

A Market Solution under Food Security Constraints:

Evidence from a Policy Experiment in China^{*}

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Abstract

Food-security concerns often motivate land-use regulations that preserve farmland but restrict urban expansion and labor reallocation. This paper studies the Chongqing Land Coupon Reform, a market-based policy in China that allows rural construction land reclaimed as farmland to generate tradable land coupons, which developers can use to convert peri-urban farmland into urban construction land while maintaining aggregate farmland. Using comprehensive transaction-level data, I document that coupon supply comes primarily from remote rural counties, while demand is concentrated in urban fringe counties. Counties with lower initial agricultural value added per worker supply more coupons and experience higher rural-to-urban migration, and coupon-purchasing counties experience faster grain-yield growth. To quantify the aggregate effects, I develop a quantitative spatial model with heterogeneous agricultural productivity, endogenous migration, regulated land conversion, and a land coupon market. The framework shows how market-based land reallocation can mitigate the distortions created by food-security-driven land regulations.

Keywords: food security; structural change; migration; land policy

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1 Introduction

Food-security concerns shape land-use and development policies in many countries. In China, these concerns are embodied in a stringent farmland preservation system and a top-down allocation of urban construction land quotas. While these policies help maintain farmland, they also restrict urban expansion, raise housing costs, and limit the reallocation of labor out of agriculture. These restrictions are particularly costly in economies undergoing structural transformation, where large productivity gaps between agriculture and non-agriculture create strong incentives for rural-to-urban migration.

A central friction arises from the separation between rural and urban land markets. Rural residential land is allocated to households for own use and cannot be freely traded, while urban land conversion is constrained by farmland preservation quotas. As rural workers migrate to cities, rural residential land often remains underutilized because households lack a formal mechanism to capitalize it. This generates a striking aggregate pattern in China: rural population has declined rapidly, yet village land has continued to expand. Panel A of Figure 1 illustrates this pattern. By contrast, Panel B shows that Chongqing experienced simultaneous declines in rural population and village land after the introduction of its land coupon reform.

This paper studies the Chongqing Land Coupon Reform, a market-based solution to this land-use friction. Launched in December 2008, the reform allows rural households and collectives to reclaim rural construction land into farmland. The newly created farmland generates land coupons, which developers purchase to obtain additional urban construction land quotas. The system therefore creates a spatial link between remote rural regions that supply coupons and urban-fringe regions that use them. It preserves aggregate farmland while allowing urban expansion and compensating rural households for the value of reclaimed residential land.

The empirical analysis uses comprehensive transaction records from the Chongqing Rural Land Exchange. The data reveal a clear spatial separation between the creation and use of development rights: coupon supply is concentrated in rural counties, whereas coupon purchases are concentrated in more urbanized and urban-fringe counties. I then document several facts consistent with the mechanism of the reform. Counties with lower initial agricultural value added per worker supplied more land coupons. These counties also experienced higher rural-to-urban migration by 2015. In addition, counties supplying more coupons experienced faster grain-yield growth. At the aggregate level, a synthetic-control exercise shows that Chongqing's agricultural employment share declined more rapidly after the reform than that of a counterfactual Chongqing constructed from other Chinese provinces.

To interpret these facts and quantify the aggregate implications, I develop a quan-

titative spatial model with heterogeneous farming ability, endogenous migration, and regulated urban land conversion. The model links multiple rural regions to a Chongqing urban region through a land coupon market. Rural households decide whether to remain in agriculture, migrate to the urban sector, and convert rural residential land into farmland. Developers demand land coupons because each coupon relaxes the urban land quota and permits additional urban construction. The model highlights two channels through which the coupon market affects structural transformation. First, coupon compensation raises the return to leaving idle rural residential land, encouraging rural-to-urban migration. Second, coupon purchases expand urban land supply, lowering urban housing costs and further attracting migrants. Because low-productivity farmers are more likely to leave agriculture, the reform can also increase aggregate agricultural labor productivity through selection.

