Managers, Modernization, and Economic Growth: Evidence from Japan's Decolonization

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Abstract

Poor countries have many workers in self-employment or small single-unit firms whereas rich countries have much more employment in large multi-establishment firms. I study how manager supply shapes this transition using Japan's post-WWII repatriation of six million people. Cities receiving white-collar repatriates had higher output per worker, shifted workers into wage employment and saw firms expand across cities. I develop a model in which firms are constrained by owner managerial capacity and modern firms hire managers whose headquarters services are non-rival across establishments. The estimated model implies that manager inflow increased output per worker by 5.5 percent between 1950 and 1970, with about one-third of the effect operating through multi-establishment networks.

Key Words: managers, multi-establishment firms, modernization, migration
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1 Introduction

The organization of production differs sharply between low- and high-income economies. Poor countries are dominated by small, single-establishment firms: self-employment is widespread, hired managers are scarce, and most workers are employed in small single-unit businesses. Rich countries, by contrast, have far less self-employment and a much larger share of workers in large, multi-establishment firms that rely on hired managers.[1] A large literature attributes these gaps to credit constraints and institutional frictions and emphasizes financial development and institutional reform as ways to reduce them.[2]

Yet even with well-functioning institutions and financial markets, firms may struggle to grow if they lack one specific input: managers. If the supply of people who can coordinate and manage production is too low and the cost of hiring them is too high, firms may be unable to scale beyond what a single owner can oversee, leaving the economy stuck with small single-unit firms and high self-employment. This paper examines how managerial labor supply affects the organization of production and economic growth, highlighting the role of multi-establishment firms operating across regions in driving economic growth.

Examining these questions poses two main challenges. The first challenge is empirical. The supply of managers is endogenous to development. Richer places attract more skilled workers, so cross-sectional correlations between manager supply and modernization are difficult to interpret causally.[3] Second, evaluating how manager supply affects the organization of production within and across locations requires a model that captures how firms organize across space. Because modern firms often consist of multiple establishments, a local managerial supply shock not only affects the host region but spills over to other regions through the firm's establishment network. A quantitative framework is therefore essential to evaluate the role of these spatial linkages and quantify the aggregate effect of the shock.

In this paper, I examine the role of managers in modernization and economic growth in three steps. First, I exploit Japan's post-World War II repatriation as a plausibly exogenous shock to the local supply of managers to estimate its effect. Second, I develop a spatial model in which traditional firms are constrained by fixed owner managerial capacity while modern firms pay a fixed cost to hire outside managers and operate multiple establishments. Third, I estimate the model to quantify the aggregate effects of the shock and the role of

[1] On self-employment differences across countries, see Gollin (2008) and Gindling and Newhouse (2014). On firm size and manager scarcity, see Poschke (2018), Bento and Restuccia (2021), and Gottlieb et al. (2025).

[2] On credit constraints, see De Mel et al. (2008), Meager (2019), and Meager (2022). On institutional frictions, see Ulyssea (2018), Ulyssea (2020), and Akcigit et al. (2021).

[3] In this paper, modernization refers to a shift in the organization of production toward multi-establishment firms so that a larger share of employment is organized by multi-establishment firms rather than traditional owner-managed single-unit firms.

multi-establishment firms operating across regions in transmitting them.

I assemble a novel dataset that allows me to measure both local manager inflows and their effects on firms and local economies. The repatriation records report prewar occupations, initial settlement addresses, family registry locations, and landing ports. I link these records to prewar city-level tax statistics and population censuses and to digitized firm directories that identify establishment locations. These data allow me to trace how local manager inflows changed sectoral structure, employment structure, and firms' multi-establishment networks.

The repatriation brought back over six million Japanese nationals, nearly 9% of the home population. I identify causal effects with an instrument based on predetermined family registry locations (*honseki*) and Allied landing-port assignments, which shifts settlement through historical ties and repatriation logistics rather than postwar local opportunities. Because colonial labor markets placed Japanese workers in managerial and administrative positions, and because returnees were allowed to bring back only limited cash, the setting provides plausibly exogenous variation in local manager supply.[4]

My empirical analysis yields three main takeaways. First, the white-collar inflow triggered structural transformation and economic growth. Cities receiving more white-collar repatriates experienced faster expansions in manufacturing and services, as well as higher non-agricultural output per worker. In contrast, cities receiving more production worker repatriates showed little improvement.

Second, this transformation was driven by a local change in the organization of production. In cities with white-collar worker shocks, production moved away from the traditional, small-firm structure. The self-employed and family worker share fell while the share of managers and wage labor increased. These are precisely the organizational features that distinguish high-income from low-income economies.

Third, this shock was not confined to a single location. The inflow of white-collar repatriates increased the number of establishments per firm.[5] Crucially, this was a spatial expansion, not just an increase in the number of local establishments. Cities receiving more white-collar repatriates saw a higher probability that headquarters opened establishments outside the headquarters city and a larger maximum distance from headquarters to any establishment. These results show that the local manager shock propagated to other regions

[4]This contrasts with Dinkelman et al. (2024), who study migrant repatriation in Malawi and show that return-induced capital inflows reshaped local economic structure through investments in non-farm physical and human capital. In my setting, by contrast, returnees were permitted to bring back only limited cash and liquid assets, which helps isolate the labor-supply channel.

[5]Multi-unit organization is a defining characteristic of the modern organization of production (Chandler, 1977), requiring professional managers to coordinate transactions across business units.

through firms' cross-city establishment networks.[6]

I develop a spatial general equilibrium model to rationalize the empirical findings and study how multi-region establishment firms transmit local shocks. Each firm has a headquarters city and can open establishments in other cities. Establishments hire local production labor while headquarters produce managerial services that can be deployed across the firm's establishments, following Kleinman (2025).[7] Opening an establishment in another city is costly, and this cost rises with distance from headquarters, capturing the increasing difficulty of operating and coordinating remote units.

Firms face an endogenous organization choice. Traditional firms rely only on the owner's fixed managerial input, following Akcigit et al. (2021). They are local-only and do not hire outside managers (e.g., micro-enterprises, self-employed, and mom-and-pop stores). Modern firms pay a fixed cost to access an external managerial labor market and acquire the organizational structure required to operate multiple establishments across locations. Once produced in modern firms, headquarters managerial services are used across multiple establishments, so additional managers raise the profitability of both existing and potential establishments.[8]

This structure delivers a manager-driven development mechanism with both local and spatial margins. When managers are scarce, few firms pay the modernization cost, the cost of hiring outside managers remains high, and the economy is dominated by small, owner-managed, local-only firms.[9] When manager supply rises, managerial hiring costs fall, more firms modernize, and headquarters cities shift toward modern organization where more workers are employed in multi-establishment firms. But the mechanism does not stop in the HQ city. Modern firms open satellite establishments in other cities and spread modern organization through their establishment networks. Manager supply therefore affects development not only by modernizing HQ cities, but also by propagating modern organization across space.

One additional implication of the model is that establishment expansion acts like manager-

[6]This mechanism is consistent with Giroud et al. (2024) who find that large multi-region firms propagate local productivity shocks to distant plants hundreds of miles away through shared knowledge networks.

[7]I abstract from the knowledge-based hierarchy models of Garicano and Rossi-Hansberg (2015) and instead model headquarters managers as an aggregate firm-wide input that improves management practices within the firm. This reduced-form assumption is also consistent with Bloom et al. (2014a), who show that plants located nearer universities and business schools tend to have higher management scores.

[8]Another interpretation of non-rival manager services is that management is technology, as in Bloom et al. (2016). Under this interpretation, headquarters managers create management practices that can be used in any establishment.

[9]Hjort et al. (2026) documents that low income countries have a higher manager wage premium than high income countries. The model can rationalize that low income countries have many small firms with a high manager wage premium.

complementary technological change: more establishments per firm raise the marginal product of managers because the same headquarters managerial services are deployed across more establishments. Because greater manager supply also induces firms to expand their establishment networks, the model provides a micro-foundation for an agglomeration force among managers and delivers weak equilibrium bias toward managers.[10] This mechanism matters for economic development. Economies with scarce managers remain stuck with few modern firms, few multi-establishment firms, and a low marginal product of managers. By contrast, when manager supply rises, firms reorganize into larger multi-establishment networks, and that reorganization itself raises the productivity of managers. This creates an amplification mechanism through which relaxing managerial scarcity accelerates the transition from traditional owner-managed firms to modern multi-establishment firms.

I then use the estimated model to conduct two counterfactual exercises. First, I remove the white-collar repatriate shock to HQ-manager supply while holding other fundamentals fixed. Second, I shut down non-HQ establishment expansion to isolate the role of multi-establishment networks. The model implies that manager inflow raised output per worker by 5.5 percent between 1950 and 1970, and that about one-third of this effect operated through firms' cross-city establishment networks. A model without multi-establishment firms would therefore understate the aggregate impacts of manager supply.

Overall, this paper shows that manager supply is a key driver of the modernization of production and economic growth. It also shows that this process is not purely local: multi-establishment firms transmit local manager shocks across regions through their establishment networks. Managerial bottlenecks therefore limit development along two margins: they slow firm modernization within regions and weaken the spatial propagation of modern organization across regions. For low-income economies, expanding manager supply can promote growth not only by modernizing local production, but also by spreading that modernization through firms' establishment networks.

Related Literature. First, I contribute to the literature that links cross-country differences in firm size and organization to management practices and managerial human capital. Evidence from the World Management Survey and field experiments shows that management quality varies widely and matters for productivity and firm performance (Bloom and Van Reenen (2007), Bloom et al. (2014b), Bloom et al. (2013)). Related work shows that low delegation efficiency keeps firms small and that richer countries have more managers, lower relative

[10] Following Acemoglu (2007, 2010), weak equilibrium bias means that the technological change induced by an increase in a factor's supply raises the marginal product of that same factor. In my model, organizational change takes the form of more establishments per firm, which acts like manager-complementary technological change in the spirit of Kleinman (2025).

management costs, and larger modern firms (Akcigit et al. (2021), Engbom et al. (2025), Hjort et al. (2026), Gottlieb et al. (2025)).

My paper contributes to this literature in three ways. First, I provide the first causal evidence that an exogenous increase in manager supply shifts production away from traditional owner-operated firms and toward modern multi-unit firms. Second, I provide new empirical evidence that manager supply at headquarters changes firms' spatial organization, increasing the probability that firms open establishments in other cities and expanding their geographic reach. This pattern is consistent with models in which headquarters managerial or other non-rival HQ inputs shape firms' spatial organization (Gumpert et al. (2022), Kleinman (2025)), with management as a firm-level technology (Bloom et al. (2016)), and with establishments within a firm sharing intangible inputs such as managerial and organizational know-how (Atalay et al. (2014)). Third, I incorporate spatial firm organization into a development model of managers and modernization, showing that ignoring propagation through multi-establishment firms can understate the aggregate effects of relaxing managerial constraints.

I also contribute to the literature on the economic effects of migration. Existing work focuses largely on partial equilibrium effects of immigration on labor markets, innovation, and entrepreneurship (Card (1990), Borjas (2003), Ottaviano and Peri (2012), Hornung (2014), Bernstein et al. (2022), Beine et al. (2024)), and recent papers study general equilibrium impacts using spatial models (Monras (2020), Adda et al. (2022)). Two recent papers are closely related. Peters (2022) shows that German expellees increased local productivity and long-run income, and Terry et al. (2026) combine immigration shocks with an idea-based growth model to estimate a scale elasticity of innovation. My approach differs by targeting the impacts of population inflows on output per worker through firm modernization rather than idea creation, the mechanism emphasized in both papers.

The remainder of the paper is organized as follows. Section 2 provides historical background on the repatriation. Section 3 presents the empirical analysis. Section 4 develops a general equilibrium spatial model that rationalizes the empirical findings. Section 5 estimates the model and conducts counterfactual analyses. Section 6 concludes.

2 Historical Context

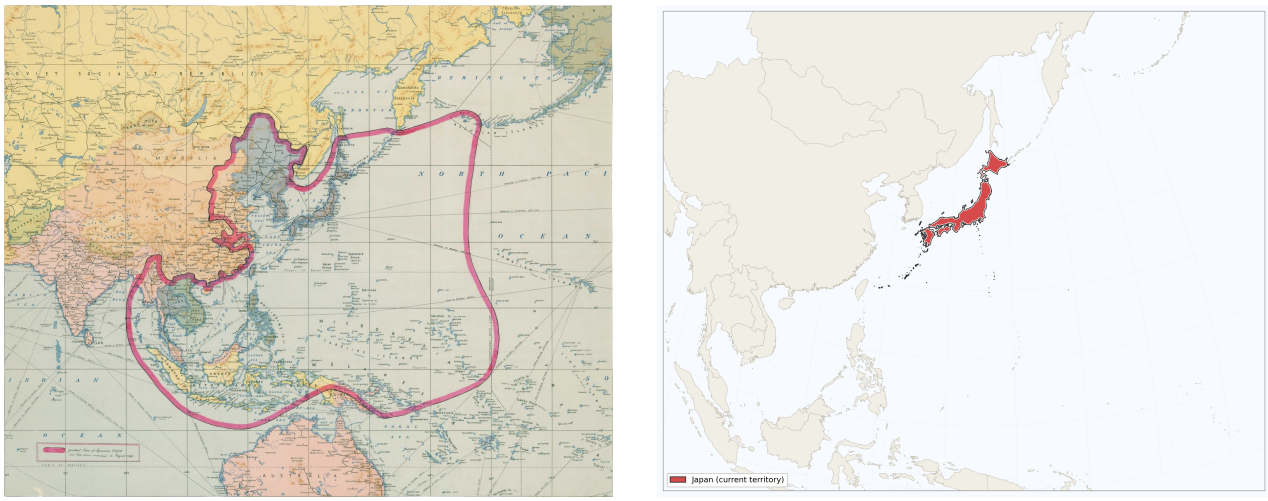
In this section, I provide the historical context for the repatriation. First, I establish the scale and coercive nature of the repatriation (Section 2.1). Second, I show that settlement patterns were driven by exogenous logistical and administrative factors, specifically Allied-assigned landing ports and the prewar family registry system (Section 2.2). Third, I show that many repatriates were white-collar workers employed in managerial and administrative

positions before the war (Section 2.3). Fourth, I explain why postwar Japan provides a useful development setting for studying how manager supply affects the organization of production (Section 2.4). Lastly, I discuss the data (Section 2.5).

2.1 Decolonization and Forced Repatriation

Japan's territorial expansion after the Meiji Restoration sent millions of settlers, administrators, and soldiers to Korea, Taiwan, Manchuria, and Southeast Asia. By the early 1940s, the empire extended across much of East and Southeast Asia. Figure 1(A) illustrates the geographic reach of the empire at its wartime peak. Japan's defeat in 1945 reversed fifty years of expansion. All overseas territories were lost, and the collapse of imperial administration set off one of the largest forced population movements of the twentieth century. Roughly six million Japanese, three million civilians and three million military personnel, were returned to Japan under Allied supervision (Ministry of Health and Welfare Relief Bureau, 1977).[11] Figure 1(B) shows modern Japan, highlighting the territorial contraction that generated this mass migration.

Figure 1: The Japanese Empire at Its Maximum Extent Compared to Modern Japan



(A) Japanese Empire (August 1942) (B) Modern Japan

Notes: Panel (A) depicts the territorial extent of the Japanese Empire in August 1942. The area enclosed by the pink boundary indicates regions under Japanese control at the time, including the Japanese home islands, Korea, Taiwan, Manchuria, southern Sakhalin, Pacific mandate islands, and territories occupied during the early phase of the Pacific War such as Indochina, the Philippines, the Dutch East Indies, Burma, and large parts of coastal China. Panel (B) shows modern-day Japan. Source: Panel (A) is "Map of Japanese Empire, August 1942," Docsteach (NARA), taken from https://docsteach.org/document/map-of-japanese-empire-august-1942/. Panel (B) is based on country boundaries from Natural Earth, https://www.naturalearthdata.com/.

Repatriation was compulsory. Although the Japanese government initially attempted to

[11] For the empirical analyses, I focus on civilian repatriates.

preserve its overseas settlements, growing violence against Japanese civilians, particularly in Manchuria under Soviet occupation, forced a policy reversal (Nishizaki, 2016). A December 1945 U.S. directive further stated that "all Japanese nationals whose place of origin was the main Japanese islands ... should be repatriated to Japan" (U.S. Office of the Historian, 1945). The combination of collapsing local security and Allied policy left Japanese civilians with essentially no choice but to return.

Importantly, returnees brought limited cash. The Supreme Commander for the Allied Powers (SCAP) limited civilians to ¥1,000 in cash and instructed reception-center officials to take up excess currency and most financial assets at landing ports (Supreme Commander for the Allied Powers, 1945, 1946b,a). For perspective, research on Tokyo households in March 1946 put average monthly food expenses at about ¥700 and average monthly living expenses at about ¥1,130 for a four-person household, so ¥1,000 represented roughly one month of subsistence (Choi, 2013). Japanese government sources further emphasized that many repatriates had been forced to abandon property overseas (Ministry of Health and Welfare, 1957). Repatriation therefore represented primarily a labor-supply shock rather than a wealth or physical capital shock.

Landing ports were also not chosen by returnees. SCAP designated authorized reception ports and directed repatriation vessels to land only at those ports. The Ministry of Welfare operated these centers at specified capacities based on schedules provided by the Shipping Control Authority for the Japanese Merchant Marine (SCAJAP) (Supreme Commander for the Allied Powers, 1946b). Port assignments also varied systematically by origin. SCAP, for example, authorized a dedicated China-to-Sasebo run for Japanese repatriates, while Maizuru was one of eighteen designated entry ports and received approximately 660,000 returnees from Siberia and northeastern China (Frank and Shaw, 1968; UNESCO, 2014). Allied quarantine directives could still override these routes when necessary. During the cholera outbreak of April 1946, ships arriving from South China were ordered to Uraga, with Sasebo designated as an alternate receiving port (General Headquarters, Supreme Commander for the Allied Powers, 1946). Thus, port of entry was determined administratively by origin, shipping logistics, and public-health control rather than by repatriates' preferences.

2.2 Family Registry Location as Ancestral Home

The Meiji government formalized Japan's traditional *ie* (household) system through the 1898 Civil Code, establishing the household, headed by a legally designated household head, as the basic unit of civil status and registration (Krogness, 2014). This legislation introduced the family registry system, which anchored each family's official registration (*koseki*) to a fixed location (*honseki*). Crucially, a family's *honseki* typically remained in its ancestral

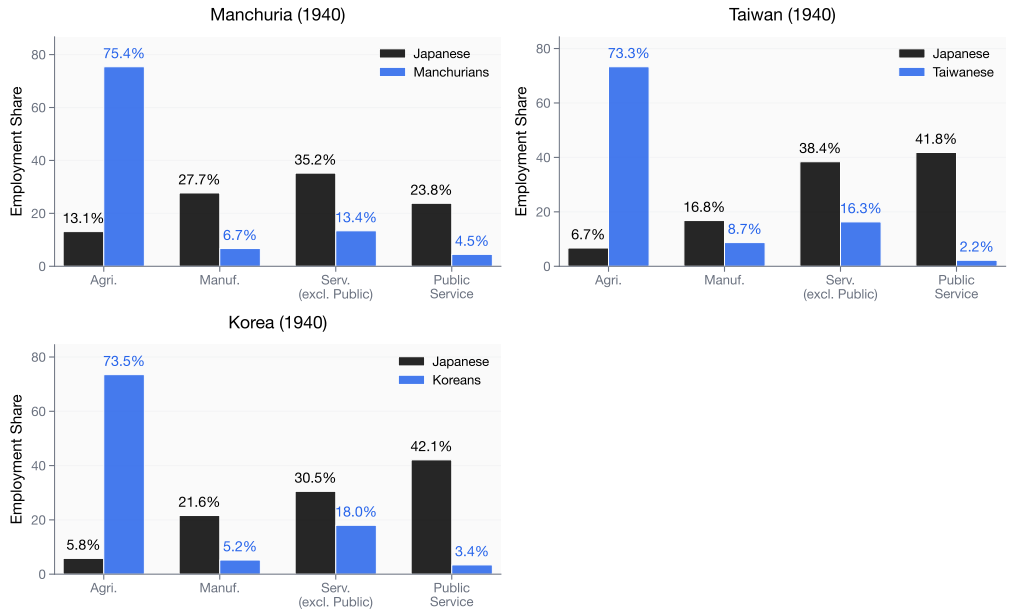
village for generations, regardless of where members actually lived (Office of Population Research, 1946).

In practice, *honseki* served as a marker of lineage rather than current residence. Individuals commonly moved for work, marriage, or schooling while keeping their ancestral *honseki* unchanged (Krogness, 2014). A Tokyo resident could live there for decades while officially registered in a rural hometown (Sawada, 1996). Historical evidence from overseas migration shows the same pattern. Sawada (1996) documents that prewar Japanese residents in New York were recorded by their *honseki* in Japan, indicating that official family-registry ties often remained in Japan even for long-term migrants abroad. This persistence extended to Japan's colonies. In Karafuto (southern Sakhalin), most Japanese settlers did not transfer their *honseki*, maintaining registration in their home prefectures despite long-term residence in the colony (Ivings, 2014). Hence, *honseki* locations reflect ancestral ties rather than economic opportunities or recent migration decisions.

2.3 White-Collar Returnees Brought Back Managerial Human Capital

One of the defining features of Japan's colonial labor system was the sharp ethnic hierarchy that governed occupational assignment in Korea, Taiwan, and Manchuria. Japanese nationals monopolized managerial, supervisory, and administrative positions while natives were concentrated in agriculture. The occupational data confirm this divide (Figure 2).

FIGURE 2: SECTORAL EMPLOYMENT SHARES IN COLONIES, 1940



Notes: This figure shows the sectoral employment shares in three major colonies—Manchuria, Taiwan, and Korea—in 1940 by natives and Japanese. Blue bars represent native employment shares, while black bars represent Japanese employment shares.

