
Non-Japanese	63,435,926	60,313,936	55,758,304
Percent Japanese	0.4	0.4	0.7
Fam Value, Land and Building (thousand $)			
Japanese	72,600	93,000	148,400
Non-Japanese	3,163,400	4,731,000	4,520,600
Percent Japanese	2.2	1.9	3.2
Farms Value, Land (thousand $)			
Japanese	63,514	85,984	na
Non-Japanese	2,523,012	4,000,530	na
Percent Japanese	2.5	2.1	na
Farm Value, Implements and Machinery (thousand $)			
Japanese	6,829	4,121	na
Non-Japanese	226,217	224,718	na
Percent Japanese	2.9	1.8	na
Avg. Value, Land and Building ((thousand $ per farm)			
Japanese	11.87	19.60	24.43
Non-Japanese	11.71	18.41	19.82
Avg. Value, Land ($ per acre)			
Japanese	246.1	405.5	na
Non-Japanese	39.8	66.3	na
Avg. Value, Implements and Machinery ((thousand $ per farm)			
Japanese	1.12	0.89	na
Non-Japanese	0.84	0.87	na

Notes: This table compares the characteristics of Japanese-operated farms and non-Japanese farms in California, Oregon, and Washington—the three states where most exclusion counties were located. The statistics are reconstructed from the raw data presented in Table 68 of the published *Final Report: Japanese Evacuation from the West Coast* DeWitt (1943), originally sourced from the U.S. Census Bureau. Values for non-Japanese farms are calculated by subtracting the Japanese farm statistics from the totals for all farms. The reported percentages in the first few rows represent the share of each specified item attributable to Japanese farms relative to all farms.

Table A.4. Acreage of Commercial Truck Crops Grown by Japanese in California

Commodity	Total 1940 Acreage for State	Estimated Acres Grown by Japanese	Estimated Acres Grown by Japanese as Percent of State Acreage
Artichokes	10,600	5,300	50
Asparagus	79,780	20,164	25
Canning snap beans	563	287	51
Marketing snap beans (spring)	6,950	6,602	95
Snap beans (fall)	4,600	4,369	95
Green lima beans	2,373	1,011	43
Cabbage	6,850	2,362	34
Cantaloup:			
Imperial	26,100	7,830	30
Other	12,000	2,880	24
Carrots: (fall and winter)	9,800	3,605	37
Spring	13,700	3,630	26
Cauliflower:			
Fall and Winter	6,700	4,487	67
Spring	8,850	6,302	71
Celery:			
Fall and Winter	8,850	5,627	64
Spring	3,100	2,954	95
Summer	1,800	1,710	95
Cucumbers:			
Pickle	2,330	1,165	50
Table	2,200	1,100	50
Garlic	1,890	1,420	75
Spring lettuce	30,350	10,530	35
Lettuce (Imperial)	15200	3800	24
Summer lettuce	16500	4935	30
Fall lettuce	27550	7637	28
Bermuda onions	800	240	30
Intermediate Onions	1,350	675	50
Late onions	3200	1440	45
Canning peas	2394	182	8

Notes: The table is replicated from Table 69 (p. 409) of *Final Report of Japanese Evacuation from the West Coast, 1942* by the United States Department of War (DeWitt, 1943). Original estimates were made by Carl Schiller, Division of Agricultural Statistics, Bureau of Agricultural Economics, and Murray Thompson, economic advisor to western region, Agricultural Adjustment Administration. Released by the Bureau of Agricultural Economics for submission to the House Committee Investigating National Defense Migration. Table 34, Supplement I of the Committee's report, "Findings and Recommendations on Evacuation of Enemy Aliens and Others from Prohibited Military Zones". May, 1942.