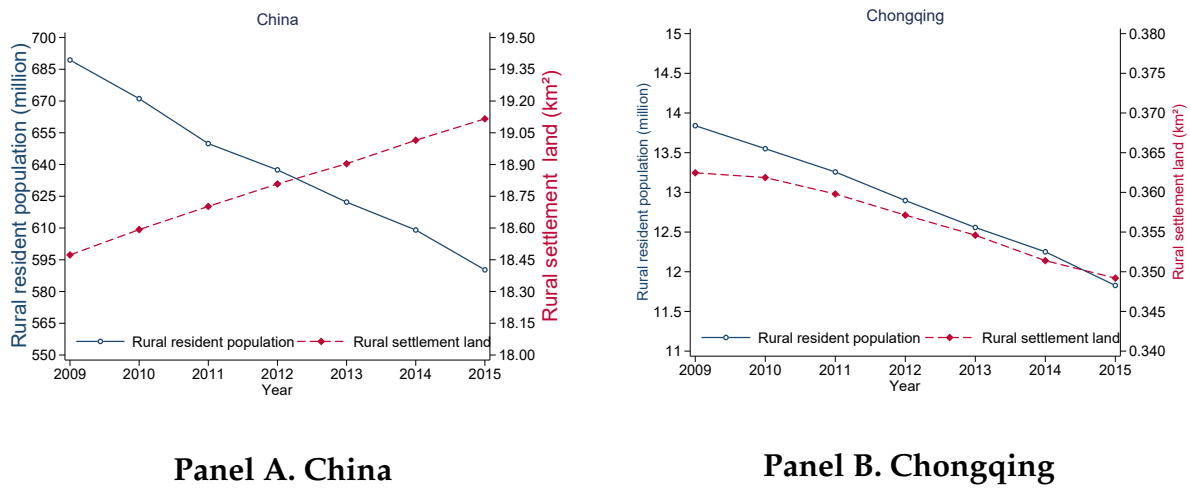


Figure 1. Rural Population and Rural Settlement Land, 2009-2015

Notes: This figure shows the relationship between rural resident population and rural settlement land area. Panel A presents national-level evidence for China, while Panel B focuses on Chongqing. Data for land is from second national land survey, and data for population is from China statistical yearbook.

Related Literature This paper is related to three strands of literature. First, it is related to the literature evaluating agricultural and food security policies, particularly policies that shape agricultural employment, land use, and rural labor allocation. This literature examines how food security-oriented policies affect agricultural production decisions and labor outcomes (Chen et al., 2024; Ding et al., 2025; Yu, 2026). Related work studies how farmland property rights and land-use institutions influence rural-to-urban migration and agricultural labor reallocation (De Janvry et al., 2015; Adamopoulos et al., 2024; Adamopoulos and Restuccia, 2020; Chen et al., 2025). A complementary line of research focuses on land tenure security and its implications for rural development, including entrepreneurship, human capital investment and firm location (Bu and Liao, 2022; Liu et al., 2023; Bird and Venables, 2020). This pa-

per contributes to this literature by empirically and quantitatively examining the role of rural residential land in shaping land and labor allocation.

This paper also connects to the literature on land-use regulations and aggregate welfare. Stringent land-use regulations deter labor mobility and reduce aggregate welfare (Hsieh and Moretti, 2019; Yu, 2026; Liang et al., 2024). In China, urban land expansion follows a top-down quota allocation system (Wang et al., 2010; Fu et al., 2021; Fang et al., 2022), under which local governments determine zoning decisions for individual land parcels by trading off expected tax revenues from industrial firms against direct land revenues from real estate development. This institutional arrangement generates a persistent price gap between industrial and residential land (He et al., 2022; Henderson et al., 2022; Lu et al., 2024). This study contributes to this literature by providing empirical evidence on how a market-based land reform that expands urban construction quotas affects land allocation and welfare.

Lastly, this paper is related to the literature on property rights and resource allocation efficiency, which emphasizes the role of tradable rights in mitigating misallocation under regulatory constraints (Coase, 1960). The applications include transferable development rights in land use regulation (Mills, 1980; Wang et al., 2010), cap-and-trade systems for pollution control, and tradable fishing quotas (Goulder, 2013; Arnason, 2012). This paper contributes to this literature by providing empirical evidence on how a market-based land quota system reallocates land and labor under food security constraints, thereby improving agricultural productivity and facilitating rural-to-urban migration.

The rest of the paper is structured as follows. Section 2 introduces the institutional background of Chongqing Land coupon Reform. Section 3 introduces data and presents the reduced-form evidence documenting the spatial distribution of land coupon supply, the relationship between coupon supply and structural change, improvement of agricultural productivity. Section 4 introduces the quantitative spatial model that link rural and urban labor and land market through land coupon reform. Section 5 calibrates the model. Section 6 presents the counterfactual results that hypothetically eliminate land coupon transaction, and compare the market-based land reform with quantity-based relaxation of farmland requirement, and relaxation of labor mobility. Section 7 concludes.

2 Institutional Background

2.1 Food Security and Farmland Preservation

Like many developing countries, food self-sufficiency is a priority in China. Lester Brown's 1995 book, *Who will feed China*, attracted Chinese top leaders' attention to protect farmland (Wang et al., 2010). Consequently, the central government implemented stringent measures to safeguard arable land. In 1998, the Farmland Red Line

policy was officially introduced, mandating the preservation of a minimum of 1.2 million square kilometers of farmland (approximately 12.5% of the country's total land area). This policy enforces a strict dynamic balance: it stipulates that for every unit of farmland converted to non-agricultural use, an equal quantity of new farmland must be created within the same jurisdiction (Yu, 2026).