Private firms and the colonial government reinforced this structural divide. In the government bureaucracies of Taiwan and Korea, Japanese officials occupied virtually all high-ranking positions. Similarly, in large conglomerates such as the South Manchuria Railway (Mantetsu), Japanese staff dominated technical and managerial roles (Nishizaki, 2022; Lim, 2024). In 1944, for example, Mantetsu employed 39,428 Japanese and 5,567 non-Japanese in *shokuin* positions, the career-track category for university or higher technical school graduates. At the other end of the hierarchy, it employed no Japanese but 195,041 non-Japanese in *yoin* positions, the elementary-school and blue-collar track (Nishizaki, 2022).[12]

A second institutional feature relevant for classifying repatriates is the prewar Japanese "education-status system" (*gakureki mibun-sei*). Occupational status in Japanese firms was closely tied to educational attainment: *shain*, *jun-shain*, *koin*, and *yoin* broadly corresponded to university or higher technical school graduates, middle-school graduates, higher elementary-school graduates, and primary-school graduates, respectively (Ujihara (1959)). This hierarchy also mapped into distinct career tracks. *Shain* were managerial-track personnel paid monthly salaries; *jun-shain* were lower white-collar employees engaged in clerical and administrative work and paid on a daily-monthly basis; *koin* were trained blue-collar workers paid daily wages; and *yoin* were bottom-tier workers performing simple manual tasks and employed by subcontractors (Aso, 1983). Ujihara (1968)'s later discussion makes the content of the *shain* category especially clear:

> "*Shain* were the management core, their staff, or their future candidates. Accordingly, *shain* were familiar with the details of the clerical or technical tasks that made up the management of the firm. ... Even when their work belonged to a particular department, they were in a position where they needed, and were expected, to make judgments with the firm as a whole constantly in mind. ... From the time of hiring, *shain* in such positions differed from other employee groups. Even in firms with establishments across the country, workers expected to become future senior managers were recruited centrally at headquarters. ... Their placement and promotion were generally carried out from the standpoint of giving them the knowledge and training necessary to become future senior managers."

I classify repatriates based on these institutional features (Table 1). The white-collar category comprises occupations that Japanese nationals disproportionately held: *shain* or *shokuin*, government officials, educators, and police. These roles involved administrative and managerial responsibilities, making this group a shock to the supply of managerial human capital. By contrast, I classify primary and manual-service tertiary occupations as production

[12] Nishizaki (2023) gives concrete examples of Okinawan Mantetsu employees who worked in headquarters budget administration and as section heads in industrial operations.

worker occupations. This includes agricultural workers and manual service jobs (e.g., waiters, hotel workers). I exclude secondary workers (factory and craft) from the main analysis due to the ambiguity of occupation titles in the data. For example, many secondary-sector occupation titles report only broad industry categories such as "manufacturing" (*kōgyō*), making it impossible to distinguish between blue-collar production workers and plant managers.[13]

Table 1: Occupation Distribution of Repatriates

Occupation Group	Share (%)
Primary & Manual-Service Tertiary	22.3
Secondary	15.0
White-Collar	62.7
of which:	
Company Employee (*Shain, Shokuin*)	(42.1)
Government Official	(5.9)
Police Officer	(2.9)
Teacher	(2.6)
Railway Worker	(1.9)
Total	100.0

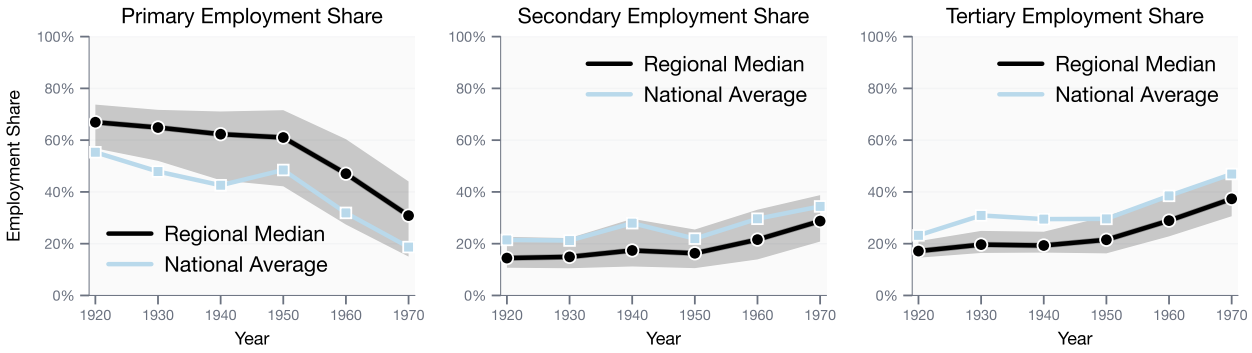
Note: This table reports the occupation distribution of repatriates based on prewar occupation. Primary and manual-service tertiary workers include agricultural and manual service jobs. Secondary workers include factory and craft workers. White-collar workers include company employees (*shain*), government officials, police officers, teachers, and railway staff in clerical or supervisory positions.

2.4 Postwar Japan as a Development Setting

Postwar Japan shared important organizational features with today's low-income economies. As shown in Figure 3, nearly half of employment remained in agriculture in 1950, and the subsequent decades saw a rapid shift toward manufacturing and services. The organization of work was also still relatively traditional at the beginning of the period: in 1950, self-employment and family labor accounted for a large share of employment, while wage employment was much less prevalent than by 1970 (Table 2). Japan's transition toward wage employment, managerial hierarchies, and modern firm organization therefore provides a useful setting for studying how manager supply affects the organization of production in economies where modern organization is initially limited.

[13] I include the secondary workers in the robustness check in Appendix B.15.

FIGURE 3: SECTORAL EMPLOYMENT SHARES IN JAPAN, 1920–1970



Notes: This figure shows the evolution of employment shares across three sectors (primary, secondary, and tertiary) in Japan from 1920 to 1970. Blue lines represent national rates, while grey lines show the median and grey shaded areas show the interquartile range of district-level employment shares.

TABLE 2: EMPLOYMENT SHARES IN 1950 AND 1970

	1950		1970	
Category	Mean	S.D.	Mean	S.D.
Employment Status				
Self-employed	0.272	(0.051)	0.219	(0.067)
Family workers	0.380	(0.134)	0.223	(0.098)
Wage workers	0.347	(0.171)	0.557	(0.160)
Occupation				
Managers	0.015	(0.012)	0.028	(0.017)

Notes: This table reports the mean and standard deviation of employment shares across districts in 1950 and 1970.

2.5 Data

The analysis draws on three main data sources: Section A provides comprehensive documentation.

Repatriate Data. I construct a novel micro-level dataset from the 1964 *Survey of Overseas Private Assets*, preserved at the Kanagawa Prefectural Archives. Originally commissioned for compensation purposes, this survey offers granular information on repatriate households, including pre-repatriation occupations, colonial residence locations, and initial settlement destinations in Japan.

Firm Data. To quantify firm modernization, I digitize the *Teikoku Bank and Company Directory* (*Teikoku Ginkou Kaisha Yoroku*) for the years 1938, 1957, and 1970. This directory

comprises the near-universe of medium and large enterprises, containing firm-level records on establishment counts.

Census, Manufacturing, and Other Data. I construct district-level economic and demographic panels using the Population Census (1920–1970), Manufacturing Census (1950, 1960), Census of Commerce (1952, 1960), Prefectural Statistical Yearbooks (1950), and 1934 Tax Statistics. Additionally, I integrate data on war destruction, transportation infrastructure, university locations, patent applications, and household expenditure from the National Survey of Family Income and Expenditure.

3 Structural Transformation, Economic Growth, and Modernization

In this section, I empirically examine how inflows of managers reshaped the organization of production. I begin by examining city-level outcomes capturing sectoral employment shares, the number of establishments, average establishment size, and output per worker (Section 3.1 and Section 3.2). I then analyze local production structure by tracking changes in family labor, self-employed, wage employment, and managers (Section 3.3). Lastly, I estimate the impacts on spatial organization of firms (Section 3.4). Together, these patterns establish a link between the supply of managers and the organization of production within and across regions, motivating the theory of managerial supply and economic growth that follows.

3.1 Structural Transformation

First, I examine the impact of repatriates on structural transformation by analyzing changes in sectoral employment shares. Moving labor from agriculture to manufacturing and services is central to economic development. A shift toward non-agricultural sectors signals the expansion of higher-productivity activities and modern economic structures. Thus, sectoral reallocation serves as a measure of how white-collar versus production worker repatriates reshaped local economies. Specifically, I estimate the following equation:

$$\Delta z_{r,1960-1940} = \beta_0 + \beta_1 \text{White-Collar Rep}_{r,1950} + \beta_2 \text{Production Worker Rep}_{r,1950} + \boldsymbol{X}_r' \Gamma + \varepsilon_r, \quad (1)$$

where $z_{r,t}$ represents either log employment or sectoral employment shares (agriculture, manufacturing, or services) in district r at time t and $\boldsymbol{X}_r$ is a vector of control variables in district r. I analyze changes in these outcomes over the period 1940–1960. The denominator of the white-collar and production worker repatriate shares is the size of the labor force

in 1940. The specification includes controls for prefecture fixed effects, the extent of war damage, log density in 1940 and the level of the dependent variable in 1940, following Peters (2022). I estimate this specification using the instrumental variable described below, only reporting the coefficients of interest β_1 and β_2 for brevity.

Instrument. If white-collar repatriates selected into cities with better future economic prospects, OLS would conflate the causal effect of manager inflows with endogenous sorting. To address this potential endogeneity, I construct an instrument based on predicted settlement flows from a random-utility model whose shifters are determined by repatriation logistics and the family registry system described in Section 2.1 and Section 2.2.

Specifically, each repatriate i, routed to landing port j by colonial origin and shipping logistics, chooses a final destination k to maximize her utility:

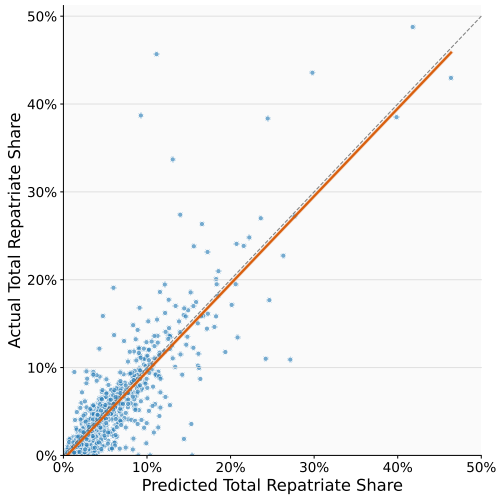
$$U_{ijk} = \underbrace{\beta_h \cdot \mathbf{1}\{k = \text{honseki}_i\}}_{\text{Institutional Ties}} + \underbrace{\beta_d \cdot \ln(\text{distance}_{jk})}_{\text{Geographic Constraints}} + \varepsilon_{ijk} \tag{2}$$

with $\varepsilon_{ijk} \sim$ i.i.d. Type-I extreme value. Conditional on the landing port, this delivers a conditional-logit probability for each destination. The key shifters are predetermined: (i) the *honseki* registry creates historically rooted ties to ancestral places; (ii) distances from assigned ports encode repatriation logistics rather than postwar local economic prospects. I estimate the conditional logit by maximum likelihood on the destination choice set.[14] The coefficients are economically sensible. A large positive β_h (strong *honseki* pull), and a negative β_d (distance discourages settlement). Table A4 in the Appendix reports the estimates.

Using the estimated parameters, I compute individual settlement probabilities $\hat{P}_{ir} = \frac{\exp(X_{ir}'\hat{\beta})}{\sum_{k\in\mathcal{J}}\exp(X_{ik}'\hat{\beta})}$, where $\mathcal{J}$ is the destination set, r is individual i's destination choice, and X_{ir} contains *honseki* ties and distance from port in Equation (2). Then, I aggregate this individual term to the region-level to form a predicted settlement share in region r. This predicted share is the instrument for the *actual* repatriate share in region r, $\widehat{\text{Share}}_r \equiv \frac{1}{\text{Labor Force}_{r,1940}} \sum_{i=1}^{N} \hat{P}_{ir}$. Figure 4 shows the strong positive relationship between the predicted repatriate share and the actual shares at the district-level, supporting instrument relevance. I construct the predicted share for white-collar and production worker repatriates separately. The identifying assumption is that $\widehat{\text{Share}}_r$ is uncorrelated with unobserved postwar shocks to outcomes, conditional on prewar controls and prefecture fixed effects.

[14] The geographic unit used in this paper is district with the 1960 definition.

FIGURE 4: PREDICTED VS. ACTUAL SETTLEMENT



Notes: District-level comparison of predicted repatriate shares (X-axis) and actual repatriate shares (Y-axis).

Results. White-collar repatriates generated shifts in local economic structure (Table 3).[15] They reduced agricultural employment shares, expanded manufacturing and service employment shares, and increased the labor force by more than one-for-one. White-collar repatriates thus acted as catalysts for structural transformation. By contrast, production worker repatriates had no significant effects on any sectoral margin, indicating that a pure increase in population did not by itself induce structural transformation. A 6 percentage point increase in the white-collar repatriate share, roughly the difference between the 10th and 90th percentiles, is associated with a 5.9 percentage point decline in the agricultural employment share, a 1.6 percentage point increase in the manufacturing employment share, and a 4.3 percentage point increase in the service employment share.

As a placebo check, I regress prewar changes in these outcomes on later repatriate exposure. If white-collar repatriate share were proxying for pre-existing structural transformation trends, it should predict changes in these outcomes before the shock. It does not. Columns 4 and 5 show that the coefficient on white-collar repatriate share is small, statistically insignificant, and not consistently signed.

These findings parallel Peters (2022), who shows that the arrival of post-World War II German refugees increased local population, lowered agricultural employment, and expanded manufacturing employment. However, unlike the German setting, the Japanese case shows that these transformative effects were driven entirely by white-collar repatriates.[16]

[15] I present IV estimates in the main text, with OLS results reported in Section B.13.

[16] Section B.7 shows the regression results using total repatriate share as the independent variable. The results show that repatriates increased labor force size, reduced agricultural employment, and expanded manufacturing and service employment shares. The results show the importance of analyzing differential

TABLE 3: REPATRIATES AND LOCAL STRUCTURAL TRANSFORMATION (IV)

Panel A: Log Labor Force Change					
	1960-1940			1940-1930	1930-1920
	(1)	(2)	(3)	(4)	(5)
Production Worker Repatriate Share$_{1950}$	2.77***	2.54***	0.73	0.50	-0.34
	(0.86)	(0.82)	(0.86)	(0.57)	(0.35)
White-Collar Repatriate Share$_{1950}$	4.24***	4.05***	2.62***	-1.94**	0.26
	(0.67)	(0.64)	(0.82)	(0.82)	(0.17)
F-Stat	45.09	40.91	48.46	48.46	48.46
Panel B: Agriculture Emp. Share Change					
	(1)	(2)	(3)	(4)	(5)
Production Worker Repatriate Share$_{1950}$	-0.15	-0.15	-0.14	-0.13	0.17**
	(0.34)	(0.34)	(0.34)	(0.11)	(0.07)
White-Collar Repatriate Share$_{1950}$	-0.97***	-0.97***	-0.98***	0.05	-0.03
	(0.25)	(0.25)	(0.25)	(0.10)	(0.06)
F-Stat	56.22	56.11	56.05	56.05	56.05
Panel C: Manufacturing Emp. Share Change					
	(1)	(2)	(3)	(4)	(5)
Production Worker Repatriate Share$_{1950}$	0.38	0.38	0.38	0.03	-0.07
	(0.23)	(0.23)	(0.23)	(0.05)	(0.06)
White-Collar Repatriate Share$_{1950}$	0.26*	0.26*	0.26**	-0.01	0.00
	(0.14)	(0.14)	(0.13)	(0.04)	(0.03)
F-Stat	56.22	56.11	56.28	56.28	56.28
Panel D: Service Emp. Share Change					
	(1)	(2)	(3)	(4)	(5)
Production Worker Repatriate Share$_{1950}$	-0.24	-0.23	-0.24	0.10	-0.11***
	(0.16)	(0.16)	(0.15)	(0.09)	(0.03)
White-Collar Repatriate Share$_{1950}$	0.71***	0.71***	0.72***	-0.03	0.03
	(0.14)	(0.14)	(0.14)	(0.06)	(0.03)
N	1,107	1,107	1,107	1,107	1,107
F-Stat	56.22	56.11	56.90	56.90	56.90
Prefecture Fixed Effects	✓	✓	✓	✓	✓
Log Density$_{1940}$	✓	✓	✓	✓	✓
War Destruction		✓	✓	✓	✓
Level Dep.			✓	✓	✓

Notes: The table presents the estimation results of the relationship between the share of white-collar and production worker repatriates and local sectoral structure (Equation (1)). The dependent variables are changes in log labor force (Panel A) and sectoral employment shares (agriculture (Panel B), manufacturing (Panel C), or services (Panel D)) between 1940 and 1960. The independent variable is the share of white-collar and production worker repatriates in district r at time 1950. The control variables include prefecture fixed effects, log population density in 1940 (Log Density$_{1940}$), war damage (War Destruction) and level of the corresponding dependent variable in 1940 (Level Dep). Standard errors are clustered at the district level and reported in parentheses. F-Stat reports the Kleibergen-Paap rk Wald weak-identification statistic
$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

As briefly mentioned, a main concern for my empirical analyses is that white-collar

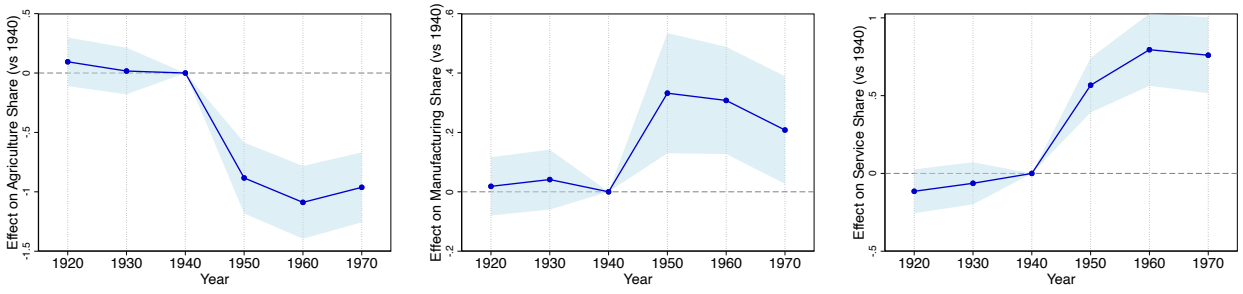
impacts between skill groups.

repatriates simply settled in places that were already going through structural transformation and modernization before World War II. Measuring pre-trends for local production structure, firm modernization, or output per worker is impossible due to data limitations, but sectoral employment shares could provide a consistent long-run proxy for local modernization and economic development. If white-collar inflows were merely chasing pre-existing growth, we should see differential trends in structural transformation before 1945. To test this pre-trend, I estimate an event-study specification for the impact of the white-collar repatriate share on agricultural, manufacturing, and service employment shares using census years from 1920 to 1970. Figure 5 plots the event-study coefficients of the following specification:

$$Y_{r,t} = \sum_{\tau \neq 1940} \beta_{\tau}^{PW} \cdot \left(PW_{r,1950} \times \mathbf{1}\{t = \tau\}\right) + \sum_{\tau \neq 1940} \beta_{\tau}^{WC} \cdot \left(WC_{r,1950} \times \mathbf{1}\{t = \tau\}\right) + \alpha_r + \lambda_t + \lambda_{p(r)} + \epsilon_{rt} \quad (3)$$

where $Y_{r,t}$ is the sectoral employment share in district r at time $t \in 1920, 1930, 1940, \ldots, 1970$, $PW_{r,1950}$ is the production worker repatriate share in district r in 1950, $WC_{r,1950}$ is the white-collar repatriate share in district r in 1950, α_r is the district fixed effect, λ_t is the time fixed effect, and $\lambda_{p(r)}$ is the prefecture fixed effect.

Figure 5: Event Study: Sectoral Employment Shares and White-Collar Repatriates



(A) Agriculture (B) Manufacturing (C) Services

Notes: This figure shows the event-study (Equation (3)) coefficients for the impact of the white-collar repatriate share on agricultural, manufacturing, and service employment shares in Japan from 1920 to 1970.

Across all three sectors, the coefficients are flat and statistically indistinguishable from zero in all pre-repatriation years. Districts that would later receive white-collar repatriates were not on different structural-change trajectories before repatriation. Agricultural shares decline only after repatriation begins. Manufacturing and service shares increase only in the postwar period.

This event pattern is reassuring for two reasons. First, the absence of differential structural

change before repatriation makes it less likely that white-collar exposure is proxying for pre-existing economic development dynamics. Sectoral shares summarize broad local economic structure, so if exposed districts had already been modernizing faster, this would appear in prewar trends. Second, the same evidence is informative for outcomes for which I cannot observe prewar panels. Although output per worker and local production structure are unavailable before the war, sectoral employment shares provide a summary measure of local modernization. Their flat prewar path therefore increases confidence that the postwar effects reflect the repatriation shock rather than continuation of earlier growth.

3.2 Economic Growth

Having established that white-collar repatriates reshaped local sectoral composition, I now examine whether these shifts translated into gains in productivity and output per worker. I estimate regressions of the form

$$\Delta \ln Y_{r,1960-1950/1940} = \beta_0 + \beta_1 \text{White-Collar Rep}_{r,1950} + \beta_2 \text{Production Worker Rep}_{r,1950} + \boldsymbol{X}_r' \Gamma + \varepsilon_r, \tag{4}$$

where the dependent variable Y_r is either (i) the number of establishments between 1950 and 1960, (ii) employees per establishment between 1950 and 1960, or (iii) revenue per employee between 1940 and 1960.[17] The controls match those used in Table 3. I begin with the number of establishments, which captures expansion in local business activity and, because firms that modernize often extend into multi-establishment organizations, organizational upgrading as well. Employees per establishment capture production scale within establishments. Revenue per employee provides a direct measure of non-agricultural output per worker.