Table A.5. Crop Basket of the Fixed-Price Output Index

Bucket	Canonical unit	Yearbook 1939 price ($)	Yearbook 1939 product. (thou.)	Census / Yearbook ratio (%)
Field grains				
corn (grain)	bu	0.57	2,342,710	98.7
wheat	bu	0.69	751,435	94.3
oats	bu	0.31	935,942	93.0
barley	bu	0.40	274,767	95.0
rice	bu	0.73	53,722	81.5
flax	bu	1.46	20,152	93.4
sorghum (grain)	bu	0.56	51,448	101.9
rye	bu	0.44	39,049	91.8
buckwheat	bu	0.63	5,669	97.9
Cash crops				
tobacco	lb	0.154	1,874,407	90.7
cotton	bale	43.63	11,817	93.3
sugar beets	ton	4.76	10,781	95.5
sugarcane (for sugar)	ton	2.84	5,783	80.3
Hay and forage				
alfalfa hay	ton	8.63	26,888	95.4
clover/timothy hay	ton	9.21	23,780	86.9
other tame hay	ton	5.99	7,545	100.7
wild hay	ton	4.58	9,025	108.9
small grain hay	ton	5.99	3,901	99.7
corn silage	ton	4.69	31,388	103.5
sorghum (forage)	ton	4.22	8,704	116.7
Legumes / oilseeds				
peanuts †	lb	0.034	1,179,505	97.9
soybeans	bu	0.81	91,272	96.0
dry beans	bag	3.24	14,388	98.7
cowpeas	bu	1.40	8,661	68.8
dry peas	bu	1.50	3,822	99.1
Tubers				
Irish potatoes	bu	0.71	353,459	90.0
sweetpotatoes	bu	0.76	72,679	80.7
Tree fruits				
apples	bu	0.64	143,085	104.9
peaches	bu	0.82	61,072	92.6
pears	bu	0.70	31,047	80.5
grapes	ton	16.50	2,526	87.3
plums and prunes	ton	25.02	751	85.4
cherries	ton	59.87	187	83.0
apricots	ton	33.74	323	85.9
Subtropical / oil fruits				
figs	ton	28.82	88	107.7
olives	ton	74.00	23	85.8
avocados	ton	126.00	10	134.6

Continued on next page

Table A.5 continued from previous page

Bucket	Canonical unit	Yearbook 1939 price ($)	Yearbook 1939 product. (thou.)	Census / Yearbook ratio (%)
Citrus				
oranges	box	0.94	75,646	84.4
grapefruit	box	0.44	35,175	82.7
lemons	box	1.54	11,963	88.6
limes	box	2.80	95	92.0
Berries				
strawberries	crate	2.39	13,624	82.9
Nuts				
pecans	lb	0.093	63,639	114.5
walnuts	ton	165.00	59	108.1
almonds	ton	209.00	19	124.7
filberts	ton	227.00	4	82.8
Livestock products				
milk (whole, sold)	gal	0.144	41,968,000	110.1
chicken eggs	doz	0.174	3,185,500	75.1
cream (sold)	lb bf	0.238	1,277,680	85.3
wool (shorn)	lb	0.223	377,397	76.8
mohair and kid hair	lb	0.473	18,709	81.1
Other				
hops	lb	0.245	37,932	84.8
alfalfa seed	bu	10.48	1,488	97.6
mint (peppermint) oil	lb	1.95	876	98.6
maple sirup	gal	1.68	2,515	97.4

Notes: "Canonical unit" is the quantity unit after Census-internal harmonization across years. Unit conversions (citrus field-box weights, cotton 480-lb bale, 100-lb dry-bean bag, 24-quart strawberry crate, 8.6 lb/gal milk at 3.25% butterfat) follow USDA *Agricultural Handbook 697* (U.S. Department of Agriculture, Economic Research Service, 1992). "Yearbook 1939 price" is the 1939 national price ($/canonical unit) extracted from *USDA Agricultural Statistics 1941* (U.S. Department of Agriculture, 1941). "Yearbook 1939 product. (thou.)" is the 1939 US-total production in thousands of canonical units. "Census/Yearbook ratio (%)" is the audit ratio (sum of 1939 county production in our panel divided by the published yearbook US total); values near 100 confirm that the county basket reproduces the national total. † Peanuts is included in the four-year primary panel (1930, 1940, 1950, 1959) but excluded from the five-year robustness panel because it is not separately enumerated in 1954.