In China, urban land is owned by government, rural land is owned by rural collectives. Rural land shall not be converted into urban construction land unless the state expropriates it. In each year, the maximum size of urban land can be developed is called the urban construction land quota. The central government decides the aggregate urban land construction quota and allocates to each province, then the provincial government allocates construction land to each prefecture, and so on (Fang et al., 2022). The allocation of land quotas and protection of farmland follows almost uniform method, despite huge variations in land endowment and development need (Wang et al., 2010). The farmland preservation requirement put pressure on local economic and population growth (Yu, 2026).

In the past 10 years, the central government has been implementing land reform to mitigate misallocation. First, they relaxed farmland balance at the provincial level and considered a national platform. In 2017, cross-province farmland balance was allowed. In 2020, the central government proposed establishing a unified construction land market for urban and rural areas and a fair and reasonable land value-added distribution system for the marketization of rural collective land. Yet, due to the lack of publicly available data on these national-level reforms, this study restricts its scope to the Chongqing Land Coupon system, a pioneering land reform for which detailed transaction data is available.

2.2 Chongqing Land Coupon Reform

Chongqing is one of China's four direct-controlled municipalities, holding the same administrative rank as a province. It is the largest city in China in terms of both population and administrative area, comprising 38 districts and counties with a population of 32 million and covering 82,400 square kilometers as of 2024. In recent years, Chongqing has undergone rapid urbanization and structural transformation. Its urbanization rate rose from 50% in 2008 to 72% in 2024, while the share of agricultural employment declined from 43.7% to 21.7% over the same period.

The Chongqing Land Coupon System was implemented in 2008 to balance farmland preservation with the need to alleviate strict constraints on urban construction land quotas. By 2007, the population of rural migrant workers in Chongqing had reached 7.5 million. While these individuals lived and worked in urban areas, they lacked a legal mechanism to monetize their vacant rural homesteads. This massive migration generated excess demand for urban construction land, while simultaneously

leaving rural construction land underutilized and legally restricted from conversion. To address this spatial imbalance of population and land, the Chongqing municipal government initiated the Land Coupon Reform.

The Land Coupon Reform encourages farmers to voluntarily reclaim idle or abandoned rural construction land into arable farmland.¹ By increasing the stock of farmland, additional urban land can be developed while adhering to the strict Red Line policy for farmland protection. This process effectively expands the urban construction land quota allocated by the central government. The additional quotas generated by restoring rural construction land to farmland are called land coupons. These coupons can be openly traded via the Chongqing Rural Land Exchange² and utilized within Chongqing's designated urban planning zones. This system is analogous to Transferable Development Rights (TDR) programs in the United States, which establish a market mechanism for transferring development rights from conservation zones to development zones (Mills, 1980). While Chongqing is not the only region attempting to implement land quota trading³, it is the first to formally establish a centralized platform with transparent transaction records. This transparency ensures the data availability necessary for this study.

Figure 2 plots the transaction process of Land coupon. It involves three steps: creation (application and reclamation rural residential land by farmers), transaction (auction by real-estate firms and pay compensation to farmers) and use of land coupon by developers. Han and Lin (2019) provide a more detailed description of land coupon system.

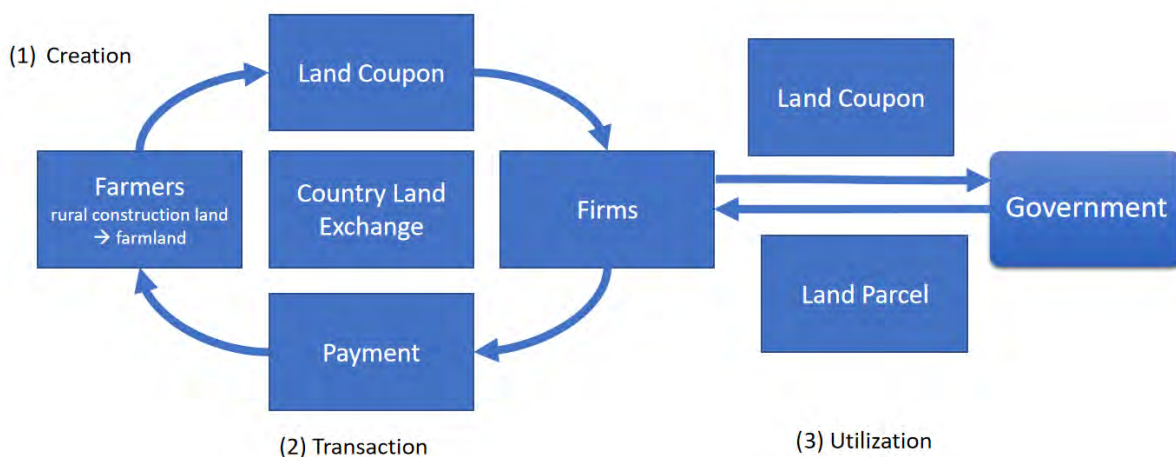


Figure 2. Land Coupon Transaction Process

¹Rural construction land comprises rural residential land (homesteads), schools, factories, and other land for non-agricultural purposes.