Across all three outcomes, the coefficient on the white-collar repatriate share is positive and statistically significant. White-collar inflows increased the number of establishments, raised establishment size, and raised output per worker. In contrast, the coefficients on the production worker share are small and statistically indistinguishable from zero, indicating that production worker inflows did not contribute to these margins of economic growth. An increase in the white-collar repatriate share from the 10th to the 90th percentile is associated with about a 20 percent increase in the number of establishments between 1950 and 1960, a 13 percent increase in establishment size between 1950 and 1960, and a 12 percent increase in output per worker between 1940 and 1960.

[17] The number of establishments before World War II is not available; the earliest year is 1950.

TABLE 4: PRODUCTIVITY (1960–1950) AND OUTPUT PER WORKER (1960–1940), IV

	# of Establishment$_{1960-1950}$	Establishment Size$_{1960-1950}$	Output per Worker$_{1960-1940}$
	(1)	(2)	(3)
Production Worker Rep$_{1950}$	1.10	-1.23	-0.89
	(1.04)	(0.92)	(0.71)
White-Collar Rep$_{1950}$	3.03***	2.11***	1.89***
	(0.67)	(0.68)	(0.51)
N	1,100	1,090	1,102
F-Stat	56.76	55.55	52.05

Notes: This table presents the estimation results of the relationship between the share of white-collar and production worker repatriates and non-agricultural productivity (Equation (4)). The dependent variable is the change in the number of establishments, the average employees per establishment, and the average revenue per employee in log between 1960 and 1950 or 1940. The independent variable is the share of white-collar and production worker repatriates in district r at time 1950. The control variables include prefecture fixed effects, log population density in 1940, war damage, and level of the corresponding dependent variable in 1950 or 1940. Standard errors are clustered at the district level and reported in parentheses. F-Stat reports the Kleibergen-Paap rk Wald weak-identification statistic
$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

3.3 Modernization of Local Economies

How did repatriates affect the organization of local production? To answer this question, I first examine changes in four margins: the share of self-employed workers, the share of family workers, the share of wage workers, and the share of managers. These measures capture the extent to which cities transitioned from traditional household-based production toward modern wage-labor firms.

In low-income economies, production is typically organized around small, owner-operated firms that rely on unpaid family labor and fewer outside managers (Akcigit et al. (2021), Engbom et al. (2025), Gottlieb et al. (2025)). In high-income economies, production is dominated by larger, multi-establishment firms that rely primarily on hired wage workers and outside managers (Akcigit et al. (2021), Engbom et al. (2025), Gottlieb et al. (2025)).

Shifts in these labor-force shares therefore provide a measure of organizational modernization. A fall in self-employed or family-worker shares reflects movement away from traditional, household-based production toward firms that separate ownership, management, and labor. To study the impacts on these margins, I estimate the following specification:

$$\Delta w_{r,1970-1950} = \beta_0 + \beta_1 \text{White-Collar Rep}_{r,1950} + \beta_2 \text{Production Worker Rep}_{r,1950} + \boldsymbol{X}_r'\Gamma + \varepsilon_r, \quad (5)$$

where $w_{r,t}$ is one of the organizational outcomes in district r, and the control set X_r matches that used in the structural-transformation regressions (prefecture fixed effects, log density

in 1940, war destruction, and the 1950 level of the dependent variable).[18] I estimate the specification by IV.

White-collar repatriates pushed districts away from traditional organizational forms (Table 5). An increase in the white-collar repatriate share from the 10th to the 90th percentile is associated with a 1.6 percentage point decline in the self-employment share, a 0.8 percentage point decline in the family worker share, a 2.0 percentage point increase in the wage worker share, and a 0.2 percentage point increase in the manager share. By contrast, production worker repatriates had no significant effects on these margins.

These magnitudes are economically meaningful relative to Japan's aggregate postwar transformation. Between 1950 and 1970, the wage worker share rose by about 20 percentage points and the manager share by 1.3 percentage points nationally; moving from the 10th to the 90th percentile of the white-collar repatriate share is associated with a 2 percentage point increase in the former and a 0.2 percentage point increase in the latter.

White-collar repatriates contributed to the modernization of local production by reducing reliance on family labor and expanding the use of hired wage workers and outside managers. These changes are consistent with white-collar repatriates bringing managerial capabilities that relax organizational constraints and allow firms to scale.

Production worker repatriates, by contrast, left all organizational margins unchanged. Their arrival increased production labor supply but did not change production structure. The modernization of local economies was therefore driven by managerial labor supply rather than by population size alone or channels through increased demand for goods and services due to population inflow. White-collar repatriates shifted cities toward more complex, scalable firm structures.

[18] The Population Census first measured the number of self-employed, family workers, wage workers, and managers in 1950. Hence, I use the change between 1950 and 1970.

TABLE 5: MODERNIZATION OF THE LOCAL ECONOMY (1970–1950, IV)

	Self-employed Share$_{1970-1950}$	Family Worker Share$_{1970-1950}$	Wage Worker Share$_{1970-1950}$	Manager Share$_{1970-1950}$
	(1)	(2)	(3)	(4)
Production Worker Rep$_{1950}$	0.08	0.14	-0.23	-0.01
	(0.07)	(0.09)	(0.14)	(0.01)
White-Collar Rep$_{1950}$	-0.27***	-0.13***	0.34***	0.03***
	(0.04)	(0.05)	(0.08)	(0.01)
N	1,107	1,107	1,107	1,107
F-Stat	55.88	55.66	55.11	56.16

Notes: This table presents the estimation results of the relationship between the share of white-collar and production worker repatriates and the modernization of the local economy (Equation (5)). The dependent variable is the change in the share of self-employed workers, the share of family workers, the share of wage workers, and the change in the share of managers (including managers in the public sector) between 1970 and 1950. The independent variable is the share of white-collar and production worker repatriates in district r at time 1950. The control variables include prefecture fixed effects, log population density in 1940, war damage, and level of the corresponding dependent variable in 1950. Standard errors are clustered at the district level and reported in parentheses. F-Stat reports the Kleibergen-Paap rk Wald weak-identification statistic
$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

3.4 Spatial Expansion of Firms

Next, I examine how repatriates influenced the spatial organization of individual firms. Unlike the city-level analyses, which study aggregate changes over time, the firm-level analysis uses a difference-in-differences specification across firms observed in 1938, 1957, and 1970. I focus on three outcomes: the number of establishments per firm, an indicator for operating at least one establishment outside the headquarters (HQ) city, and the maximum geographic distance to the HQ. As Chandler (1977) argues, the transition from a single-owner operation to a multi-unit enterprise requires managers who can coordinate activities across establishments. Hence, looking at how the manager supply affects the number of establishments per firm directly tests Chandler's hypothesis.

Furthermore, Gumpert et al. (2022) show that firms are less likely to locate an establishment in a county that is distant from their headquarters, and that the complexity of managerial organization increases with the distance between the headquarters and the establishments. This suggests that operating remote units requires managerial capacity to overcome geographic coordination frictions. Therefore, a local shock that increases the supply of managers provides firms with the personnel required to scale operations across these distances. This predicts that an influx of managers in the headquarters city will increase a firm's maximum geographic scope and its probability of operating outside the headquarters city. To capture this dynamic, I use an indicator for operating outside the HQ city and the maximum HQ-establishment distance as primary measures of spatial expansion.

To estimate the causal effect of manager supply on these margins, I estimate:

$$Y_{frt} = \theta_1(\text{Post}_t \times \text{White-Collar Rep}_{r,1950}) + \theta_2(\text{Post}_t \times \text{Production Worker Rep}_{r,1950}) + \delta_r + \delta_{p(r)} + \lambda_t + \varepsilon_{frt}, \tag{6}$$

where Y_{frt} represents one of the three spatial outcomes for firm f headquartered in district r at year t. The variable Post_t equals one for $t \geq 1950$. The specification includes district fixed effects (δ_r), prefecture fixed effects ($\delta_{p(r)}$), and year fixed effects (λ_t). The coefficients θ_1 and θ_2 identify the differential postwar change in firm organization attributable to white-collar and production worker repatriate exposure, instrumented using the *honseki*-based predicted shares interacted with the post indicator. The results are presented in Table 6.

White-collar repatriates drove firm-level organizational upgrading. An increase in the white-collar repatriate share from the 10th to the 90th percentile is associated with about a 36 percent increase in the number of establishments per firm (Column 1). Production worker inflows, by contrast, are associated with about a 24 percent decline in the number of establishments per firm.

Crucially, this local manager supply shock spread across space. An increase in the white-collar repatriate share from the 10th to the 90th percentile is associated with a 32 percentage point increase in the probability that a firm operates at least one establishment outside the HQ city (Column 2) and a 69 kilometer increase in the maximum geographic distance of the firm's establishment network (Column 3). Conversely, production worker inflows decrease the probability of operating outside the HQ city and reduce the geographic span of the firm's establishment network. Because the specification exploits variation at the headquarters district, these estimates indicate that multi-unit expansion depends on manager supply at the HQ. This suggests that firms recruit qualified managers at their headquarters and deploy their services to coordinate distant operations, consistent with evidence that multinationals transport management practices across borders (Bloom et al., 2012).

Taken together, these spatial outcomes are central for identifying the mechanism of the change in the organization of firms. If managerial services are produced at the HQ, a positive HQ manager shock increases productivity in exising or potentially new establishments, propagating the local shock through the firm's network of establishments.[19] This identifies an inherently spatial dimension of firm organization and structural change that existing macro-development models abstract from. Ultimately, the local supply of managers allows firms not only to scale locally but to coordinate operations at a distance, spreading modern organization to other regions.

[19]This is consistent with evidence that multi-unit firms transmit local shocks to other regions through their internal networks (Atalay et al., 2014; Gumpert et al., 2022; Giroud et al., 2024; Kleinman, 2025).

Table 6: Modernization of Firms (IV)

	Log Establishments	Outside-HQ Dummy	Max Distance to HQ, km
	(1)	(2)	(3)
Post × Production Worker Repatriate Share	-4.46*	-4.66**	-1068.59**
	(2.45)	(1.89)	(497.43)
Post × White-Collar Repatriate Share	5.12*	5.30**	1144.40*
	(2.85)	(2.24)	(585.41)
N	78,455	78,455	78,455
F-Stat	40.94	40.94	40.94

Notes: This table presents IV-DID estimates of the relationship between repatriate shares and the modernization and spatial expansion of firms (Equation (6)). The dependent variable is log establishments (Column (1)), an indicator for operating at least one establishment outside the HQ city (Column (2)), and maximum HQ-establishment distance in kilometers (Column (3)). The independent variable is the post-treatment interaction of the share of production worker and white-collar repatriates in district r at time 1950. The control variables include firm fixed effects, year fixed effects, and prefecture fixed effects. All endogenous post-treatment interactions are instrumented with the corresponding predicted settlement shares interacted with post. The sample includes years 1938, 1957, and 1970. Standard errors are clustered at the district level and reported in parentheses. F-Stat reports the Kleibergen-Paap rk Wald weak-identification statistic
$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

3.5 Other Channels

I examine three other potential channels through which white-collar repatriates influence local growth: universities, innovation, and transportation infrastructure.[20]

Universities. The structural transformation literature highlights universities as engines of local economic development. Two mechanisms emphasized in recent work are particularly relevant. First, universities shape local human-capital supply. Dziadyk (2025) shows that the opening of new universities can increase the stock of skilled workers in a region by attracting students, retaining graduates, and raising local productivity. Universities thus function as persistent sources of skilled labor and can catalyze long-run growth.

Second, universities act as intellectual and organizational hubs. Liu and Takeda (2025) demonstrate that universities accelerate local innovation by facilitating knowledge diffusion and generating interaction between researchers and firms. In their framework, universities serve as anchor institutions. They upgrade local capabilities, raise the quality of management, and stimulate firm formation and expansion.

These papers suggest that if repatriates had expanded the university sector, this could have created a complementary mechanism through which white-collar inflows increased growth. Universities could have amplified managerial talent, raised the supply of skilled

[20]All the results in this subsection are available in Section B.12.

workers, and stimulated local knowledge creation, any of which might explain part of the structural transformation and economic growth documented earlier.

Motivated by this mechanism, I examine whether cities receiving more white-collar repatriates experienced differential growth in their university sector. Specifically, I estimate difference-in-differences regressions of the number of universities per capita on the white-collar and production worker repatriate shares, controlling for prefecture fixed effects. The effects are small and statistically insignificant. Cities that received more white-collar repatriates did not open more universities. This null result implies that the university channel, which is central in other settings, played no meaningful role in postwar Japan through white-collar repatriates.

Innovation. I also examine whether white-collar repatriates increased idea creation, using city-level patenting as an innovation proxy. Regressions analogous to the main specification, with the number of patents per capita as outcomes, yield coefficients on the white-collar share that are small and statistically indistinguishable from zero, and the production worker coefficients are similarly null. This null effect is informative when viewed in light of the existing growth literature. In models of scale effects based on idea creation, such as those emphasized by Peters (2022) and Terry et al. (2026), population inflows raise growth by increasing the innovation rate and accelerating technological discovery. My results point to a distinct mechanism. White-collar repatriates did not increase measured innovative output, but they significantly expanded firm size and the adoption of modern organizational forms. Their comparative advantage lay not in generating new ideas but in executing and scaling existing ones, coordinating larger workforces and implementing known technologies more efficiently. Thus, while Peters (2022) and Terry et al. (2026) link population shocks to growth through innovation, my estimates show that income per worker in this setting grew through managerial execution and firm modernization rather than idea creation. This distinction matters for development: most low-income economies do not grow by inventing frontier technologies but by closing the gap in organizational efficiency, and the evidence here identifies managerial supply as the key input that enables this catch-up process.

Transportation. Finally, I examine whether white-collar repatriates improved transportation access, which could stimulate growth by reducing trade costs and improving labor mobility. I therefore estimate difference-in-differences regressions using the number of train stations and the number of highway exits in each city as outcomes. The results show no positive effect. The coefficients are small and, in the case of transportation infrastructure, statistically significant and negative. Cities receiving larger white-collar inflows did not expand transportation networks; in some cases, they experienced slightly fewer station or

highway additions. There is no evidence that repatriate-heavy cities built more transportation infrastructure as a result of the inflows.

The absence of any transportation response rules out physical connectivity as a source of the growth effects. Combined with the null results for universities and patenting, the evidence indicates that white-collar repatriates stimulated local development through changes inside firms rather than through external channels such as new educational institutions, knowledge hubs, or infrastructure upgrades.

3.6 Taking Stock

There are three main takeaways from the empirical evidence. First, white-collar repatriates triggered *structural transformation*. Districts that received more white-collar repatriates lost agricultural employment, expanded manufacturing and services, and experienced net in-migration, while districts that received mainly production worker repatriates did not. Second, this transformation was driven by a *local change in the organization of production*. Where white-collar inflows were larger, local production shifted away from self-employed and family workers toward wage workers and outside managers, indicating a move from household production to scalable modern firms. Third, this modernization enabled the *spatial expansion of firms*. At the firm level, white-collar exposure not only raised the number of establishments per firm, but also increased the probability of operating outside the headquarters city and expanded the geographic span of the firm's establishment network.

Despite these changes in firm scale and organization, neither white-collar nor production worker repatriates affected new idea creation, proxied by patenting. The population shock acted not through idea creation, but by relaxing managerial constraints and improving the firm's organization, an interpretation the model in the next section builds in explicitly. White-collar repatriates did not simply add labor. They changed how production was organized, allowing cities to absorb workers from agriculture, expand the non-agricultural sector, and raise output per worker. Importantly, through firms' establishment networks, white-collar repatriates also spread modernization to other regions.

4 Theory

This section develops a spatial general-equilibrium model that rationalizes the empirical findings, with a focus on manager supply and multi-establishment firms in economic development.

4.1 Environment

There are R regions indexed by $i, j \in \{1, \ldots, R\}$. Each region contains a unit mass of identical micro-locations. As described later, this unit mass is equivalent to the total market size of the region and each firm chooses the market penetration in each region. The economy has two sectors: tradable agriculture and non-tradable non-agriculture.

In agriculture, competitive homogenous farmers in each region use land and production labor to produce a homogeneous good. Agricultural trade is frictionless across regions, so the agricultural price is common across regions and is the numéraire.

In non-agriculture, heterogeneous firms produce differentiated varieties and can operate multiple establishments across regions. Following Akcigit et al. (2021), each firm has fixed owner managerial input at headquarters. Firms that choose to modernize can hire outside HQ managers. Following Kleinman (2025), HQ managerial services are non-rival across the firm's establishments, so increases in HQ managerial capacity raise the productivity of all satellite (potential) establishments.

4.2 Preferences

There are two labor types: production workers (P) and managers (M). A worker of type $s \in \{P, M\}$ in region j has preferences

$$U_{js} = B_j b_{js} c_{js}^{1-\phi} Q_{js}^{\phi}, \qquad \phi \in (0,1), \tag{7}$$

where B_j is amenity in region j, b_{js} is its idiosyncratic preference shock distributed Fréchet, c_{js} is agricultural consumption and Q_{js} is the CES non-agricultural aggregator

$$Q_{js} = \left(\int_{\omega \in \Omega_j} q_{js}(\omega)^{\frac{\theta-1}{\theta}} \, d\omega \right)^{\frac{\theta}{\theta-1}}, \qquad \theta > 1. \tag{8}$$

Let non-agricultural expenditure be $E_{js} = \phi y_{js}$, where y_{js} is labor income of worker type $s \in \{P, M\}$ in region j. Demand (q_{js}) for a variety with price p and the spending (r_{js}) are

$$q_{js} = E_{js} p^{-\theta} P_j^{\theta-1}, \qquad r_{js} \equiv p_{js} q_{js} = E_{js} \left(\frac{p_{js}}{P_j} \right)^{1-\theta}. \tag{9}$$

Define

$$\Xi_{js} \equiv E_{js}^{1/\theta} P_j^{(\theta-1)/\theta}, \qquad \delta \equiv \frac{\theta - 1}{\theta} \in (0,1), \tag{10}$$

so inverse demand is $p(q) = \Xi_{js} q^{-1/\theta}$ and spending is $r(q) = \Xi_{js} q^{\delta}$.

Since its idiosyncratic preference shock is distributed Fréchet, location choice implies

$$L_{js} = \bar{L}_s \cdot \frac{\left(\frac{B_j w_{js}}{P_j^{\phi}}\right)^{\kappa_s}}{\sum_k \left(\frac{B_k w_{ks}}{P_k^{\phi}}\right)^{\kappa_s}}. \tag{11}$$

Hence, workers of type s are more likely to locate in regions with higher real wages.

4.3 Agriculture

Agriculture in region j uses production labor L_{Aj} and fixed land T_j:

$$Y_{Aj} = A_{Aj} L_{Aj}^{\alpha_A} T_j^{1-\alpha_A}, \qquad \alpha_A \in (0,1). \tag{12}$$

Under perfect competition:

$$w_j = \alpha_A A_{Aj} L_{Aj}^{\alpha_A - 1} T_j^{1-\alpha_A}, \tag{13}$$

which pins down downward-sloping agriculture labor demand. Since the production wage equalizes across sectors, when production wages increase, the agriculture labor demand decreases. Hence, the increase in production wages induces structural transformation. The payment to land is given to immobile absentee owners.

4.4 Non-agriculture

The non-agriculture block has three key features: (i) non-rival HQ managerial services shared across establishments, (ii) fixed owner managerial input $\bar{h}$, and (iii) endogenous organizational choice between traditional and modern firms. Together, these features generate manager-driven changes in the spatial organization of production.

Production Technology. A firm with HQ in region i and productivity z produces in region j according to

$$q_{ij}(z) = z\, \tilde{h}_i(z)^{\alpha}\, l_{ij}(z)^{\beta}, \qquad \alpha, \beta > 0, \quad \alpha + \beta < 1, \tag{14}$$

where $l_{ij}(z)$ is local production labor hired in region j, and $\tilde{h}_i(z)$ is managerial services produced at HQ and shared across all establishments, following Kleinman (2025). I interpret $\tilde{h}_i(z)$ as HQ-produced management practices: firm-wide intangible inputs that can be replicated across establishments.[21] A concrete example is an HQ-designed defect-tracking

[21] Following Kleinman (2025), headquarters activity is interpreted as the production of non-rival firm-level inputs, not simply as skilled labor. Kleinman shows that headquarters intensity remains distinct from standard skill measures, implying that the relevant HQ input is an organizational object rather than generic skill. In this paper, I impose the stronger restriction that this non-rival HQ input is managerial services.

and daily quality-review system. Once headquarters codifies this practice, the same system can be used in every establishment without requiring the continuous physical presence of a lead manager at each site (Bloom et al., 2013). In this sense, HQ managerial services are non-rival in the model: the same headquarters managerial capacity can raise the productivity of local production labor l_{ij} in multiple regions simultaneously.[22]

This assumption is also consistent with Atalay et al. (2014), who show that vertically integrated firms are linked less by internal shipments of physical goods than by intangible inputs such as managerial and organizational know-how. In this model, those intangible inputs are captured by HQ managerial services.

Another important feature of the model is that each firm has a fixed owner managerial input $\bar{h}$, following Akcigit et al. (2021). Without hiring outside managers, managerial services are fixed. This fixed managerial services restricts the firm's ability to expand and the size of the firms both intensively and extensively. HQ managerial services are

$$\tilde{h}_i(z) = \bar{h} + h_i^{\text{hired}}(z), \tag{15}$$

where $\bar{h}$ is fixed owner managerial input and $h_i^{\text{hired}}(z)$ is the amount of hired managerial services.