Table A.6. Vegetable Basket of the Fixed-Price Output Index

Vegetable	1940 Census acreage (1,000 acres)	1940 Census value (1,000 $)	1940 Census value per acre ($)
tomatoes	517.4	41,487	80.2
snap beans	231.0	14,886	64.4
cabbage	166.3	12,375	74.4
sweet corn	402.3	12,187	30.3
lettuce & romaine	121.1	12,182	100.6
green peas	296.3	11,456	38.7
celery	36.0	11,060	307.2
asparagus	115.9	10,379	89.5
dry onions	111.7	9,850	88.2
cantaloupes & muskmelons	140.5	7,600	54.1
watermelons	305.0	7,436	24.4
carrots	54.1	5,532	102.2
spinach	68.0	5,339	78.5
cucumbers	78.7	5,075	64.5
green lima beans	93.4	4,948	53.0
peppers (sweet, hot, pimentos)	57.1	4,787	83.8
cauliflower	27.7	3,856	139.4
beets (table)	26.0	2,126	81.8
squash	27.9	1,676	60.1
broccoli	11.5	1,058	92.2
turnips	13.8	811	58.7
radishes	5.9	590	100.6
eggplant	4.0	474	118.2
okra	7.5	354	46.9
green onions & shallots	4.6	353	76.4
kale	4.1	258	63.1
pumpkins	9.1	183	20.3
escarole & endive	1.3	166	127.1
collards	1.9	118	62.6
total (29 vegetables)	2,975	199,488	67.1

Notes: Because the USDA *Agricultural Statistics 1941* yearbook does not separately enumerate the 29 vegetables listed here, we draw acreage and value directly from the 1940 Census of Agriculture (which surveys 1939 production data; there is no separate 1939 Census). Vegetables enter the fixed-price index via a value-per-acre proxy: county acreage in each year multiplied by the national value per acre shown in the third column. The state-priced version of the index substitutes state-specific value per acre where reported.

Table A.7. Effect of Japanese Exclusion on Adoption of Mechanization and Fertilizer (Extensive Margin)

	%Farms with Motor-trucks	%Farms with Tractors	%Farms with Automobiles	Telephones per Farm	%Farms Using Commercial Fertilizer
	(1)	(2)	(3)	(4)	(5)
%Japanese×Excl.×Post	-1.885**	-6.412***	-2.316**	-0.079***	-5.479***
	(0.799)	(1.095)	(0.998)	(0.015)	(2.067)
%Japanese×Post	1.105	5.124***	0.991	0.077***	3.674*
	(0.753)	(1.049)	(0.993)	(0.015)	(2.059)
Excl.×Post	5.148**	0.444	5.316	0.027	13.383***
	(2.139)	(2.261)	(5.257)	(0.017)	(3.083)
Obs.	18,380	18,380	18,380	18,378	15,318
Num. of Counties	3,064	3,064	3,064	3,064	3,064
Sample Year	1930-59	1930-59	1930-59	1930-59	1925-59

Notes: Columns (1)–(3) are the share of farms reporting use of motor trucks, tractors, and automobiles, respectively. Column (4) is the number of telephones per farm, a proxy for communication-technology adoption. Column (5) is the share of farms using commercial fertilizer. Columns (1)–(4) cover the census years 1930, 1940, 1945, 1950, 1954, and 1959; column (5) covers 1925, 1930, 1940, 1954, and 1959. Intensive-margin counterparts are reported in Table 5. All specifications use the same controls as column (4) of Table 1; control coefficients are omitted for compactness. Standard errors clustered at the county level are reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

A.1 Construction of the Fixed-Price Output Index

This appendix documents the construction of the fixed-price output index used in Section 6.4. We describe the crop basket and the Census quantity series; the 1939 price source and how state-level prices are obtained; the unit conversions used to harmonize Census quantities with yearbook prices; the audit of the constructed index against published US-total production; and the value-per-acre proxy used for vegetables.

Panel and basket

The fixed-price index uses a four-year decennial-ending panel comprising 1930, 1940, 1950, and 1959, with a five-year robustness panel that adds 1954 (Appendix Figure A.6). We drop the 1925 and 1935 Censuses because both were abbreviated mid-decade enumerations: many of the individual vegetables, specialty fruits, and tree-fruit categories that are separately reported in 1930 and 1940 are not separately reported in those two mid-decade years, so retaining them would force us to shrink the basket to a small set of staples. We drop 1945 from both panels because the wartime mid-cycle Census collected aggregate vegetable acreage only (no individual-vegetable detail) and is missing several specialty crops in our basket.