As described later, another important feature of the model is that firms endogenously choose traditional or modern organizational form. Traditional firms have no outside managers, so $h_i^{\text{hired}}(z) = 0$. Traditional firms are also local only, meaning that they can serve only the market in which their HQ is located in. Modern firms pay a fixed modernization cost F_M of the tradable agriculture sector and can choose $h_i^{\text{hired}}(z) \geq 0$ and can serve multiple markets.[23]

Traditional firms are interpreted as micro, owner managed businesses, such as self employed and mom and pop firms, that operate only in their local market. This captures the idea that very small informal businesses typically lack the administrative structure required to coordinate establishments across locations. Multi establishment operation arises only after the firm pays a fixed modernization cost, formalizes its organization, and hires outside managers.

There are at least two conceptually distinct ways in which manager supply may shape spatial firm organization. One is through managerial or middle skill availability at potential

[22]Here, I implicitly assume that more managers in HQ mean higher HQ managerial services or firms adopt better management practices.

[23]This fixed adoption cost can be interpreted as the one-time fixed cost of accessing the formal managerial labor market, including registration and payroll tax setup, formal contracting and HR systems, and the reporting and governance infrastructure required for delegation to hired managers. Another interpretation is the cost of entering the formal sector as in Ulyssea (2020).

destination sites, which affects whether production can be profitably organized there, as emphasized by Antràs et al. (2008). The other is through managerial supply at headquarters, which affects whether firms can hire the managers needed to coordinate, monitor, and support expansion across locations. In the baseline model, I abstract from the destination side channel in order to isolate the headquarters side mechanism highlighted by the empirical results.[24] This emphasis on headquarters manager supply is also consistent with the institutional organization of Japanese firms. Ujihara (1968) describes *shain* as centrally recruited at headquarters and trained for firm-wide managerial responsibilities rather than establishment-specific tasks.

Market Penetration, Expansion Intensity, and Expansion Costs. A firm with HQ in i and productivity z chooses market-specific establishment intensity $n_{ij}(z) \in [0, \infty)$ in region j, following Kleinman (2025). Market penetration ($x_{ij}(z)$) in region j is a function of establishment intensity:

$$x_{ij}(z) = x(n_{ij}(z)) \equiv \frac{n_{ij}(z)}{1 + n_{ij}(z)} \in [0, 1), \qquad x'(n) = \frac{1}{(1+n)^2}. \tag{16}$$

Because each region has a unit mass of identical micro-locations, $x_{ij}(z)$ can be interpreted as the fraction of locations in region j served by a firm with HQ in i and productivity z. The choice variable $n_{ij}(z)$ controls this local footprint: higher $n_{ij}(z)$ means that more consumers in region j can access the firm's variety. Since micro-locations are identical within region j, total sales in region j are $x_{ij}(z)R_{ij}(z)$, where $R_{ij}(z)$ denotes sales per served micro-location.

The concavity of the penetration function captures within-market saturation (cannibalization): additional establishments raise coverage by less when n_{ij} is already high. Intuitively, when n_{ij} is low, an additional establishment reaches many previously unserved micro-locations. When n_{ij} is already high, most micro-locations are already covered, so a new establishment mainly overlaps with the firm's existing footprint and adds little new demand. This local saturation also creates a force for spatial expansion: once local penetration is already high, the return to adding another establishment in the same region falls relative to expanding into a new region and hence firms tend to expand into new regions.

[24] A simple extension would allow both channels to matter by specifying effective managerial services as a CES aggregate of headquarters managerial services and destination specific managerial inputs, in the spirit of Kleinman (2025). Specifically,

$$\tilde{h}_{id}(z) = (h_i(z)^\rho + h_d(z)^\rho)^{1/\rho},$$

where $h_d(z)$ is the managerial services available in destination regions, and ρ is the elasticity of substitution between headquarters and destination managerial services.

Opening new establishments is costly, with expansion cost

$$C\left(\{n_{ij}\}_{j=1}^{R}\right) = \sum_{j\neq i} \tau_{ij} n_{ij} + \frac{\kappa}{2}\left(\sum_{j=1}^{R} n_{ij}\right)^2, \tag{17}$$

where $\kappa > 0$ is the firm-wide scope-cost parameter. As in Kleinman (2025), opening an establishment in a region farther from HQ is more costly, so τ_{ij} is increasing in distance d_{ij}. In the quantitative implementation, I normalize the local expansion cost to zero and parameterize remote expansion cost as

$$\tau_{ij} = \begin{cases} 0 & \text{if } i = j, \\ d_{ij}^{\rho} & \text{if } i \neq j, \end{cases} \qquad \rho > 0,$$

where d_{ij} is bilateral distance in kilometers.[25] The parameterization generates a gravity force in firm expansion: conditional on fundamentals, firms are less likely to open establishments in distant regions. Conversely, higher profits in region j increase the desired establishment intensity in that region. Because HQ managerial services are non-rival across establishments, an increase in HQ managerial capacity raises potential profits across markets and therefore tends to increase both total establishment intensity and the geographic reach of the firm, subject to expansion costs. The quadratic term captures firm-wide span-of-control costs in managing a larger network of establishments.

Organization Choice and Productivity Draws. Potential entrants in region i pay entry cost f_e in the tradable agricultural sector goods and draw productivity from a Pareto distribution:

$$G(z) = 1 - z^{-\nu_z}, \qquad \nu_z > 1. \tag{18}$$

Firms then choose organizational form between traditional and modern forms by comparing the profits from each form.

Traditional Firm. Traditional firms in region i are local-only (can only expand in region i) and owner-managed (no outside managers):

$$n_{ij} = 0 \;\forall j \neq i, \qquad h_i^{\text{hired}} = 0. \tag{19}$$

[25] In the no-spatial-propagation counterfactual, I set $\tau_{ij} = \infty$ for all $i \neq j$ to shut down non-HQ establishment expansion.

This captures the idea that traditional firms do not hire outside managers and are closer to self-employment or small owner-run businesses.[26]

Traditional firms still choose local intensity n_{ii}. This may seem inconsistent with Chandler's characterization of traditional firms as single-unit enterprises. Here, however, n_{ii} is interpreted as a continuous local market footprint (or establishment-equivalent intensity) that affects local penetration x_{ii} rather than as a literal integer branch count. This keeps the model tractable while preserving Chandler's core distinction: traditional firms are owner-managed *single-market* enterprises, whereas modern firms can build *multi-region* networks with outside managers.

I normalize the local fixed-per-establishment cost for traditional firms to zero, $\tau_{ii} = 0$, so only the convex local expansion cost remains. Their problem is

$$\Pi_i^T(z) = \max_{n_{ii}\geq 0,\ l_{ii}\geq 0} x(n_{ii})\left[\Xi_i\left(z\,\bar{h}^{\alpha} l_{ii}^{\beta}\right)^{\delta} - w_i l_{ii}\right] - \frac{\kappa}{2} n_{ii}^2. \tag{20}$$

Traditional firms in region i choose establishment intensity n_{ii} and production labor l_{ii}, internalizing the local expansion cost. This follows the Lucas-style span-of-control logic (Lucas (1978)): with fixed owner managerial input $\bar{h}$ and $\beta, \delta < 1$, output is concave in production labor, so the marginal product of labor declines with l_{ii}. Unlike modern firms in this model, traditional firms cannot relax this span-of-control constraint by hiring outside managers.

Define per-micro-location revenue and profit:

$$R_i^T(l) \equiv \Xi_i\left(z\,\bar{h}^{\alpha} l^{\beta}\right)^{\delta}, \qquad \pi_i^T(z) \equiv \max_{l\geq 0}\{R_i^T(l) - w_i l\}. \tag{21}$$

The production labor demand is

$$l_i^T(z) = \left[\frac{\beta\delta}{w_i}\,\Xi_i\, z^{\delta}\,\bar{h}^{\alpha\delta}\right]^{\frac{1}{1-\beta\delta}}. \tag{22}$$

Revenue and profit at the optimum are

$$R_i^T(z) = \left[\Xi_i z^{\delta}\bar{h}^{\alpha\delta}\right]^{\frac{1}{1-\beta\delta}}\left(\frac{\beta\delta}{w_i}\right)^{\frac{\beta\delta}{1-\beta\delta}}, \qquad \pi_i^T(z) = (1-\beta\delta)R_i^T(z). \tag{23}$$

For a given local production wage w_i, higher productivity z increases local production labor demand, revenue, and operating profit. Given optimal operating profit $\pi_i^T(z)$, the local

[26] Davis et al. (2023) documents that self-employment or micro-enterprises are much more prevalent in low-income countries than in high-income countries. To capture the transition from traditional to modern firms, I assume that traditional firms cannot hire outside managers and can operate only in the region where their HQ is located, which restricts firm size.

penetration choice satisfies

$$\max_{n_{ii}\geq 0} \; x(n_{ii})\pi_i^T(z) - \frac{\kappa}{2}n_{ii}^2, \tag{24}$$

with FOC

$$\frac{\pi_i^T(z)}{(1+n_{ii})^2} = \kappa n_{ii}. \tag{25}$$

Thus, more productive traditional firms choose greater local penetration. However, because $x(n)$ is concave and local expansion costs are convex, local footprint rises less than proportionally with profitability. Fixed owner managerial input $\bar{h}$ therefore restricts traditional firms on two margins. First, it limits the amount of production labor the firm can profitably manage, keeping the firm small on the intensive margin. Second, because greater managerial capacity raises operating profits and hence the return to local penetration, fixed $\bar{h}$ also limits the firm's local footprint n_{ii}, keeping traditional firms small on the extensive margin.

Modern Firm. Modern firms in region i choose hired HQ managers (h_i^{hired}), market-level local production labor (l_{ij}), and spatial penetration (n_{ij}) in each region j. Their problem is

$$\begin{aligned}\Pi_i^M(z) = \max_{h_i^{\text{hired}}\geq 0,\ \{n_{ij},l_{ij}\}_{j=1}^R\geq 0} \quad & \sum_{j=1}^{R} \underbrace{x(n_{ij})\left[\Xi_j\left(z\,\tilde{h}_i^{\alpha}\,l_{ij}^{\beta}\right)^{\delta} - w_j l_{ij}\right]}_{\text{Operating profit in } j} - \underbrace{w_i^M h_i^{\text{hired}}}_{\text{HQ manager cost}} \\ & \underbrace{- \sum_{j\neq i}\tau_{ij}n_{ij} + \frac{\kappa}{2}\Big(\sum_{j=1}^{R} n_{ij}\Big)^2}_{\text{Expansion cost}} - \underbrace{F_M}_{\text{Modernization cost}},\end{aligned} \tag{26}$$

where

$$\tilde{h}_i = \bar{h} + h_i^{\text{hired}}. \tag{27}$$

Unlike traditional firms, modern firms can augment fixed owner managerial input by hiring outside managers once they pay the fixed cost F_M. This relaxes the managerial bottleneck on two margins. First, a higher $\tilde{h}_i$ raises the profitability of production in each served market, allowing the firm to employ more production labor and expand on the intensive margin. Second, because HQ managerial services are non-rival across establishments, a higher $\tilde{h}_i$ raises potential profits across markets and therefore increases the return to local penetration and to operating in more regions, allowing the firm to expand in geographic scope.

Hired HQ-manager demand is pinned down by

$$w_i^M = \sum_{j=1}^{R} x(n_{ij}) \frac{\partial \pi_{ij}(z, h_i^{\text{hired}})}{\partial h_i^{\text{hired}}}. \tag{28}$$

Using the within-market profit function, define

$$\gamma \equiv \frac{\alpha\delta}{1-\beta\delta} \in (0,1), \qquad B_{ij}(z) \equiv (1-\beta\delta)\left[\Xi_j z^{\delta}\right]^{\frac{1}{1-\beta\delta}} \left(\frac{\beta\delta}{w_j}\right)^{\frac{\beta\delta}{1-\beta\delta}}, \tag{29}$$

so that

$$\pi_{ij}(z, h_i^{\text{hired}}) = B_{ij}(z)\tilde{h}_i^{\gamma}. \tag{30}$$

Conditional on the penetration profile $\{n_{ij}\}_{j=1}^{R}$, the hired manager demand is therefore

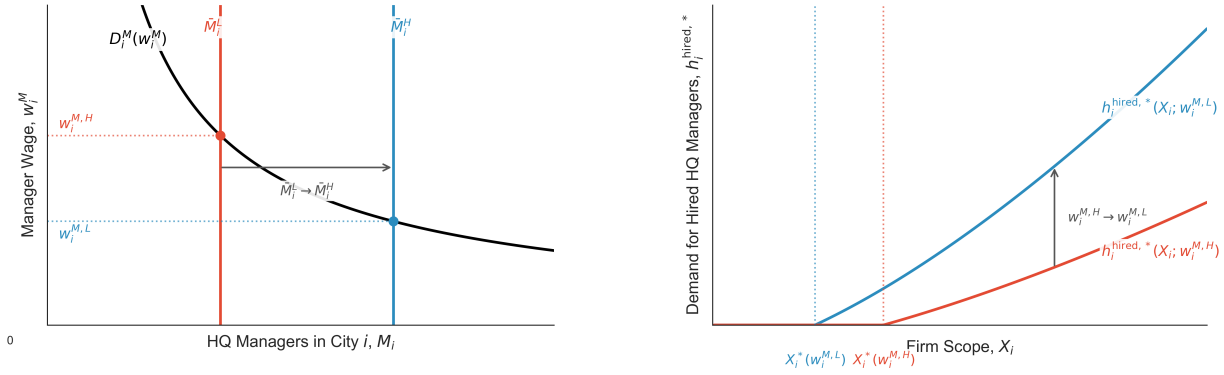
$$h_i^{\text{hired},*} = \max\left\{\left[\frac{\gamma \sum_{j=1}^{R} x(n_{ij}) B_{ij}(z)}{w_i^M}\right]^{\frac{1}{1-\gamma}} - \bar{h},\ 0\right\}. \tag{31}$$

The hired-manager demand equation shows that the firm hires HQ managers until the marginal cost of one more hired manager, w_i^M, equals the sum of marginal profit gains across all served markets. A lower HQ manager wage w_i^M therefore raises optimal hired managers directly by reducing the cost of expanding HQ managerial capacity. Higher firm productivity z raises $B_{ij}(z)$, and thus operating profits, in every market, so an additional HQ manager generates larger operating-profit gains wherever the firm is active. Broader market reach, captured by higher $x(n_{ij})$, also raises manager demand because HQ managerial services are non-rival: the same additional managerial input can be applied across more establishments and regions at once. Thus, manager demand is stronger for firms that are more productive, serve more markets, or have deeper penetration within those markets. In this sense, spatial scope and HQ managerial input are complements.

Panel A of Figure 6 illustrates the aggregate manager labor market in the HQ city. Because workers do not choose occupations in this model, local manager supply is vertical. A positive manager-supply shock shifts that vertical supply schedule to the right, lowers the equilibrium manager wage from $w_i^{M,H}$ to $w_i^{M,L}$, and increases total hired managers in equilibrium. Panel B plots firm-level hired HQ-manager demand against firm scope $X_i = \sum_{j=1}^{R} x(n_{ij})$. The lower-wage curve lies above the higher-wage curve because, for a given market reach, the firm finds it cheaper to expand HQ managerial capacity. The figure also shows a scope threshold below which fixed owner managerial input $\bar{h}$ is sufficient and the firm hires no outside managers. As scope rises, hired-manager demand increases because the same HQ managerial services

can be applied across more markets and establishments.

FIGURE 6: MANAGER SUPPLY, WAGES, AND FIRM-LEVEL HQ MANAGER DEMAND



(A) HQ MANAGER LABOR MARKET (B) FIRM-LEVEL HIRED HQ-MANAGER DEMAND

Notes: This figure shows the aggregate HQ-manager labor market (Panel A) and firm-level hired HQ-manager demand (Panel B). Because occupations are fixed in the model, manager supply in Panel A is vertical. A positive HQ-city manager-supply shock shifts that vertical supply line to the right and lowers the equilibrium manager wage from $w_i^{M,H}$ to $w_i^{M,L}$. Panel B plots firm-level hired HQ-manager demand against firm scope $X_i = \sum_{j=1}^{R} x(n_{ij})$. The blue line corresponds to a low manager wage ($w_i^{M,L}$) and the red line to a high manager wage ($w_i^{M,H}$). Hired-manager demand is zero below the threshold scope at which fixed owner managerial input is sufficient and then increases with scope.

Modernization Cutoff and Firm Composition. A firm with HQ in region i and productivity z chooses modern organization iff

$$\underbrace{\Pi_i^M(z)}_{\text{Modern profit}} \geq \underbrace{\Pi_i^T(z)}_{\text{Traditional profit}} . \tag{32}$$

Define the modernization surplus

$$\Delta_i(z) \equiv \Pi_i^M(z) - \Pi_i^T(z). \tag{33}$$

If $\Delta_i(z)$ is increasing in z, then there exists a cutoff productivity $z_i^\star$ such that firms with $z \geq z_i^\star$ choose the modern organization, while firms with $z < z_i^\star$ remain traditional. In this sense, more productive firms are more likely to modernize and, once modernized, tend to employ more production labor and operate in more regions, whereas less productive firms remain owner-managed and local-only. Under the Pareto distribution, the share of modern firms headquartered in region i is

$$s_i^M = \Pr(z \geq z_i^\star) = (z_i^\star)^{-\nu_z}. \tag{34}$$

The traditional firm share is $1 - s_i^M$. Therefore, when the cutoff $z_i^\star$ falls, a larger fraction of firms chooses the modern organization because more firms satisfy the modernization condition $\Pi_i^M(z) \geq \Pi_i^T(z)$. By contrast, for a given cutoff, a lower firm-level productivity draw z makes modernization less likely.

4.5 Comparative Statics

To connect the model to the empirical evidence and build intuition, I isolate the firm-side effects of a manager-supply shock around HQ city i. I hold local demand shifters, production wages, and distances fixed, and assume symmetry so that non-HQ locations differ only by distance from city i. Consider an exogenous increase in local manager supply that lowers the HQ-manager wage w_i^M. This setup yields two comparative statics. The first concerns local firm composition. The second concerns firms' spatial expansion through establishment networks.

Proposition 1. *Under these conditions, a fall in w_i^M lowers the modernization cutoff $z_i^\star$. The lower cutoff lowers the traditional-firm share and raises the modern-firm share in the shocked economy.*

Proof. Proof is in the appendix C. □

This proposition captures the local modernization margin. Lower HQ-manager wages make modernization profitable for a larger set of firms, reduce the share of traditional firms, and increase the share of modern firms in the shocked economy. In the empirical analysis, this result corresponds to the decline in the self-employed share, which I interpret as a proxy for the traditional-firm share.

The second proposition turns to the new spatial implication of the model. Lower HQ-manager wages expand firms' establishment networks along two margins: already-modern firms expand farther, and additional firms switch into modern organization. In the model, this appears as higher establishment intensity, a higher probability of operating outside the HQ city, and greater maximum distance from headquarters.

Proposition 2. *Under the same conditions as Proposition 1, a fall in w_i^M has three effects:*

(i) For every firm that is modern at both wages, total establishment intensity and maximum operating distance from the HQ weakly rise.

(ii) For every firm that switches from traditional to modern organization when the wage falls, total establishment intensity rises relative to the traditional allocation.

(iii) Across all firms headquartered in region i, the probability of operating at least one non-HQ establishment weakly rises.

Proof. Proof is in the appendix C. □

This result operates through two margins. First, among already-modern firms, lower HQ-manager wages raise the optimal HQ managerial services. Because HQ managerial services are non-rival across establishments, the resulting increase in the HQ managerial services raises profitability in every current and potential market. Modern firms therefore choose greater establishment intensity, serve more non-HQ locations, and can profitably operate farther from the HQ. Second, lower HQ-manager wages reduce the modernization cutoff, so some firms switch from traditional to modern organization. For those switching firms, access to hired managers relaxes the fixed-owner managerial bottleneck and weakly raises total establishment intensity relative to the traditional allocation. These two margins jointly increase the probability of operating outside the HQ city. These implications rationalize the three firm-level results in Section 3.4. In the model, total establishment intensity is equivalent to the number of establishments per firm in the data.

The next proposition shows that spatial expansion raises the productivity of managerial capacity.

Proposition 3. *Under the same conditions as Proposition 1, a higher establishment intensity n raises the firm-level marginal product of managers.*

Proof. Proof is in the appendix C. □

This proposition shows that establishment expansion acts like manager-complementary technological change. Holding fixed HQ managerial services, a higher establishment intensity raises the firm-level marginal product of managers because the same HQ managerial capacity is deployed across more operating units. This is the manager-complementary mechanism emphasized by Kleinman (2025). What I show, through Proposition 2, is the supply-side margin: a larger manager supply lowers manager wages and induces firms to expand establishment intensity. Combining the two propositions yields two broader implications. First, in the sharing sense of Duranton and Puga (2004), the model provides a micro-foundation for an agglomeration force among HQ managerial workers: headquarters managerial services are an indivisible input, and when firms operate more establishments, the same services are shared across more units, raising the productivity of HQ managers. Second, in the sense of Acemoglu (2007, 2010), the model exhibits weak equilibrium bias toward managers: the increase in manager supply induces organizational change, and that induced organizational change raises the marginal product of the same factor. Relative to Kleinman (2025), the

contribution here is therefore not only manager-complementary organizational change, but also a micro-foundation for agglomeration and weak equilibrium bias. Manager abundance does not simply increase the number of managers employed; it reorganizes production in a way that makes managerial capacity more productive and amplifies the transition from traditional owner-managed firms to modern networked firms.

4.6 Taking Stock

Because traditional firms can rely only on fixed owner managerial input, economies with scarce or expensive managers have a higher modernization cutoff. In that case, a larger mass of firms remains small, owner-managed, and local-only, so the economy stays more traditional. By contrast, an increase in manager supply lowers manager wages, reduces the modernization cutoff, and shifts the economy toward modern organization. This local modernization margin is closely related to the mechanisms emphasized in Akcigit et al. (2021) and Engbom et al. (2025). What is new in my model is that modernization does not stop at the shocked location. Because modern firms use non-rival HQ managerial services across establishments, they open satellite establishments in other regions and spread modern organization through their establishment networks. Manager supply therefore affects development not only by modernizing the local economy, but also by propagating modernization across space through multi-establishment firms. This same organizational margin has two broader implications. First, because a larger manager supply expands firms' establishment networks and larger establishment networks raise the marginal product of managers, the model provides a micro-foundation for an agglomeration force among HQ managerial workers. Second, the model exhibits weak equilibrium bias toward managers: a larger manager supply induces organizational change, and that induced organizational change raises the marginal product of the same factor.

5 Structural Estimation and Counterfactual Analysis

This section estimates the model and describes the counterfactual analysis. Section 5.1 outlines the estimation strategy. Section 5.2 reports the benchmark parameter estimates. Section 5.3 describes the counterfactual exercises.

5.1 Estimation

The goal of this section is to measure how much of postwar aggregate output per worker growth can be attributed to the relaxation of local HQ-manager scarcity, and how much of that effect is transmitted through firms' establishment networks. I therefore treat white-collar repatriates as a shock to the district endowment of HQ-manager workers, $\bar{L}_{M,j}$.

There are two broad sets of parameters. The first set consists of regional fundamentals, namely district amenities B_j, agriculture productivity A_{Aj}. The second set consists of common parameters that are held fixed across districts. In the benchmark implementation, I calibrate or estimate

$$\Omega = \{ \underbrace{\phi, \kappa_s, \theta}_{\text{Preference}}, \quad \underbrace{\alpha_A}_{\text{Agriculture Production}}, \quad \underbrace{\nu_z, \alpha, \beta, F_M, \kappa, \rho, f_E}_{\text{Non-agriculture Production}} \}.$$

Agriculture Production and Preferences (α_A and ϕ). I estimate α_A and ϕ using expenditure and agricultural production data. With Cobb–Douglas preferences over agriculture and non-agriculture composites, the agriculture expenditure share equals ϕ, so I set ϕ to match the spending share on food in the data. I estimate α_A from district-level variation in agricultural income, agricultural labor, and cultivated land in 1960 by exploiting the log-linear relationship of the agriculture production function,

$$\ln Y_{Aj} = \ln A_{Aj} + \alpha_A \ln L_{Aj} + (1 - \alpha_A) \ln T_j,$$

and use the resulting estimate as the baseline agriculture parameter α_A.

Non-agriculture Firm Block. I estimate the firm productivity tail ν_z from the upper tail of the 1970 firm size distribution. I then estimate the production block in three steps. First, I estimate the distance elasticity ρ from the 1970 HQ-destination branch-link distance, keeping only outside-HQ-city links and matching the empirical branch-gravity slope. Second, I calibrate the branch-labor elasticity β using the model implication $\omega L/R = \beta\delta$ in the modern annual-sales sample. Third, conditional on $(\hat{\rho}, \hat{\beta})$, I estimate (α, F_M, κ) from the 1970 firm cross section and recover the entry cost from the zero-profit condition at the cutoff. I define modern firms in the data as firms with at least one establishment outside the HQ city.

The benchmark estimation targets a set of moments. The moments are the branch-gravity slope for ρ, the labor-share moment for β, the share of firms with any outside-HQ establishment for F_M, average establishments per firm for κ, the slopes of outside-HQ activity and total establishments with respect to HQ-district manager abundance for α, and mean employment per firm for entry cost f_E.

Regional Fundamentals. Conditional on the demand and mobility blocks, I invert district amenity shifters and agriculture productivity so that the model reproduces the regional distribution of population, agricultural activity, and manager shares. Amenities are recovered from the worker-location system. Agriculture productivity is recovered from district output, land, and labor data. District HQ-manager endowments are chosen so that the model matches the observed manager employment shares in 1950 and 1970.

5.2 Estimation Results

Table 7 reports the parameter estimates. The dispersion of location tastes, $\kappa_s = 1.664$, falls within the range of migration elasticities in Monte et al. (2018) and is close to Peters (2022). The common-demand and agriculture block yields $\phi = 0.798$, and $\alpha_A = 0.607$. I assume that the elasticity of substitution between varieties is $\theta = 5$ following the trade literature. The firm tail estimate is $\nu_z = 6.874$, which is close to the range used in Kleinman (2025).

The production block combines a direct gravity estimate, a direct calibration, and static cross-sectional estimation. The branch-link data imply $\rho = 1.32$, which is close to the estimate of 0.76 in Kleinman (2025).

Table 7: Benchmark Structural Parameter Estimates

Parameter	Description	Estimate
Demand and Agriculture		
θ	CES elasticity across varieties	5.00
ϕ	Non-agriculture expenditure share	0.79
α_A	Agriculture labor share	0.61
Mobility and Firm Heterogeneity		
κ_s	Worker-location elasticity	1.66
ν_z	Firm productivity tail	6.87
Production Block		
ρ	Distance elasticity of remote expansion	1.32
β	Branch-labor elasticity	0.19
α	HQ-manager elasticity	0.19
F_M	Modernization cost	3.53
κ	Scope-cost parameter	1.04
f_E	Entry cost	27.29

Notes: This table reports the parameter estimates used in the model. The mobility parameters are estimated from repatriate origin-destination flows. The firm productivity tail is estimated from the upper tail of the 1970 firm size distribution. The distance elasticity ρ is estimated from the 1970 HQ-destination branch-link data by matching the branch-gravity slope. The branch-labor elasticity β is fixed from the labor-share calibration in the modern annual-sales sample. Conditional on (ρ, β), the remaining production-block parameters are estimated from the 1970 firm cross section. The entry cost f_E is recovered from the zero-profit cutoff condition.

5.3 Counterfactual Exercises

This subsection asks how much the inflow of white-collar repatriates contributed to growth in output per worker between 1950 and 1970. In both exercises I solve the 1970 spatial general equilibrium around the estimated production block, allow workers to reallocate across

districts, and hold 1970 non-manager fundamentals fixed. I treat the 1950 HQ-manager environment as the common pre-shock benchmark. Because the baseline and counterfactual share the same 1950 starting point, the gap in 1970 log output per worker can be interpreted as the contribution of manager inflow to growth between 1950 and 1970. If y^B_{1970} and y^{CF}_{1970} denote baseline and counterfactual 1970 output per worker, the contribution of manager inflow to 1950–1970 growth is therefore $\log y^B_{1970} - \log y^{CF}_{1970}$.

The Role of Managers The first counterfactual measures the total contribution of the manager shock to postwar growth. Concretely, I replace the observed 1970 HQ-manager environment with its 1950 benchmark while holding district land, non-manager population, amenities, and other 1970 fundamentals fixed. This exercise removes the postwar increase in HQ-manager supply generated by white-collar repatriates and asks how much lower 1970 output per worker would have been without it. Removing the white-collar component lowers aggregate non-agricultural output per worker by 5.5 percent. The non-agricultural employment share falls by about 4 percentage points. The largest losses are concentrated in the major headquarters locations, such as Osaka, indicating that the manager shock mattered most where multi-establishment firms were most prevalent. I interpret this 1970 gap as implying that manager inflow contributed about 5.5 percent to growth in non-agricultural output per worker between 1950 and 1970.

The Role of Multi-Establishment Networks The second exercise asks how much of that growth effect was transmitted through firms' multi-establishment networks. I begin by shutting down non-HQ expansion, setting $\tau_{ij} = \infty$ for all $i \neq j$, so firms may still reorganize locally but cannot open outside-HQ establishments. This benchmark measures the economy-wide importance of multi-establishment networks in the observed 1970 economy. Relative to the baseline, shutting down non-HQ expansion lowers aggregate non-agricultural output per worker by about 7 percent. The non-agricultural employment share falls by about 6 percentage points. These changes show that cross-city establishment networks are quantitatively important even holding the observed manager shock fixed.

To isolate the multi-establishment network-mediated component of the manager shock, I then recompute the no-white-collar counterfactual under the same no-spatial-expansion restriction. This benchmark is necessary because shutting down networks changes output even when the manager shock is still present. Without it, one cannot distinguish the overall value of multi-establishment networks in the 1970 economy from the specific part of the manager shock that is transmitted through those networks. To make it concrete, let $Y(m, n)$ denote an outcome when the manager shock is either present ($m = 1$) or removed ($m = 0$), and when non-HQ expansion is either allowed ($n = 1$) or shut down ($n = 0$). Then the

multi-establishment network-mediated component of the manager contribution to growth is

$$\underbrace{\left[\log Y(1,1) - \log Y(0,1)\right]}_{\substack{\text{manager effect} \\ \text{with multi-establishment networks}}} - \underbrace{\left[\log Y(1,0) - \log Y(0,0)\right]}_{\substack{\text{manager effect} \\ \text{without multi-establishment networks}}}$$

The first term, $\log Y(1,1) - \log Y(0,1)$, compares the baseline economy to the no-manager counterfactual with networks intact. This term equals 0.057 log points, implying that removing the manager shock lowers non-agricultural output per worker by 5.5 percent in the full model. The second term, $\log Y(1,0) - \log Y(0,0)$, compares the local-only economy with and without the manager shock. This term equals 0.039 log points, implying a 3.8 percent decline when firms are forced to remain local. The difference between these two terms is 0.018 log points. Therefore, 32 percent of the manager contribution to non-agricultural output-per-worker growth between 1950 and 1970 operates through cross-city establishment networks. A model without multi-establishment networks would therefore understate the effect of manager inflow on non-agricultural output per worker by about one-third, because it misses the spatial propagation of local manager shocks through firm expansion.

6 Conclusion

This paper studies the role of managers in economic development by analyzing Japan's post-World War II repatriation, in which six million Japanese nationals returned from the former colonies. Using predetermined family registries and Allied logistics as instruments, I identify the differential effects of white-collar and production worker population shocks on local economies and firms' spatial organization.

Three main empirical findings emerge. First, white-collar repatriates triggered structural transformation and economic growth. Districts receiving more white-collar returnees experienced declines in agricultural employment, expansions in manufacturing and services, and an increase in output per worker. Second, this transformation was driven by a local change in the organization of production. White-collar exposure shifted local production from self-employed and family labor toward wage workers and outside managers, indicating a transition from traditional household production to scalable modern firms. Third, this modernization enabled the spatial expansion of firms. At the firm level, white-collar exposure raised the number of establishments per firm, increased the probability of operating outside the headquarters city, and expanded the geographic span of the firm's establishment network. Neither group affected patenting, indicating that growth operated through organizational upgrading rather than innovation. White-collar repatriates provided the "visible hands" that enabled local firms to modernize and expand spatially (Chandler, 1977).

I develop a model that explains these patterns through endogenous organization choice. Traditional firms are constrained by fixed owner managerial capacity and remain local-only, whereas modern firms pay a fixed cost to hire outside managers at headquarters and use those services across establishments. A larger manager supply lowers the cost of modernization, shifts firms from traditional to modern organization, and expands firms' establishments across cities. Because the same headquarters managerial services are deployed over a larger establishment network, expansion raises the marginal product of managers. The model therefore links manager supply to structural transformation, spatial propagation, and growth, and also implies both an agglomeration force among HQ managerial workers and weak equilibrium bias toward managers.

The counterfactual exercises show that these organizational margins matter quantitatively. Removing the white-collar repatriate shock lowers output per worker in 1970 by 5.5 percent, which I interpret as the contribution of manager inflow to growth between 1950 and 1970. Shutting down non-HQ establishment expansion shows that about one-third of this effect operates through firms' multi-establishment networks. A model without spatial firm organization would therefore understate the aggregate consequences of manager supply.

The historical setting may limit direct generalization to contemporary economies. That said, post-World War II Japan shared key features with today's low-income countries. The economy was predominantly agricultural, firms were organized as small family enterprises, and professional managers were scarce. In this sense, the findings offer insights for developing economies where traditional firm structures dominate and managerial constraints limit growth. The results suggest that policies expanding the supply of managerial human capital, through education, training programs, or skilled migration, could lower the costs of hiring outside managers and help firms transition from traditional to modern organizational forms, enabling productivity gains, economic growth, and spatial spillovers to other regions through firm expansion.

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C Theory

C.1 Proof of Proposition 1

C.2 Proof of Proposition 2

C.3 Proof of Proposition 3

A Data

This section details the construction of the primary datasets used in the analysis. The project relies on three main data sources: (1) novel microdata on repatriates digitized from archival survey records, (2) firm-level microdata digitized from business directories, and (3) district-level economic and demographic data from the Population Census and other government statistics. Table A1 summarizes these datasets.

Table A1: Summary of Data Sources

Dataset	Years	Sample/Coverage	Source
Repatriation and Firm Microdata			
Repatriate Survey	1964	460,000 households	Kanagawa Archives
Teikoku Directory	1938, 1957, 1970	All registered firms	TDB-CAREE
Census and Establishment Data			
Population Census	1920–1970	All districts	Statistics Bureau
Census of Commerce	1952, 1960	All establishments	METI
Census of Manufactures	1950, 1960	Estab. with 4+ employees	METI
Prefectural Yearbooks	1950	All districts	J-DAC
Other Data Sources			
Tax Statistics	1934	All tax districts	Ministry of Finance
IIP Patent Database	1964–1970	All applications	IIP
War Damage	1945	All districts	ESB (1949)
Transportation	1920–1970	All stations/exits	MLIT
Universities	1920–1970	All universities	MEXT
NSFIE	1989–2014	National sample	Statistics Bureau

Notes: J-DAC = Japan Digital Archives Center (Prefectural Statistical Online). METI = Ministry of Economy, Trade and Industry. ESB = Economic Stabilization Board. IIP = Institute of Intellectual Property. MLIT = Ministry of Land, Infrastructure, Transport and Tourism. MEXT = Ministry of Education, Culture, Sports, Science and Technology. NSFIE = National Survey of Family Income and Expenditure. TDB-CAREE = Teikoku Databank Center for Advanced Empirical Research on Enterprise and Economy.

A.1 Repatriation Microdata

I construct a novel dataset of repatriates by digitizing the *Zaigai Shiyu Zaisan Jittai Chosa Hyo* (Survey on the Actual Status of Overseas Private Assets) stored at the Kanagawa Prefectural Archives. This survey was conducted in November 1964 by the National Federation of Repatriate Organizations (*Hikiagesha Dantai Zenkoku Rengo-kai*). Its primary purpose was to document the assets left behind by Japanese nationals in the former colonies to inform compensation policies. As described in Teikoku Databank Museum (2019), the original survey slips were stored in cardboard boxes at the Federation's office before being transferred

to the archives, where they were eventually organized and digitized. The sample covers approximately 460,000 households. Unfortunately, the Kanagawa Prefectural Archives do not contain records for Kagoshima and Yamanashi prefectures. I randomly chose and digitized 15% of total households.

Although the survey was conducted in 1964, it provides detailed information on each household's status as of August 15, 1945 (the end of World War II). Key variables include the name of the household head, their occupation in the colonies, their last address abroad, their family registry (*honseki*), and their post-repatriation settlement location in Japan.

A.2 Firm and Establishment Data

Firm-Level Data. To measure firm modernization and organizational structure, I use the *Teikoku Ginkou Kaisha Yoroku* (Teikoku Bank and Company Directory) for the years 1938, 1957, and 1970. The data for available prefectures (Osaka, Kyoto, Hyogo, Fukuoka, Aichi, Shizuoka, Nagano, and Gunma) were obtained from the Teikoku Databank Center for Advanced Empirical Research on Enterprise and Economy (TDB-CAREE) database at Hitotsubashi University. For prefectures not covered by the database, I digitized the corresponding directories to create a complete national dataset. I digitized randomly selected firms in each page of the *Teikoku Ginkou Kaisha Yoroku*. The directory was compiled by Teikoku Koshinsho (now Teikoku Databank). It covers joint-stock companies (*Kabushiki Kaisha*), limited partnerships (*Goshi Kaisha*), and unlimited partnerships (*Gomei Kaisha*). The directory lists firms meeting a minimum capital threshold, which varies by year (e.g., 50,000 yen in 1938 and generally 1 million yen in 1957). Thus, it covers the universe of medium and large enterprises but excludes smaller firms. Crucially, starting from the postwar editions (such as 1957), the directory includes the number of employees and annual sales, in addition to standard financial and organizational variables like capital, board members, and establishment year. I use this data to construct measures of firm scale (employees, capital) and scope (number of establishments).

Manufacturing Establishments (1950). To measure the postwar recovery of the business sector, I use the number of manufacturing establishments in 1950, digitized from the *Prefectural Statistical Yearbooks* (*Ken Tokei Sho*), accessed through the Prefectural Statistical Online database.

Service Establishments (1952). To measure service sector capacity, I use establishment counts from the *Shogyo Tokei Hyo* (Census of Commerce) for 1952 (Ministry of International Trade and Industry, 1952), which provides the earliest comprehensive baseline for commercial activity in the postwar period.

Service and Manufacturing Establishments and Output (1960). For 1960, I use establishment counts and output from the *Shogyo Tokei Hyo* (Census of Commerce) (Ministry of International Trade and Industry, 1960) and the *Kogyo Tokei Chosa* (Census of Manufactures) (Ministry of Economy, Trade and Industry, 1960). The 1960 Census of Manufactures is the earliest edition providing municipality-level data, allowing for consistent district-level analysis.

A.3 Regional Economic Data

Population Census. I construct a panel of sectoral employment shares (agriculture, manufacturing, and services) and employment status (self-employed, family labor, wage workers, and managers) from the Population Census of Japan (*Kokusei Chosa*) for 1920–1970. Employment status variables are available only after WWII. The data are aggregated to 1960 district (*gun* or *shi*) boundaries using the procedure described in Section B.9.

Pre-World War II Output Data. I obtain prewar output data from the *Zeimu Tokei Sho* (Tax Statistics) for fiscal year 1934 (Ministry of Finance, 1934). I use the *Eigyo Shueki Zei* (Business Profits Tax), levied on net profits of commercial and industrial enterprises, as a proxy for local non-agricultural economic activity before the war. The data reports taxpayer counts and taxable profits at the city (*shi*) and county (*gun*) levels.

Patents. I obtain patent data from the Institute of Intellectual Property (IIP) Patent Database 2020 edition (*IIP Patent Database 2020-nen ban*) (Nakamura, 2016). This database covers approximately 12.7 million patent applications filed since 1964. I use the number of patent applications filed by residents of each district to measure local innovation output between 1964 and 1970.

Household Consumption and Income. I use anonymized microdata from the National Survey of Family Income and Expenditure (*Zenkoku Shohi Jittai Chosa*) for 1989, 1994, 1999, 2004, 2009, and 2014. This statistic was independently created and processed using anonymized data from the National Survey of Family Income and Expenditure (Ministry of Internal Affairs and Communications) provided by the National Statistics Center under the Statistics Act (National Statistics Center, 2024). I use this data to estimate the income elasticity and the elasticity of substitution.

A.4 Geography and Infrastructure

War Damage. To control for the destruction caused by WWII, I use data on buildings destroyed by air raids. The data are originally from Economic Stabilization Board (1949), which I obtain via Davis and Weinstein (2002).

Transportation Infrastructure. I construct a district-level panel of transportation infrastructure, specifically the number of railway stations and highway interchanges. The data are obtained from the National Land Numerical Information download service provided by the Ministry of Land, Infrastructure, Transport and Tourism (Ministry of Land, Infrastructure, Transport and Tourism, 2024).

Universities. Data on the location and establishment year of universities are collected from the *Zenkoku Daigaku Ichiran* (National List of Universities) (Ministry of Education, Culture, Sports, Science and Technology, 2023). I use this to count the stock of universities in each district over time.

B Additional Empirical Results

B.1 Summary Statistics of Repatriate Share

Table A2: Summary Statistics of Repatriate Shares

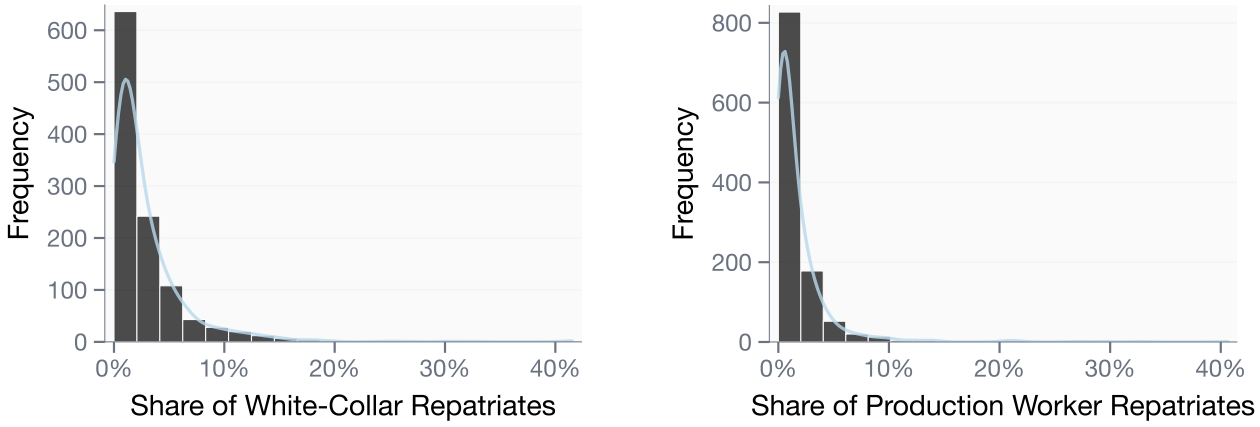
	Production Worker Share	White-Collar Share
10th percentile	0.000	0.003
50th percentile	0.008	0.017
90th percentile	0.038	0.067
Mean	0.017	0.029
S.D.	0.030	0.038
Observations	1,107	

Notes: This table reports selected summary statistics for district-level production and white-collar repatriate shares in 1950.