The crop basket consists of 55 buckets in the four-year panel and 54 buckets in the five-year robustness panel, which drops peanuts because peanuts are not separately enumerated in 1954. Five additional crops are separately enumerated in all four (or five) panel years but are excluded from the final basket because of county-level disclosure suppression in the ICPSR series: cranberries, blackberries, blueberries, raspberries, and broomcorn each exhibit year-varying state-level suppression that injects artifactual within-panel noise. Each of these is small relative to the basket (under 0.3% of total fixed-price value), and including them changes the regression coefficient by less than 0.005 of a log point. Table A.5 provides the complete bucket inventory together with the audit ratio described below.

To these 55 (or 54) crop buckets we add a vegetable basket containing 29 vegetable categories, separately enumerated in the Census of Agriculture across all four panel years. The Census reports vegetable *acreage* (and 1940 vegetable value) but not vegetable physical quantity, so we include vegetables in the fixed-price index using a value-per-acre proxy described below. The full list of vegetables is given in Table A.6.

1939 price source and extraction

All 1939 prices used in the index are drawn from *USDA Agricultural Statistics 1941* (U.S. Department of Agriculture, 1941), the U.S. Department of Agriculture's official annual statistical compendium published by the Government Printing Office in 1941. We anchor on 1939 because the 1940 Census of Agriculture reports its county-level production data for the 1939 crop year, so multiplying 1939 production by 1939 prices yields a county-level value series that can be audited directly against the 1940 Census-reported value of products sold (the coverage check below) and against the published 1939 US-totals in the 1941 yearbook (the bucket-by-bucket audit ratio below). The choice of 1939 is therefore driven by audit feasibility, not by proximity to the start of our panel (1930) or to the policy shock (1942). We use the 1941 yearbook rather than later vintages (which sometimes contain revised values) so that the base prices match the contemporaneous reporting of the 1939 season-average.

Each bucket is mapped to a specific table and page in the yearbook (e.g., wheat to Table 3 on page 14; tobacco to Table 224 on page 176; chicken eggs to Table 637 on page 473). For 50 of the 55 buckets, the yearbook publishes both a national-aggregate row and a state-level breakdown; for the remaining 5 buckets (the very-small-volume buckets such as olives, almonds, and walnuts which are concentrated in a single state), only the national table is published, and we use the national price as the state price. National-priced regressions in Figure A.5 use the published US-total price; state-priced regressions use the state row, with national fallback for states not separately reported. Cents-per-pound and cents-per-dozen prices reported in the yearbook are converted to dollars before multiplication.

Unit conversions

Census-reported quantity units differ from yearbook price units in 16 of the 55 buckets, and 7 buckets exhibit unit drift across Census years that requires within-source harmonization before merging with prices. We document both classes of conversion below.

Quantity-side, within-Census harmonization. Before merging with prices, we harmonize each bucket's quantity to a single canonical unit across all four Census years (the "Canonical unit" column of Table A.5). The notable harmonizations include: 1930 cherries reported in bushels, converted to pounds at 56 lb/bu; 1930 avocados in field boxes, converted to pounds at 27 lb/box; 1930 sugarcane separately reported for sugar (tons) and sirup (gallons), restricted to the cane-for-sugar component for cross-year scope consistency; 1930 peanuts in bushels, converted to pounds at 25 lb/bu; 1959 milk reported in pounds, converted to gallons at 8.6 lb/gal; 1959 lemons in tons, converted to 76-lb California field boxes. Census-reported dry beans are in bushels in all years but published price tables are in 100-pound bags (cwt); we apply a 60 lb/bu conversion before merging. Cotton is harmonized to 500-lb gross-running bales. All conversion factors—including bushel-to-pound, ton-to-pound, and citrus field-box weights—follow USDA *Agricultural Handbook 697* (U.S. Department of Agriculture, Economic Research Service, 1992), which catalogs standard weights, measures, and conversion factors for U.S. agricultural commodities.

Price-side reconciliation. The 1941 yearbook reports prices in different units across commodity classes: cents per pound (eggs, cream, hops, mohair, peanuts, pecans, tobacco, wool); cents per pound for cotton (which is then multiplied by 480 to obtain $/bale); dollars per ton (hay, grapes, plums and prunes, apricots, cherries, almonds, walnuts, filberts, avocados, figs, olives, sugarcane, sugar beets, sorghum forage, corn silage); dollars per bushel (most grains and tree fruits); dollars per gallon (maple sirup); dollars per crate (strawberries, in 24-quart crates); dollars per box (citrus, in commodity-specific field-box weights of 76, 80, 85, or 90 pounds depending on the citrus type); dollars per hundredweight (milk, dry beans). Prices are converted to dollars per canonical unit so that the simple multiplication $Q_{c,k,t} \cdot \bar{P}_{k,1939}$ yields fixed-price value in current dollars.

Audit of the index against published yearbook totals

To validate that the constructed county-aggregated quantity panel reproduces the published 1939 national totals, we compare for each bucket the sum of 1939 county-level Census quantities against the published 1939 US-total in the 1941 yearbook (after applying the unit reconciliations above). The audit ratio ("Census/yb %") is reported in the final column of Table A.5. A ratio of 100 indicates exact agreement; values below 100 indicate that the Census enumeration captures less than the AMS/BAE estimate (typically because the Census applies a farm-definition threshold of $250 in sales or 3 acres that excludes very small operations covered by the yearbook); values above 100 indicate Census over-coverage relative to the yearbook (typically because the yearbook reports commercial production while the Census reports all harvested production, including home and small-scale operations).

The constructed county-aggregated quantities reproduce the published US-totals closely for the large majority of buckets. A small number of buckets diverge from the yearbook total by more than 20 percentage points—chicken eggs, wool, cowpeas, almonds, and avocados—and these reflect documented scope or methodology differences between Census enumeration and the AMS/BAE statistical series rather than pipeline errors. None of the deviations is concentrated in a way that would systematically bias the post-1942 differential between exclusion-zone and non-exclusion counties.

Vegetable value-per-acre proxy

Because county-level Census enumeration of individual vegetables reports acreage but not physical quantity, we include vegetables in the fixed-price index via a value-per-acre proxy. For each vegetable j, we compute the 1940 national value per acre as the ratio of total reported value ($) to total reported acreage at the national level: $\bar{p}_j^{\text{acre,nat}} = V_{j,1940}^{\text{nat}}/A_{j,1940}^{\text{nat}}$. The vegetable component of the fixed-price index for county c in year t is then $\sum_j \bar{p}_j^{\text{acre,nat}} \cdot A_{c,j,t}$, where $A_{c,j,t}$ is county-level acreage for vegetable j in year t. The state-priced version replaces the national value-per-acre with a state-specific value-per-acre, with national fallback for states that do not report 1940 acreage of vegetable j.

This proxy is equivalent to assuming that 1939-1940 yield per acre and 1939 price per pound are constant across years and counties for each vegetable category. The within-county component of identification absorbs the county-level cross-sectional pattern (via county fixed effects in the regression), so the estimated triple-difference coefficient is identified off the differential change in vegetable acreage between 1940 and post-1942 years across treatment groups. Table A.6 lists the 29 vegetable categories.

Coverage check at the 1940 baseline

Figure A.4 reports the diagnostic that anchors our basket against the directly-reported Census measure of total products sold (the "products sold" aggregate that combines all crops, livestock, dairy, and horticultural specialties). At the national-aggregate level, our 84-item basket (55 crops + 29 vegetables) accounts for 95.6% of the 1940 (1939-priced) Census-reported value of products sold. Across counties, the Pearson correlation between the logarithm of the fixed-price crop+vegetable index and the logarithm of products sold ranges between 0.91 and 0.95 within each panel year (pooled $r = 0.85$). The 1940 panel of Figure A.4 is the apples-to-apples comparison year: both axes use 1939 prices. The other panels exhibit year-level shifts driven by inflation in the products-sold series (which is in current dollars) but the within-year linear fit remains tight throughout.