B.2 Repatriate Share Distribution

Figure A1 plots the distribution of white-collar and production worker repatriate inflows normalized by the 1940 district labor force. Both distributions show geographic heterogeneity. Although the majority of districts received inflows below 5%, the distributions are characterized by a pronounced right skew, with a long tail of districts absorbing significantly larger population shocks. This cross-sectional variation in exposure intensities for both skill groups serves as the primary source of identification.

Figure A1: Repatriate Share Distribution



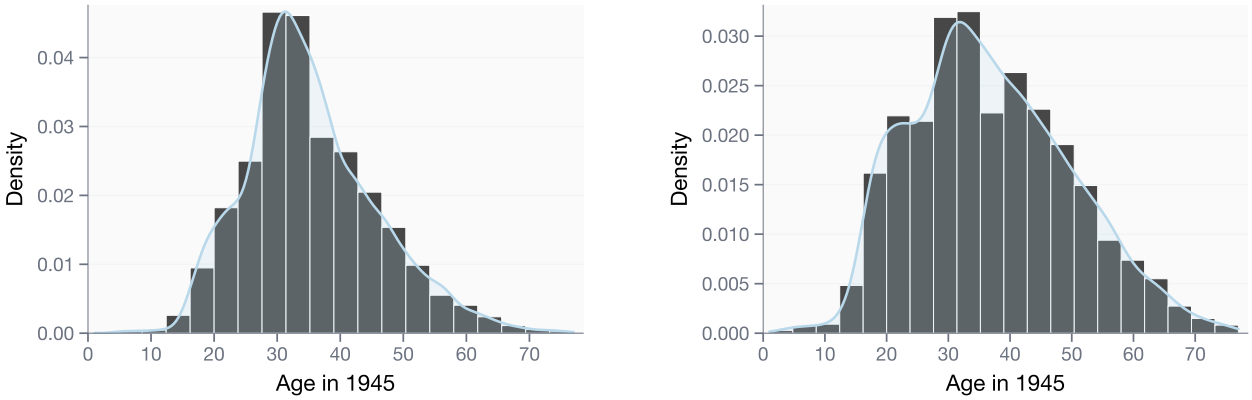
(A) White-Collar (B) Production Worker

Notes: This figure plots the distribution of white-collar (Panel A) and production worker (Panel B) repatriate shares in 1945. The histograms show the density of districts in each repatriate share bin, and the curves represent kernel density estimates.

B.3 Repatriate Age Distribution

Figure A2 presents the age distributions for white-collar and production worker repatriates. Both groups were predominantly working-age adults, with the distribution concentrated between ages 20 and 40. The similar age profiles rule out lifecycle differences as a driver of their divergent economic effects.

Figure A2: Repatriate Age Distribution



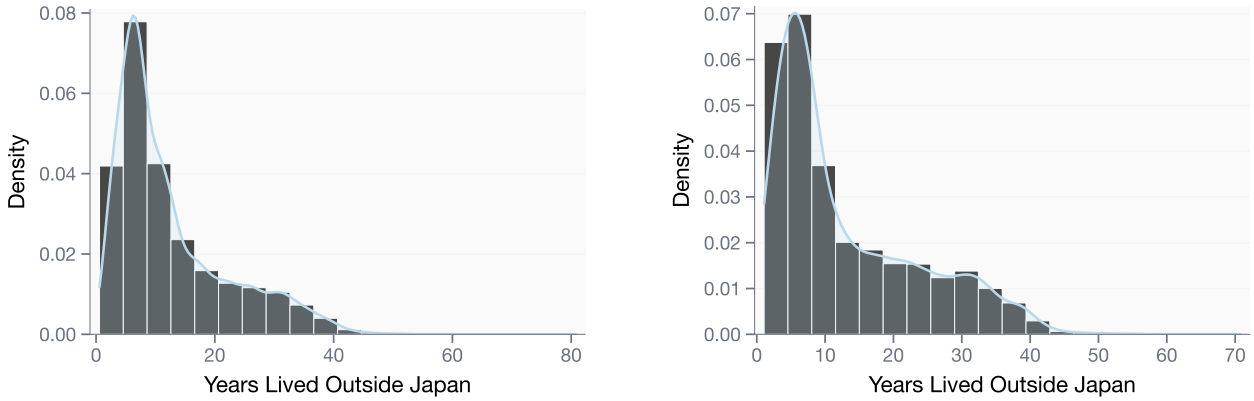
(A) White-Collar (B) Production Worker

Notes: This figure plots the age distribution of white-collar (Panel A) and production worker (Panel B) repatriates in 1945. The histograms show the density of individuals in each age bin, and the curves represent kernel density estimates.

B.4 Repatriate Length of Stay Distribution

Figure A3 shows the distribution of the length of stay in the colonies for white-collar and production worker repatriates. Many repatriates, especially white-collar ones, lived abroad for several years, suggesting sustained exposure to colonial administrative and business operations.

FIGURE A3: REPATRIATE LENGTH OF STAY DISTRIBUTION



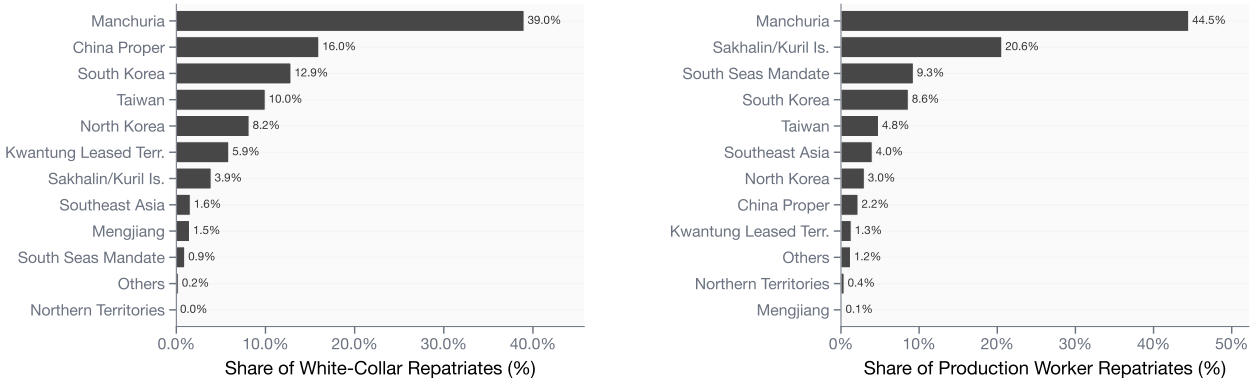
(A) WHITE-COLLAR (B) PRODUCTION WORKER

Notes: This figure plots the distribution of the number of years spent in the colonies/occupied territories for white-collar (Panel A) and production worker (Panel B) repatriates. The histograms show the density of individuals by years of residence, and the curves represent kernel density estimates.

B.5 Distribution of Colonies

Figure A4 shows the distribution of white-collar and production worker repatriates by their region of origin. Manchuria was the single largest source for both groups, accounting for nearly 40% of all returnees. However, there are notable differences: white-collar repatriates were more likely to return from Manchuria and North China, reflecting the administrative and industrial nature of Japan's presence there, whereas production worker repatriates were more dispersed across other regions.

FIGURE A4: COLONY DISTRIBUTION



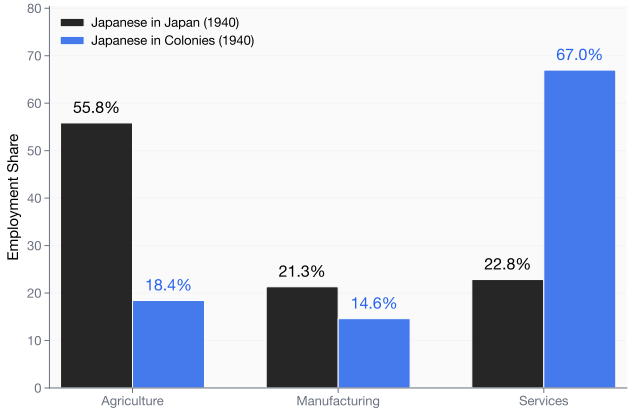
(A) WHITE-COLLAR (B) PRODUCTION WORKER

Notes: This figure displays the breakdown of white-collar (Panel A) and production worker (Panel B) repatriates by their region of last residence. The horizontal bars represent the percentage of the group's population returning from each specific colony or occupied territory.

B.6 Japan Proper vs Repatriates

Figure A5 compares the sectoral employment structure of workers in Japan proper with that of repatriates. In 1940, Japan proper was predominantly agricultural, with over 40% of the labor force in agriculture. By contrast, nearly 70% of colonial Japanese worked in services—managerial, administrative, and professional occupations—while only about 16% were in agriculture. This gap reflects the colonial labor hierarchy documented in Section 2.3 and explains why repatriation represented a substantial inflow of managerial human capital.

FIGURE A5: SECTORAL EMPLOYMENT SHARES IN JAPAN PROPER AND REPATRIATES, 1940



Notes: This figure shows the sectoral employment shares in Japan proper and repatriates in 1940. Blue bars represent Japan's industry shares, while black bars represent repatriates' industry shares. It shows that repatriates were overwhelmingly concentrated in service sector jobs compared to the labor force in Japan proper.

B.7 Overall Repatriate Effects

The main text separates repatriates by skill to identify the distinct contributions of managerial human capital. Here I present results using the total repatriate share as the independent variable. I estimate

$$\Delta z_{r,1960-1940} = \beta_0 + \beta_1 \text{Total Rep.}_r + \boldsymbol{X}_r'\Gamma + \varepsilon_{r,t}, \tag{35}$$

where $z_{r,t}$ represents either log labor force or sectoral employment shares (agriculture, manufacturing, or services) in district r at time t and $\boldsymbol{X}_r$ is a vector of control variables in district r. The denominator of the total repatriate share is the 1940 labor force. Controls include prefecture fixed effects, war damage, log density in 1940, and the level of the dependent variable in 1940, following Peters (2022). I instrument using the honseki-based IV and report only the coefficient of interest β_1.

Table A3 reports the results. Total repatriates increased local labor force, reduced the agricultural employment share, and expanded manufacturing and service employment shares. Columns (4) and (5) report pre-trend specifications using earlier census years (1940–1930 and 1930–1920) to assess whether high-repatriate districts were already on differential trajectories prior to repatriation.

Table A3: Repatriates and Local Structural Transformation (IV)

Panel A: Log Labor Force Change					
	1960-1940			1940-1930	1930-1920
	(1)	(2)	(3)	(4)	(5)
Repatriate Share$_{1950}$	3.76***	3.76***	1.75***	-0.86***	-0.01
	(0.31)	(0.31)	(0.20)	(0.33)	(0.07)
F-Stat	36.24	36.21	18.94	18.94	18.94
Panel B: Agriculture Emp. Share Change					
	(1)	(2)	(3)	(4)	(5)
Repatriate Share$_{1950}$	-0.40***	-0.40***	-0.40***	-0.00	0.02
	(0.07)	(0.07)	(0.07)	(0.03)	(0.02)
F-Stat	36.24	36.21	36.17	36.17	36.17
Panel C: Manufacturing Emp. Share Change					
	(1)	(2)	(3)	(4)	(5)
Repatriate Share$_{1950}$	0.18***	0.18***	0.17***	-0.00	-0.01
	(0.05)	(0.05)	(0.04)	(0.01)	(0.01)
F-Stat	36.24	36.21	36.30	36.30	36.30
Panel D: Service Emp. Share Change					
	(1)	(2)	(3)	(4)	(5)
Repatriate Share$_{1950}$	0.22***	0.22***	0.22***	0.01	-0.01
	(0.04)	(0.04)	(0.04)	(0.02)	(0.01)
N	1,107	1,107	1,107	1,107	1,107
F-Stat	36.24	36.21	35.98	35.98	35.98
Prefecture Fixed Effects	✓	✓	✓	✓	✓
Log Density$_{1940}$	✓	✓	✓	✓	✓
War Destruction		✓	✓	✓	✓
Level Dep.			✓	✓	✓

Notes: The table presents estimates of the relationship (Equation 35) between the share of total repatriates and local economic outcomes, using the *honseki* address as an instrumental variable. The dependent variables are changes in log labor force (Panel A) and sectoral employment shares (agriculture (Panel B), manufacturing (Panel C), or services (Panel D)) between 1940 and 1960. The independent variable is the share of total repatriates in district r at time 1950. The control variables include prefecture fixed effects, log population density in 1940 (Log Density$_{1940}$), war damage (War Destruction) and level of the dependent variable in 1940 (Level Dep.). Standard errors are clustered at the district level and reported in parentheses. F-Stat reports the Kleibergen-Paap rk Wald weak-identification statistic
$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

B.8 Structural Transformation in Post-World War II Japan

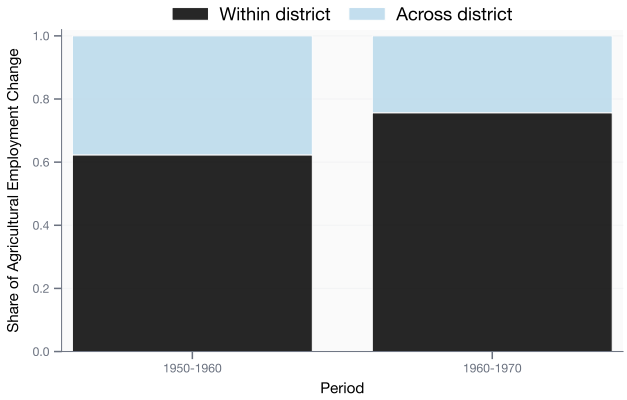
Figure A6 quantifies the contribution of local structural transformation versus population reallocation by decomposing the aggregate decline in the agricultural employment share, s_t,

into "Within" and "Across" components (Eckert et al., 2023):

$$\Delta s_t = \underbrace{\sum_{c=1}^{C} l_{ct} \Delta s_{ct}}_{\text{"Within"}} + \underbrace{\sum_{c=1}^{C} (s_{ct} \Delta l_{ct} + \Delta l_{ct} \Delta s_{ct})}_{\text{"Across"}} \tag{36}$$

where s_{ct} represents the agricultural share in district c at time t, and l_{ct} is the district's share of national employment. The "Within" term isolates the decline driven by falling agricultural shares within districts, holding the population distribution constant. The "Across" term accounts for population shifts toward less agricultural districts. As shown in the figure, the "Within" component accounts for nearly 60% of the aggregate decline, implying that structural transformation primarily occurred through adjustments within local economies rather than through the reallocation of labor to already-industrialized regions.

FIGURE A6: AGRICULTURAL CHANGE DECOMPOSITION



Notes: This figure shows the decomposition of agricultural employment changes in Japan from 1950 to 1970 into "Within" and "Across" components, following Eckert et al. (2023) and Equation (36). The "Within" (black) component represents the decline due to local structural transformation within districts, while the "Across" (blue) component represents the decline due to population reallocation across districts.

B.9 Geographic Crosswalks and Standardized Boundaries

To address the methodological challenges associated with changing administrative boundaries over time, I implement a spatial standardization procedure using 1960 district boundaries as the reference unit. Following Eckert et al. (2020), I construct geographic crosswalks by intersecting historical district boundaries with the 1960 reference map. This process generates a set of time-invariant spatial units, with area-based weights linking historical districts to their 1960 counterparts.

For a given historical year, weights are calculated as:

$$w_{ij} = \frac{A_{ij}}{A_j^{\text{hist}}} \quad \forall\, i \in I,\ j \in J,$$

where w_{ij} is the weight between district i in 1960 and district j in the historical year, A_{ij} is the intersection area between districts i and j, A_j^{hist} is the total area of historical district j, I is the set of 1960 districts (reference), and J is the set of historical districts.

For a historical variable X (e.g., population in 1940), its value in 1960 boundaries is:

$$X_i^{1960} = \sum_{j \in J} w_{ij} X_j^{1940}.$$

For example, consider a 1960 district i that overlaps with two 1940 districts: if 1940 District A has population 100 and 20% of its area overlaps with district i, and 1940 District B has population 10 and 100% of its area overlaps with district i, then the 1940 population for 1960 district i would be $X_i^{1960} = (100 \times 0.2) + (10 \times 1.0) = 30$. This area-weighted reallocation assigns 30 people from 1940 to the 1960 boundaries of district i.

B.10 Repatriate Settlement Discrete Choice Results

The conditional logit model used to construct the instrument assumes that each repatriate i, routed to landing port j by colonial origin and Allied shipping logistics, chooses a final settlement destination k to maximize utility. The utility specification includes two key shifters: (i) an indicator for whether the destination matches the repatriate's ancestral *honseki* registry, capturing historically-rooted ties to ancestral places, and (ii) log distance from the assigned landing port to the destination, encoding repatriation logistics rather than postwar economic prospects. Both shifters are predetermined and plausibly exogenous to postwar local economic conditions. Table A4 reports maximum likelihood estimates. The large positive coefficient on *honseki* indicates that repatriates were much more likely to settle in their ancestral home district, while the negative coefficient on log distance shows that settlement probability declined with distance from the landing port. These estimates are used to compute predicted settlement probabilities, which are then aggregated to construct the instrumental variable for district-level repatriate shares.

$$U_{ijk} = \underbrace{\beta_{\text{h}} \cdot \mathbf{1}\{k = \text{honseki}_i\}}_{\text{Institutional Ties}} + \underbrace{\beta_d \cdot \ln(\text{distance}_{jk})}_{\text{Geographic Constraints}} + \varepsilon_{ijk} \tag{37}$$

with $\varepsilon_{ijk} \sim$ i.i.d. Type-I extreme value. Conditional on the landing port, this delivers a conditional-logit probability for each destination.

Table A4: Discrete Choice Model of Repatriate Settlement

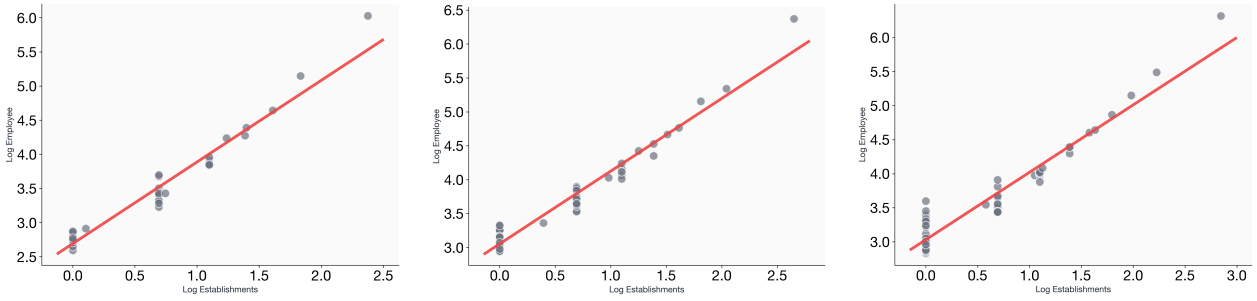
	(1)
Honseki	7.987***
	(0.011)
Log distance	-0.578***
	(0.006)

Notes: This table reports maximum likelihood (Equation 37) estimates from the conditional logit model of repatriate settlement. The dependent variable is the final settlement choice. Independent variables include honseki ties, distance from port, and their interactions with prewar income and age. Standard errors are clustered at the individual level. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

B.11 Firm-level Data

Using firm-level data from the *Teikoku Ginkou Kaisha Youroku* (Imperial Bank and Company Directory) for 1957, 1964, and 1970, this subsection documents key patterns in firm organization during the high-growth era. Figure A7 plots the relationship between firm size (total employment) and organizational scope (number of establishments). Across all three years, there is a tight, positive log-linear relationship: as firms scale up their workforce, they systematically extend their number of operating facilities. This evidence supports the view that firm growth involves a replication of production units, an extensive margin of expansion, rather than simply adding workers to a single location.

Figure A7: Log Employee vs Log Establishments



(A) 1957 (B) 1964 (C) 1970

Notes: This figure shows binscatter plots of log employees against log establishments for firms in 1957, 1964, and 1970. Each point represents a binned average of firms. The data are sourced from the *Teikoku Ginkou Kaisha Youroku*.

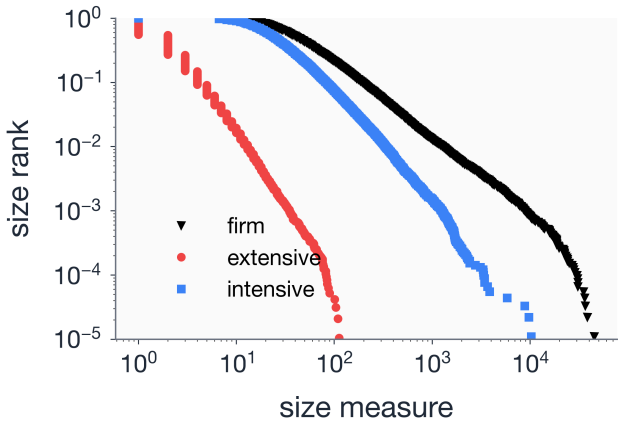
To further characterize the firm size distribution in Japan, Figure A8 plots the relationship

between firm size and rank. Following the approach of Cao et al. (2022), I decompose firm size into the extensive and intensive margins. Let N_{ft} be the total number of workers employed by firm f and E_{ft} be the total number of establishments owned and operated by firm f at time t. I define average establishment size within firm f as N_{ft}/E_{ft} so that I decompose size at the firm-level as

$$N_{ft} = \left(\frac{N_{ft}}{E_{ft}}\right) \times E_{ft} \tag{38}$$

Figure A8 examines these three measures: total employment (N_{ft}), the number of establishments (E_{ft}), and the average number of employees per establishment (N_{ft}/E_{ft}). The linear relationship in the log-log plot suggests that firm size in Japan follows a power law distribution. Moreover, the figure highlights that large firms achieve their scale through both increasing the number of establishments and expanding the size of individual establishments. This pattern is consistent with the findings in Cao et al. (2022).

FIGURE A8: FIRM SIZE DISTRIBUTION



Notes: This figure replicates Figure 1 in Cao et al. (2022) using Japanese firm-level data. It plots the relationship between firm size and rank. The x-axis shows the log of firm size (measured by number of establishments, employees, and employees per establishment), and the y-axis shows the log rank.

B.12 Other Channels

To see the impact of repatriate settlement on the development of universities and transportation infrastructure, I estimate the following difference-in-differences regression:

$$Y_{rt} = \beta_0 + \beta_1 \text{White-Collar}_{r,1950} + \beta_2 \text{Production Worker}_{r,1950} + \lambda_t + \alpha_r + \lambda_p + \epsilon_{rt} \tag{39}$$

where Y_{rt} is the number of universities per capita and the number of stations and highway exits per capita, White-Collar$_{r,1950}$ is the white-collar repatriate share, Production Worker$_{r,1950}$ is the production worker repatriate share, λ_t denotes the time fixed effect, α_r denotes the district fixed effect, and λ_p denotes the prefecture fixed effect.

Table A5: Impacts on Universities and Transportation (IV)

	Universities per capita	Stations+Highways per capita
	(1)	(2)
Production Worker Repatriate Share$_{1950}$	-0.00	-0.00***
	(0.00)	(0.00)
White-Collar Repatriate Share$_{1950}$	-0.00	-0.00*
	(0.00)	(0.00)
N	6,642	5,535
F-Stat	58.12	58.12

Notes: This table reports the relationship between repatriate settlement and the development of universities and transportation infrastructure (Equation 39). The dependent variable is the number of universities per capita and the number of stations and highway exits per 100,000 population. Standard errors are clustered at the district level. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Next, I examine the impact of repatriate settlement on patenting. I estimate the following difference-in-differences regression:

$$P_{r1970-1964} = \beta_0 + \beta_1 \text{White-Collar}_r + \beta_2 \text{Production Worker}_r + \mathbf{X}_{rt}\Gamma' + \lambda_p + \epsilon_{rt} \tag{40}$$

where $P_{r1970-1964}$ is the number of patents filed per capita in 1970–1964, White-Collar$_r$ is the white-collar repatriate share, Production Worker$_r$ is the production worker repatriate share, $\mathbf{X}_{rt}\Gamma'$ denotes the usual controls. λ_p is the prefecture fixed effect.

Table A6: Impacts on Patenting (IV)

	Patents pc	Patents pc
	(1)	(2)
Production Worker Rep_{1950}	-0.01	0.01
	(0.01)	(0.01)
White-Collar Rep_{1950}	-0.00	-0.00
	(0.00)	(0.00)
N	1,107	1,107
F-Stat	58.07	56.11
Prefecture Fixed Effects	✓	✓
Log $Density_{1940}$		✓
War Destruction		✓

Notes: This table reports the relationship between patents filed per capita in 1970–1964 and white-collar and production worker repatriate shares (Equation 40). Standard errors are clustered at the district level. F-Stat reports the Kleibergen-Paap rk Wald weak-identification statistic
$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

B.13 OLS Results

This section presents Ordinary Least Squares (OLS) estimates for the results reported in the main text.

TABLE A7: REPATRIATES AND LOCAL STRUCTURAL TRANSFORMATION (OLS)

Panel A: Log Labor Force Change					
	1960-1940			1940-1930	1930-1920
	(1)	(2)	(3)	(4)	(5)
Production Worker Repatriate Share$_{1950}$	2.62***	2.64***	1.53**	0.14	-0.64**
	(0.68)	(0.68)	(0.60)	(0.34)	(0.30)
White-Collar Repatriate Share$_{1950}$	7.19***	7.18***	4.31***	-1.02**	0.18
	(0.86)	(0.85)	(0.63)	(0.46)	(0.14)
R^2	0.33	0.34	0.52	0.25	0.44
Panel B: Agriculture Emp. Share Change					
	(1)	(2)	(3)	(4)	(5)
Production Worker Repatriate Share$_{1950}$	-0.00	-0.01	-0.01	-0.03	0.22***
	(0.27)	(0.27)	(0.27)	(0.07)	(0.07)
White-Collar Repatriate Share$_{1950}$	-1.10***	-1.09***	-1.10***	0.01	-0.08**
	(0.16)	(0.16)	(0.16)	(0.08)	(0.04)
R^2	0.19	0.19	0.21	0.34	0.37
Panel C: Manufacturing Emp. Share Change					
	(1)	(2)	(3)	(4)	(5)
Production Worker Repatriate Share$_{1950}$	0.14	0.15	0.13	0.03	-0.13***
	(0.15)	(0.15)	(0.15)	(0.03)	(0.04)
White-Collar Repatriate Share$_{1950}$	0.31***	0.31***	0.30***	-0.04	0.03
	(0.09)	(0.09)	(0.09)	(0.03)	(0.03)
R^2	0.19	0.19	0.23	0.59	0.25
Panel D: Service Emp. Share Change					
	(1)	(2)	(3)	(4)	(5)
Production Worker Repatriate Share$_{1950}$	-0.14	-0.14	-0.13	0.02	-0.10***
	(0.17)	(0.17)	(0.17)	(0.06)	(0.04)
White-Collar Repatriate Share$_{1950}$	0.79***	0.79***	0.79***	0.03	0.05**
	(0.12)	(0.12)	(0.12)	(0.06)	(0.02)
N	1,107	1,107	1,107	1,107	1,107
R^2	0.17	0.17	0.18	0.26	0.59
Prefecture Fixed Effects	✓	✓	✓	✓	✓
Log Density$_{1940}$	✓	✓	✓	✓	✓
War Destruction		✓	✓	✓	✓
Level Dep.			✓	✓	✓

Notes: The table presents OLS estimates of the relationship between repatriate shares and local economic outcomes (Equation (1)). The dependent variables are changes in log labor force (Panel A) and sectoral employment shares (agriculture (Panel B), manufacturing (Panel C), or services (Panel D)) between 1940 and 1960. The independent variable is the share of white-collar and production worker repatriates in district r at time 1950. The control variables include prefecture fixed effects (Pref FE), log density (Log Density$_{1940}$), war damage (War Destruction). Standard errors are clustered at the district level and reported in parentheses. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Table A8: Productivity (1960–1950) and Output per Worker (1960–1940), OLS

	# of Establishment$_{1960-1950}$	Establishment Size$_{1960-1950}$	Output per Worker$_{1960-1940}$
	(1)	(2)	(3)
Production Worker Rep$_{1950}$	0.29	-0.85	-0.27
	(0.75)	(0.77)	(0.69)
White-Collar Rep$_{1950}$	3.28***	2.29***	2.07***
	(0.61)	(0.62)	(0.48)
N	1,100	1,090	1,102
R^2	0.27	0.54	0.40

Notes: This table presents estimates of the relationship between the share of white-collar and production worker repatriates and non-agricultural productivity (Equation (4)). The dependent variables are the change in the number of establishments, the average employees per establishment, and the average revenue per employee in log between 1960 and 1950 or 1940. The independent variable is the share of white-collar and production worker repatriates in district r at time 1950. The control variables include prefecture fixed effects, log density, war damage, and level of the corresponding dependent variable in 1950 or 1940. Standard errors are clustered at the district level and reported in parentheses.
$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Table A9: Modernization of the Local Economy (1970–1950, OLS)

	Self-employed Share$_{1970-1950}$	Family Worker Share$_{1970-1950}$	Wage Worker Share$_{1970-1950}$	Manager Share$_{1970-1950}$
	(1)	(2)	(3)	(4)
Production Worker Rep$_{1950}$	0.04	0.08	-0.13	0.00
	(0.06)	(0.08)	(0.13)	(0.02)
White-Collar Rep$_{1950}$	-0.25***	-0.13***	0.31***	0.03***
	(0.04)	(0.04)	(0.07)	(0.01)
N	1,107	1,107	1,107	1,107
R^2	0.41	0.60	0.36	0.28

Notes: This table presents estimates of the relationship between the share of white-collar and production worker repatriates and the modernization of the local economy (Equation (5)). The dependent variable is the change in the share of self-employed workers, the share of family workers, the share of wage workers and the change in the share of managers (including managers in public sector) between 1970 and 1950. The independent variable is the share of white-collar and production worker repatriates in district r at time 1950. The control variables include prefecture fixed effects, log density, war damage, and level of the corresponding dependent variable in 1950. Standard errors are clustered at the district level and reported in parentheses.
$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

TABLE A10: SPATIAL EXPANSION OF FIRMS (OLS)

	Log Establishments	Outside-HQ Dummy	Max Distance to HQ, km
	(1)	(2)	(3)
Post × Production Worker Repatriate Share	-3.02*	-2.57**	-428.45
	(1.69)	(1.27)	(290.80)
Post × White-Collar Repatriate Share	3.61*	2.92*	408.79
	(2.02)	(1.50)	(346.18)
N	78,455	78,455	78,455

Notes: This table presents OLS estimates of the relationship between repatriate shares and the modernization and spatial expansion of firms (Equation (6)). The dependent variable is log establishments (Column (1)), an indicator for operating at least one establishment outside the HQ city (Column (2)), and maximum HQ-establishment distance in kilometers (Column (3)). The independent variable is the post-treatment interaction of the share of production worker and white-collar repatriates in district r at time 1950. The control variables include firm fixed effects, year fixed effects, and prefecture fixed effects. The sample includes years 1938, 1957, and 1970. Standard errors are clustered at the district level and reported in parentheses.
$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

B.14 Composition Effects

This appendix explores the difference between *scale* and *composition* of the repatriation inflow, and how these objects relate to the baseline specification that separately includes white-collar and production worker repatriate inflows.

Let H_r denote white-collar repatriates in district r, and U_r denote production worker repatriates. I define $R_r \equiv H_r + U_r$ and scale all inflows by the baseline labor force L_r (measured in 1940 in the main analysis) as done in the main analysis. The baseline IV specification in the paper is

$$Y_r = \alpha + \beta_H \frac{H_r}{L_r} + \beta_U \frac{U_r}{L_r} + X_r'\Gamma + \varepsilon_r. \tag{41}$$

This specification estimates the marginal effect of increasing white-collar inflows holding production worker inflows fixed (β_H), and analogously for production worker inflows (β_U).

The terms *scale* and *composition* correspond to three distinct objects.

(1) **Scale holding managerial capacity fixed.** Increase total inflows by adding production worker repatriates while holding managerial inflows fixed: $\Delta(H_r/L_r) = 0$ and $\Delta(U_r/L_r) > 0$. In (41), this object is β_U. It captures the effect of a larger repatriation shock that does *not* relax managerial bottlenecks while increasing production labor.

(2) **Scale holding production labor fixed.** Increase total inflows by adding manager repatriates while holding production labor fixed: $\Delta(H_r/L_r) > 0$ and $\Delta(U_r/L_r) = 0$. In (41), this object is β_H. It captures the effect of a larger repatriation shock that relaxes managerial bottlenecks while holding production labor fixed.

(3) **Composition holding total inflow fixed.** Hold total inflow fixed and increase managerial

workers via a one-for-one swap: $\Delta(H_r/L_r) = +1$ and $\Delta(U_r/L_r) = -1$, so $\Delta(R_r/L_r) = 0$. In other words, it increases the number of managers while holding the total number of inflows fixed.

An equivalent way to write the decomposition is

$$Y_r = \alpha + \theta \frac{R_r}{L_r} + \phi \frac{H_r}{L_r} + X_r'\gamma + \varepsilon_r. \tag{42}$$

Using $R_r/L_r = H_r/L_r + U_r/L_r$, we have

$$\theta \frac{R_r}{L_r} + \phi \frac{H_r}{L_r} = (\theta + \phi)\frac{H_r}{L_r} + \theta \frac{U_r}{L_r}.$$

Therefore, the two parameterizations map one-to-one:

$$\theta = \beta_U, \qquad \phi = \beta_H - \beta_U, \qquad \beta_H = \theta + \phi.$$

In other words, estimating (41) and reporting the difference $\beta_H - \beta_U$ is equivalent to estimating (42). It is easy to see that β_H contains the "one more repatriate" component (scale, θ) and the "one more manager" component (composition, ϕ) while total inflow is held fixed.

Hence, which specification to use depends on the question of interest. If the goal is to estimate the marginal effect of increasing managerial capacity while holding the inflow of production workers fixed (and vice versa), the natural specification is

$$Y_r = \alpha + \beta_H \frac{H_r}{L_r} + \beta_U \frac{U_r}{L_r} + X_r'\Gamma + \varepsilon_r,$$

where β_H answers the counterfactual "one more manager per baseline worker holding U_r/L_r fixed," and β_U answers "one more production worker per baseline worker holding H_r/L_r fixed." This specification aligns with the mechanism emphasized in the paper: production-labor inflows expand the workforce but may fail to relax managerial bottlenecks, whereas managerial inflows can relax those constraints and enable firm scaling and modernization.

If instead the goal is to separate changes in the *size* of the repatriation shock from changes in its *composition*, it is convenient to use this specification

$$Y_r = \alpha + \theta \frac{R_r}{L_r} + \phi \frac{H_r}{L_r} + X_r'\Gamma + \varepsilon_r, \qquad R_r \equiv H_r + U_r, \tag{43}$$

where θ captures the effect of increasing total repatriation intensity holding managerial inflows fixed (i.e., increasing non-managerial inflows), and ϕ captures the additional effect of managerial repatriates relative to non-managerial repatriates holding total inflows fixed.

A practical concern with estimating (43) is that in my setting white-collar repatriates constitute a large share of total repatriates, so $\frac{H_r}{L_r}$ and $\frac{R_r}{L_r}$ are mechanically highly correlated. Hence, standard errors for $\hat{\phi}$ can become large. This can be seen from the OLS variance formula. Let $Y = \beta_1 x_1 + \beta_2 x_2 + u$, with x_1, x_2 demeaned and no other controls (adding controls just means "residualize" first; same result). The OLS variance for $\hat{\beta}_1$ is:

$$\text{Var}(\hat{\beta}_1) = \frac{\sigma_u^2}{\sum_i (x_{1i} - \bar{x}_1)^2 \, (1 - \rho_{12}^2)},$$

where ρ_{12} is the sample correlation between x_1 and x_2. Symmetrically for $\hat{\beta}_2$. So as $|\rho_{12}| \to 1$, we have $(1 - \rho_{12}^2) \to 0$, hence $\text{Var}(\hat{\beta}_1) \to \infty$.

Below, I report the results of (42) specification.

Table A11: Repatriates and Local Structural Transformation (IV)

Panel A: Log Labor Force Change					
	1960-1940			1940-1930	1930-1920
	(1)	(2)	(3)	(4)	(5)
Total Rep. Share$_{1950}$	2.77***	2.54***	0.73	0.50	-0.34
	(0.86)	(0.82)	(0.86)	(0.57)	(0.35)
White-Collar Repatriate Share$_{1950}$	1.47	1.51	1.88	-2.45**	0.61
	(1.26)	(1.20)	(1.26)	(1.06)	(0.42)
F-Stat	45.09	40.91	48.46	48.46	48.46
Panel B: Agriculture Emp. Share Change					
	(1)	(2)	(3)	(4)	(5)
Total Rep. Share$_{1950}$	-0.15	-0.15	-0.14	-0.13	0.17**
	(0.34)	(0.34)	(0.34)	(0.11)	(0.07)
White-Collar Repatriate Share$_{1950}$	-0.83	-0.82	-0.84*	0.18	-0.20*
	(0.51)	(0.51)	(0.49)	(0.18)	(0.11)
F-Stat	56.22	56.11	56.05	56.05	56.05
Panel C: Manufacturing Emp. Share Change					
	(1)	(2)	(3)	(4)	(5)
Total Rep. Share$_{1950}$	0.38	0.38	0.38	0.03	-0.07
	(0.23)	(0.23)	(0.23)	(0.05)	(0.06)
White-Collar Repatriate Share$_{1950}$	-0.12	-0.12	-0.12	-0.04	0.07
	(0.32)	(0.32)	(0.31)	(0.08)	(0.08)
F-Stat	56.22	56.11	56.28	56.28	56.28
Panel D: Service Emp. Share Change					
	(1)	(2)	(3)	(4)	(5)
Total Rep. Share$_{1950}$	-0.24	-0.23	-0.24	0.10	-0.11***
	(0.16)	(0.16)	(0.15)	(0.09)	(0.03)
White-Collar Repatriate Share$_{1950}$	0.94***	0.94***	0.96***	-0.13	0.14**
	(0.26)	(0.26)	(0.26)	(0.13)	(0.05)
N	1,107	1,107	1,107	1,107	1,107
F-Stat	56.22	56.11	56.90	56.90	56.90
Prefecture Fixed Effects	✓	✓	✓	✓	✓
Log Density$_{1940}$	✓	✓	✓	✓	✓
War Destruction		✓	✓	✓	✓
Level Dep.			✓	✓	✓

Notes: The table presents estimates of the relationship between the share of total and white-collar repatriates and local economic outcomes, using the *honseki* address as an instrumental variable. The dependent variables are changes in log labor force (Panel A) and sectoral employment shares (agriculture (Panel B), manufacturing (Panel C), or services (Panel D)) between 1940 and 1960. The independent variable is the share of total and white-collar repatriates in district r at time 1950. The control variables include prefecture fixed effects, log population density in 1940 (Log Density$_{1940}$), war damage (War Destruction), and level of dependent variable in 1940 (Level Dep). Standard errors are clustered at the district level and reported in parentheses. F-Stat reports the Kleibergen-Paap rk Wald weak-identification statistic.
$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Table A12: Productivity (1960–1950) and Output per Worker (1960–1940), IV

	# of Establishment$_{1960-1950}$	Establishment Size$_{1960-1950}$	Output per Worker$_{1960-1940}$
	(1)	(2)	(3)
Total Rep$_{1950}$	1.10	-1.23	-0.89
	(1.04)	(0.92)	(0.71)
White-Collar Rep$_{1950}$	1.92	3.34**	2.78**
	(1.49)	(1.30)	(1.08)
N	1,100	1,090	1,102
F-Stat	56.76	55.55	52.05

Notes: This table presents estimates of the relationship between the share of total and white-collar repatriates and non-agricultural productivity. The dependent variable is the change in the number of establishments, the average employees per establishment, and the average revenue per employee in log between 1960 and 1950. The independent variable is the share of total and white-collar repatriates in district r at time 1950. The control variables include prefecture fixed effects, log population density in 1940, war damage, and level of the corresponding dependent variable in 1950 or 1940. Standard errors are clustered at the district level and reported in parentheses. F-Stat reports the Kleibergen-Paap rk Wald weak-identification statistic.
$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Table A13: Modernization of Local Economy (1970–1950, IV)

	Self-employed Share$_{1970-1950}$	Family Worker Share$_{1970-1950}$	Wage Worker Share$_{1970-1950}$	Manager Share$_{1970-1950}$
	(1)	(2)	(3)	(4)
Total Rep$_{1950}$	0.08	0.14	-0.23	-0.01
	(0.07)	(0.09)	(0.14)	(0.01)
White-Collar Rep$_{1950}$	-0.35***	-0.27**	0.58***	0.04*
	(0.10)	(0.12)	(0.19)	(0.02)
N	1,107	1,107	1,107	1,107
F-Stat	55.88	55.66	55.11	56.16

Notes: This table presents estimates of the relationship between the share of total and white-collar repatriates and the modernization of the local economy. The dependent variable is the change in the share of sole proprietors, the share of family workers, and the share of wage workers in log between 1960 and 1950. The independent variable is the share of total and white-collar repatriates in district r at time 1950. The control variables include prefecture fixed effects, log population density in 1940, war damage, and level of the corresponding dependent variable in 1950. Standard errors are clustered at the district level and reported in parentheses. F-Stat reports the Kleibergen-Paap rk Wald weak-identification statistic.
$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

B.15 Secondary Repatriates

As a robustness check, I include secondary worker repatriate share in the main specification.

Table A14: Repatriates and Local Structural Transformation (IV)

Panel A: Log Labor Force Change					
	1960-1940			1940-1930	1930-1920
	(1)	(2)	(3)	(4)	(5)
Production Worker Repatriate Share$_{1950}$	2.55**	2.23**	-0.18	0.06	-0.10
	(0.99)	(0.95)	(1.02)	(0.69)	(0.36)
White-Collar Repatriate Share$_{1950}$	4.11***	3.87***	2.10***	-2.20***	0.40**
	(0.72)	(0.69)	(0.75)	(0.84)	(0.19)
F-Stat	48.03	46.13	45.88	45.88	45.88
Panel B: Agriculture Emp. Share Change					
	(1)	(2)	(3)	(4)	(5)
Production Worker Repatriate Share$_{1950}$	0.12	0.11	0.13	-0.11	0.18**
	(0.37)	(0.37)	(0.37)	(0.14)	(0.08)
White-Collar Repatriate Share$_{1950}$	-0.81***	-0.81***	-0.81***	0.06	-0.03
	(0.27)	(0.27)	(0.26)	(0.12)	(0.08)
F-Stat	62.30	62.17	62.01	62.01	62.01
Panel C: Manufacturing Emp. Share Change					
	(1)	(2)	(3)	(4)	(5)
Production Worker Repatriate Share$_{1950}$	0.35	0.35	0.34	0.03	-0.04
	(0.27)	(0.27)	(0.26)	(0.07)	(0.06)
White-Collar Repatriate Share$_{1950}$	0.24	0.24	0.23	-0.01	0.02
	(0.18)	(0.18)	(0.17)	(0.05)	(0.05)
F-Stat	62.30	62.17	63.12	63.12	63.12
Panel D: Service Emp. Share Change					
	(1)	(2)	(3)	(4)	(5)
Production Worker Repatriate Share$_{1950}$	-0.46**	-0.46**	-0.47***	0.08	-0.15***
	(0.18)	(0.18)	(0.18)	(0.11)	(0.04)
White-Collar Repatriate Share$_{1950}$	0.57***	0.57***	0.57***	-0.04	0.00
	(0.14)	(0.14)	(0.14)	(0.08)	(0.03)
N	1,107	1,107	1,107	1,107	1,107
F-Stat	62.30	62.17	62.68	62.68	62.68
Prefecture Fixed Effects	✓	✓	✓	✓	✓
Log Density$_{1940}$	✓	✓	✓	✓	✓
War Destruction		✓	✓	✓	✓
Level Dep.			✓	✓	✓

Notes: The table presents the estimation results of the relationship between the share of white-collar and production worker repatriates and local sectoral structure (Equation (1)). The dependent variables are changes in log labor force (Panel A) and sectoral employment shares (agriculture (Panel B), manufacturing (Panel C), or services (Panel D)) between 1940 and 1960. The independent variable is the share of white-collar and production worker repatriates in district r at time 1950. The control variables include the secondary worker repatriate share, prefecture fixed effects, log population density in 1940 (Log Density$_{1940}$), war damage (War Destruction) and level of the corresponding dependent variable in 1940 (Level Dep). Standard errors are clustered at the district level and reported in parentheses. F-Stat reports the Kleibergen-Paap rk Wald weak-identification statistic.
$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Table A15: Productivity (1960–1950) and Output per Worker (1960–1940), IV

	# of Establishment$_{1960-1950}$	Establishment Size$_{1960-1950}$	Output per Worker$_{1960-1940}$
	(1)	(2)	(3)
Production Worker Rep$_{1950}$	0.65	-1.22	-1.21
	(1.31)	(1.18)	(0.85)
White-Collar Rep$_{1950}$	2.57***	2.12**	1.68***
	(0.88)	(0.95)	(0.55)
N	1,100	1,090	1,102
F-Stat	63.18	56.00	65.03

Notes: This table presents the estimation results of the relationship between the share of white-collar and production worker repatriates and non-agricultural productivity (Equation (4)). The dependent variable is the change in the number of establishments, the average employees per establishment, and the average revenue per employee in log between 1960 and 1950 or 1940. The independent variable is the share of white-collar and production worker repatriates in district r at time 1950. The control variables include the secondary worker repatriate share, prefecture fixed effects, log population density in 1940, war damage, and level of the corresponding dependent variable in 1950 or 1940. Standard errors are clustered at the district level and reported in parentheses. F-Stat reports the Kleibergen-Paap rk Wald weak-identification statistic.
$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Table A16: Modernization of the Local Economy (1970–1950, IV)

	Self-employed Share$_{1970-1950}$	Family Worker Share$_{1970-1950}$	Wage Worker Share$_{1970-1950}$	Manager Share$_{1970-1950}$
	(1)	(2)	(3)	(4)
Production Worker Rep$_{1950}$	0.07	0.18*	-0.24	-0.01
	(0.07)	(0.11)	(0.15)	(0.02)
White-Collar Rep$_{1950}$	-0.28***	-0.11*	0.34***	0.02**
	(0.05)	(0.06)	(0.09)	(0.01)
N	1,107	1,107	1,107	1,107
F-Stat	63.59	61.84	62.42	61.79

Notes: This table presents the estimation results of the relationship between the share of white-collar and production worker repatriates and the modernization of the local economy (Equation (5)). The dependent variable is the change in the share of self-employed workers, the share of family workers, the share of wage workers, and the change in the share of managers (including managers in the public sector) between 1970 and 1950. The independent variable is the share of white-collar and production worker repatriates in district r at time 1950. The control variables include the secondary worker repatriate share, prefecture fixed effects, log population density in 1940, war damage, and level of the corresponding dependent variable in 1950. Standard errors are clustered at the district level and reported in parentheses. F-Stat reports the Kleibergen-Paap rk Wald weak-identification statistic.
$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Table A17: Modernization of Firms (IV)

	Log Establishments	Outside-HQ Dummy	Max Distance to HQ, km
	(1)	(2)	(3)
Post × Production Worker Repatriate Share	-4.63*	-4.75**	-1093.40**
	(2.62)	(1.97)	(481.61)
Post × White-Collar Repatriate Share	4.49	5.20**	1254.15**
	(3.08)	(2.36)	(570.88)
N	78,455	78,455	78,455
F-Stat	35.67	35.67	35.67

Notes: This table presents IV-DID estimates of the relationship between repatriate shares and the modernization and spatial expansion of firms (Equation (6)). The dependent variable is log establishments (Column (1)), an indicator for operating at least one establishment outside the HQ city (Column (2)), and maximum HQ-establishment distance in kilometers (Column (3)). The independent variable is the post-treatment interaction of the share of production worker and white-collar repatriates in district r at time 1950. The control variables include the secondary worker repatriate share, firm fixed effects, year fixed effects, and prefecture fixed effects. All endogenous post-treatment interactions are instrumented with the corresponding predicted settlement shares interacted with post. The sample includes years 1938, 1957, and 1970. Standard errors are clustered at the district level and reported in parentheses. F-Stat reports the Kleibergen-Paap rk Wald weak-identification statistic.
$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

C Theory

C.1 Proof of Proposition 1

Fix one HQ city i. Hold $\{w_j, \Xi_j\}_{j=1}^R$ fixed and let an inflow of managers shift the local manager-supply curve out so that the HQ-manager wage falls:

$$S_i^M \uparrow \Longrightarrow \; w_i^M \downarrow .$$

Write the modern and traditional value functions as

$$\Pi_i^M(z; w_i^M) = \max_{h, \{n_{ij}, l_{ij}\}} \left\{ \sum_j x(n_{ij}) \left[\Xi_j q_{ij}^{\delta} - w_j l_{ij} \right] - w_i^M h - C_i(n) - F_M \right\},$$

$$\Pi_i^T(z) = \max_{n_{ii}, l_{ii}} \left\{ x(n_{ii}) \left[\Xi_i (z \bar{h}^{\alpha} l_{ii}^{\beta})^{\delta} - w_i l_{ii} \right] - \frac{\kappa}{2} n_{ii}^2 \right\}.$$

Define the gain from modernization by

$$\Delta_i(z, w_i^M) \equiv \Pi_i^M(z; w_i^M) - \Pi_i^T(z).$$

Under the symmetric benchmark, the single-crossing property can be derived so long as every modern firm hires a strictly positive amount of outside managers. After solving out local production labor, traditional profit can be written as

$$\Pi_i^T(z) = \max_{n_{ii} \geq 0} \left\{ z^a B_i^T x(n_{ii}) - \frac{\kappa}{2} n_{ii}^2 \right\}, \qquad a \equiv \frac{\delta}{1 - \beta\delta} > 0,$$

where $B_i^T > 0$ is independent of z. Under symmetry, suppose a modern firm serves J active markets with common establishment intensity n. Its profit can then be written as

$$\Pi_i^M(z; w_i^M) = \max_{\tilde{h}_i \geq \bar{h},\; n \geq 0} \left\{ J x(n) B_i z^a \tilde{h}_i^{\gamma} - J\tau n - \frac{\kappa}{2} (Jn)^2 - w_i^M (\tilde{h}_i - \bar{h}) - F_M \right\},$$

$$\gamma \equiv \frac{\alpha\delta}{1 - \beta\delta} \in (0, 1),$$

where $B_i > 0$ is independent of z. The interior first-order condition for $\tilde{h}_i$ implies

$$\tilde{h}_i^*(z, n) = \left(\frac{\gamma J x(n) B_i z^a}{w_i^M} \right)^{\frac{1}{1-\gamma}}.$$

Substituting this optimal choice back into the modern value function yields

$$\Pi_i^M(z;n) = \widetilde{B}_i(n, w_i^M)\, z^{\frac{a}{1-\gamma}} - J\tau n - \frac{\kappa}{2}(Jn)^2 + w_i^M \bar{h} - F_M,$$

for some $\widetilde{B}_i(n, w_i^M) > 0$. Conditional on establishment intensity n, traditional profit scales like z^a, whereas modern profit scales like $z^{a/(1-\gamma)}$. Since

$$\frac{a}{1-\gamma} > a,$$

modern profit grows faster with productivity than traditional profit for any fixed n. Higher productivity weakly raises optimal establishment intensity in both problems, so optimizing over n does not overturn this ordering. Therefore $\Delta_i(z, w_i^M)$ is increasing in z, and at the cutoff

$$\Delta_z(z_i^\star, w_i^M) > 0.$$

Traditional firms do not hire outside managers, so

$$\frac{\partial \Pi_i^T(z)}{\partial w_i^M} = 0.$$

For modern firms, the envelope theorem gives

$$\frac{\partial \Pi_i^M(z; w_i^M)}{\partial w_i^M} = -h_i^{\text{hired},*}(z; w_i^M) \le 0.$$

Hence

$$\frac{\partial \Delta_i(z, w_i^M)}{\partial w_i^M} = -h_i^{\text{hired},*}(z; w_i^M) \le 0,$$

with strict inequality whenever the modern firm hires a positive amount of outside managers. Differentiate the cutoff condition

$$\Delta_i(z_i^\star(w_i^M), w_i^M) = 0.$$

Then

$$\Delta_z(z_i^\star, w_i^M)\frac{dz_i^\star}{dw_i^M} + \Delta_w(z_i^\star, w_i^M) = 0,$$

so

$$\frac{dz_i^\star}{dw_i^M} = -\frac{\Delta_w(z_i^\star, w_i^M)}{\Delta_z(z_i^\star, w_i^M)} = \frac{h_i^{\text{hired},*}(z_i^\star; w_i^M)}{\Delta_z(z_i^\star, w_i^M)} > 0.$$

Therefore

$$w_i^M \downarrow \Longrightarrow \; z_i^\star(w_i^M) \downarrow .$$

With Pareto productivity draws,

$$G(z) = 1 - \left(\frac{z_{\min}}{z}\right)^{\nu_z},$$

the traditional-firm share is increasing in the cutoff and the modern-firm share is decreasing in the cutoff. Therefore

$$w_i^M \downarrow \Longrightarrow \; z_i^\star(w_i^M) \downarrow \Longrightarrow \; s_i^T \downarrow, s_i^M \uparrow .$$

Since a manager inflow lowers w_i^M, it reduces the traditional-firm share and raises the modern-firm share. This completes the proof.

C.2 Proof of Proposition 2

Fix an HQ city i and a firm with productivity z. Hold local demand shifters, production wages, and distances fixed. Under symmetry, the within-market problem becomes

$$\pi_{ij}(z, \tilde{h}_i) = \max_{l \geq 0} \; \Xi\left(z \tilde{h}_i^{\alpha} l^{\beta}\right)^{\delta} - wl,$$

where Ξ and w are common across locations. Solving local production labor gives

$$\pi_{ij}(z, \tilde{h}_i) = p_i(z, \tilde{h}_i) = B_i(z) \tilde{h}_i^{\gamma},$$

where

$$\gamma \equiv \frac{\alpha\delta}{1 - \beta\delta} > 0$$

and

$$B_i(z) \equiv (1 - \beta\delta) \left[\Xi z^{\delta}\right]^{\frac{1}{1-\beta\delta}} \left(\frac{\beta\delta}{w}\right)^{\frac{\beta\delta}{1-\beta\delta}} > 0.$$

Therefore

$$\frac{\partial p_i(z, \tilde{h}_i)}{\partial \tilde{h}_i} = \gamma B_i(z) \tilde{h}_i^{\gamma - 1} > 0.$$

Hence a higher HQ managerial stock raises operating profit in every potential market.

Part (i): Already-modern firms expand more when w_i^M falls. Let

$$V_i(z, \tilde{h}_i) \equiv \max_{\{n_{ij} \geq 0\}_{j=1}^R} \left\{ \sum_{j=1}^R \left[x(n_{ij}) p_i(z, \tilde{h}_i) - \tau_{ij} n_{ij}\right] - \frac{\kappa}{2} \left(\sum_{j=1}^R n_{ij}\right)^2 \right\}$$

denote optimized operating profits conditional on the HQ managerial stock $\tilde{h}_i$. The modern firm can then be written as

$$\Pi_i^M(z, w_i^M) = \max_{\tilde{h}_i \geq \bar{h}} \left\{ V_i(z, \tilde{h}_i) - w_i^M(\tilde{h}_i - \bar{h}) - F_M \right\}.$$

Take two HQ-manager wages with $w_i^{M\prime} < w_i^M$, and let

$$\tilde{h}_i^L \equiv \tilde{h}_i^*(z, w_i^{M\prime}), \qquad \tilde{h}_i^H \equiv \tilde{h}_i^*(z, w_i^M).$$

If $\tilde{h}_i^L < \tilde{h}_i^H$, optimality at the two wages implies

$$V_i(z, \tilde{h}_i^H) - w_i^M(\tilde{h}_i^H - \bar{h}) \geq V_i(z, \tilde{h}_i^L) - w_i^M(\tilde{h}_i^L - \bar{h}),$$

$$V_i(z, \tilde{h}_i^L) - w_i^{M\prime}(\tilde{h}_i^L - \bar{h}) \geq V_i(z, \tilde{h}_i^H) - w_i^{M\prime}(\tilde{h}_i^H - \bar{h}).$$

Adding the two inequalities yields

$$(w_i^M - w_i^{M\prime})(\tilde{h}_i^H - \tilde{h}_i^L) \leq 0,$$

which contradicts $w_i^M > w_i^{M\prime}$ and $\tilde{h}_i^H > \tilde{h}_i^L$. Hence

$$\tilde{h}_i^*(z, w_i^{M\prime}) \geq \tilde{h}_i^*(z, w_i^M).$$

Therefore a fall in w_i^M weakly raises the optimal HQ managerial stock of a modern firm.

Given $\tilde{h}_i$, the modern firm chooses $\{n_{ij}\}_{j=1}^R$ to solve

$$\max_{\{n_{ij} \geq 0\}} \Gamma_i(\{n_{ij}\}, \tilde{h}_i) \equiv \sum_{j=1}^R \left[x(n_{ij}) p_i(z, \tilde{h}_i) - \tau_{ij} n_{ij} \right] - \frac{\kappa}{2} \left(\sum_{j=1}^R n_{ij} \right)^2.$$

Because $x''(n) < 0$ and the quadratic term is strictly concave, the objective is strictly concave in $\{n_{ij}\}_{j=1}^R$, so the optimal establishment vector is unique. Moreover,

$$\frac{\partial^2 \Gamma_i}{\partial n_{ij} \partial \tilde{h}_i} = x'(n_{ij}) \frac{\partial p_i(z, \tilde{h}_i)}{\partial \tilde{h}_i} > 0$$

for every market j, because $x'(n) > 0$ and $\partial p_i(z, \tilde{h}_i)/\partial \tilde{h}_i > 0$. Thus the objective has increasing differences in $(\{n_{ij}\}_{j=1}^R, \tilde{h}_i)$. By Topkis's monotonicity theorem, the unique optimal

establishment vector is weakly increasing in $\tilde{h}_i$. That is, for every market j,

$$n_{ij}^M(z, \tilde{h}_i') \geq n_{ij}^M(z, \tilde{h}_i) \qquad \text{whenever } \tilde{h}_i' \geq \tilde{h}_i.$$

Hence if a market j is active at $\tilde{h}_i$, so that $n_{ij}^M(z, \tilde{h}_i) > 0$, then

$$n_{ij}^M(z, \tilde{h}_i') \geq n_{ij}^M(z, \tilde{h}_i) > 0,$$

which implies that j remains active at $\tilde{h}_i'$. Therefore the active set

$$A_i(\tilde{h}_i) \equiv \{j : n_{ij}^M(z, \tilde{h}_i) > 0\}$$

satisfies

$$A_i(\tilde{h}_i) \subseteq A_i(\tilde{h}_i') \qquad \text{whenever } \tilde{h}_i' \geq \tilde{h}_i.$$

It follows that the maximum operating distance

$$D_i^{\max}(\tilde{h}_i) \equiv \max\{d_{ij} : j \in A_i(\tilde{h}_i)\}$$

is weakly increasing in $\tilde{h}_i$, i.e.

$$D_i^{\max}(\tilde{h}_i') \geq D_i^{\max}(\tilde{h}_i).$$

Since $w_i^{M\prime} < w_i^M$ implies $\tilde{h}_i^*(z, w_i^{M\prime}) \geq \tilde{h}_i^*(z, w_i^M)$, we conclude

$$w_i^{M\prime} < w_i^M \quad \Longrightarrow \quad N_i^M(z, w_i^{M\prime}) \geq N_i^M(z, w_i^M) \quad \text{and} \quad D_i^{\max}(z, w_i^{M\prime}) \geq D_i^{\max}(z, w_i^M)$$

for every firm that is modern at both wages. This proves part (i).

Part (ii): Switching firms weakly raise total establishment intensity. Let the traditional firm's reduced objective be

$$W_i^T(N; z) = x(N)\pi_i^T(z) - \frac{\kappa}{2}N^2,$$

and let $N_i^T(z)$ denote its unique maximizer.

For the modern firm, define the gross operating payoff from total establishment intensity N by

$$R_i^M(N; z, \tilde{h}_i) \equiv \max_{\{n_{ij}\geq 0\}_{j=1}^R : \sum_{j=1}^R n_{ij} = N} \sum_{j=1}^R \left[x(n_{ij})p_i(z, \tilde{h}_i) - \tau_{ij}n_{ij}\right].$$

The corresponding reduced modern objective is

$$W_i^M(N; z, \tilde{h}_i) \equiv R_i^M(N; z, \tilde{h}_i) - \frac{\kappa}{2}N^2.$$

Because $x(n)$ is concave and the distance costs are linear, $R_i^M(N; z, \tilde{h}_i)$ is concave in N, so $W_i^M(N; z, \tilde{h}_i)$ is also concave in N.

Now consider the feasible modern allocation that places all establishments in the HQ city:

$$n_{ii} = N, \qquad n_{ij} = 0 \ \forall j \neq i.$$

Since $\tau_{ii} = 0$, this allocation yields

$$R_i^M(N; z, \tilde{h}_i) \geq x(N)p_i(z, \tilde{h}_i).$$

Hence the right derivative of the reduced modern objective at the traditional optimum satisfies

$$\partial_+ W_i^M(N_i^T(z); z, \tilde{h}_i) \geq x'(N_i^T(z))p_i(z, \tilde{h}_i) - \kappa N_i^T(z).$$

Because

$$p_i(z, \tilde{h}_i) \geq \pi_i^T(z) \qquad \text{whenever } \tilde{h}_i \geq \bar{h},$$

and because the traditional first-order condition is

$$x'(N_i^T(z))\pi_i^T(z) - \kappa N_i^T(z) = 0,$$

it follows that

$$\partial_+ W_i^M(N_i^T(z); z, \tilde{h}_i) \geq 0.$$

Since $W_i^M(N; z, \tilde{h}_i)$ is concave in N, a nonnegative right derivative at $N_i^T(z)$ implies that every maximizer of the modern problem satisfies

$$N_i^M(z, \tilde{h}_i) \geq N_i^T(z).$$

Therefore any firm that switches from traditional to modern organization weakly raises total establishment intensity.

Part (iii): The probability of operating outside the HQ city rises. Let d_{i2} denote the distance to the nearest non-HQ city. A firm has at least one non-HQ establishment if and only if

$$D_i^{\max}(z, w_i^M) \geq d_{i2}.$$

For traditional local-only firms, define

$$D_i^{\max}(z, w_i^M) \equiv 0.$$

Across firms headquartered in city i, define

$$P_i^{\text{out}}(w_i^M) = \int \mathbf{1}\{\Pi_i^M(z, w_i^M) \geq \Pi_i^T(z)\}\mathbf{1}\{D_i^{\max}(z, w_i^M) \geq d_{i2}\}\, dG(z).$$

By Proposition 1, the first indicator is weakly increasing when w_i^M falls because lower manager wages weakly lower the modernization cutoff. By part (i), the second indicator is weakly increasing for firms that are modern at both wages because lower manager wages weakly raise the maximum operating distance of modern firms. For traditional firms, $D_i^{\max}(z, w_i^M) = 0$, so the second indicator is zero until the firm switches into modern organization. Hence the integrand is weakly increasing as w_i^M falls, and therefore $P_i^{\text{out}}(w_i^M)$ is weakly increasing when w_i^M falls. This proves part (iii) and completes the proof.

C.3 Proof of Proposition 3

This appendix proves the proposition under the same symmetric benchmark used in the main text. All active markets share common demand and production-wage fundamentals, common establishment intensity n, and common optimal per-micro-location output.

After solving local production labor, optimal output per served micro-location can be written as

$$q(\tilde{h}_i) = \Gamma \tilde{h}_i^{\eta},$$

where

$$\eta \equiv \frac{\alpha}{1 - \beta\delta} > 0$$

and $\Gamma > 0$ collects the remaining demand, productivity, and wage terms. If there are J active markets, aggregate firm output is

$$Q_i(\tilde{h}_i, n) = Jx(n)q(\tilde{h}_i) = Jx(n)\Gamma\tilde{h}_i^{\eta}.$$

Define the firm-level marginal product of managers by

$$MP_M(\tilde{h}_i, n) \equiv \frac{\partial Q_i(\tilde{h}_i, n)}{\partial \tilde{h}_i}.$$

Then

$$MP_M(\tilde{h}_i, n) = \eta \tilde{h}_i^{\eta-1} J\Gamma x(n).$$

Differentiate with respect to establishment intensity:

$$\frac{\partial MP_M}{\partial n} = \eta \tilde{h}_i^{\eta-1} J\Gamma x'(n).$$

Since

$$x(n) = \frac{n}{1+n} \qquad \Rightarrow \qquad x'(n) = \frac{1}{(1+n)^2} > 0,$$

and since $\eta > 0$, $\tilde{h}_i > 0$, $J > 0$, and $\Gamma > 0$, it follows that

$$\frac{\partial MP_M}{\partial n} > 0.$$

Thus greater establishment intensity raises the firm-level marginal product of managers.