²The website is <https://www.ccle.cn>

³Prefectures in Zhejiang provinces are allowed to trade urban construction quota, but no official data is disclosed, see Wang et al. (2010).

2.2.1 Creation of Land Coupon

The creation of land coupons requires farmers to reclaim rural construction land, such as residential plots, into arable land. This process involves three stages: application, implementation, and final inspection.

During the application stage, village officials outline the regulatory framework of the program. Subsequently, interested farmers and rural collectives submit formal applications to reclaim their land.⁴ Town officials then verify these applications and forward them to the county administration for approval.

During the implementation phase, the county-level Department of Natural Resources assigns professional surveyors to conduct site investigations. These surveyors verify whether the targeted land meets the criteria for reclamation and determine the exact size and location of the plots. Following the survey, town officials sign formal reclamation agreements with the participating farmers. The county department then commissions a land planning agency to draft a reclamation plan, which is subsequently submitted to the Chongqing Municipal Department of Natural Resources for approval. Upon municipal approval of the plan, county officials issue a tender or auction notice for the reclamation project. The construction firms that secure the bid assume full responsibility for the project's safety and execution quality.

During the final inspection phase, the county-level Department of Natural Resources, in collaboration with officials from the Departments of Agriculture, Forestry, and Water Affairs, evaluates the quality and quantity of the reclamation project. To pass the inspection, the reclaimed arable land must meet several stringent criteria: an effective soil depth exceeding 40 cm, a rubble content below 15%, and a slope gradient of less than 15 degrees. Furthermore, the parcel must be contiguous with existing farmland, possess adequate drainage access, and feature structurally sound field ridges.

Upon successful inspection, the county-level Department of Natural Resources issues a Certificate of Construction Land Consolidation. This document records the project's name, ownership, location, area, and the quality grade of the reclaimed land. The county department then submits these certificates to municipal authorities for final approval. Municipal authorities subsequently dispatch technicians to conduct random spot checks on 5% to 10% of the projects. If these audits yield satisfactory results, the Chongqing Municipal Department of Natural Resources assigns a formal registration number to the certificate.

⁴Generally, three categories of rural land are eligible for reclamation into arable land: (1) abandoned or idle rural construction land, including residential plots, sites of town and village enterprises (TVEs), public facilities, and schools; (2) homesteads and adjacent land belonging to farmers who have acquired urban *hukou* or elderly individuals relocating to live with family members; and (3) dilapidated housing resulting from natural disasters or comprehensive village relocation projects.

2.2.2 Transaction of Land Coupon

The trading of land coupons is conducted exclusively through the Chongqing Rural Land Exchange. Owners of reclamation certificates can apply to sell land coupons through the Chongqing Rural Land Exchange. The Exchange then publishes announcements on its website and in newspapers, detailing the volume of land coupons available for trading. Prospective buyers submit purchase applications and pay a required security deposit. If the supply of land coupons exceeds demand, the transaction is conducted via an auction; otherwise, it proceeds as a tender. In an auction, the highest bidder secures the coupons, whereas in a tender, all participating buyers receive their requested quotas. To protect farmers' interests, the government establishes a price floor for land coupons.

Following the transaction, the Chongqing Rural Land Exchange issues a confirmation letter to the buyers. Buyers are required to settle the payment within 30 days, after which they receive their land coupon certificates. Within five days of receiving the payment, the Exchange publishes the transaction results, detailing the time of trade, total area, total transaction value, and average unit price. Because a land coupon essentially represents a tradable urban construction land quota, the original location of the reclaimed land is irrelevant to the buyer. Consequently, all suppliers participating in the same trading session receive a uniform price for their quotas. The Exchange also publicly announces the compensation distribution plan for the suppliers. After deducting the reclamation cost⁵, the original landholders receive 85% of the net payment, while the rural collective retains the remaining 15%.

2.2.3 Utilization of Land Coupon

Buyers of land coupons are permitted to bid on specific urban land parcels for construction purposes. Furthermore, the area of the targeted parcel cannot exceed the total land coupon quota held by the bidding firm.⁶ To date, only firms bidding on urban commercial and residential land are required to purchase land coupons, whereas those bidding on industrial land are exempt.

2.2.4 Summary

Following the land coupon reform, the total urban construction land quota consists of two parts: the nationally assigned quota and the supplementary quota generated through land coupons (i.e., the reclamation of rural construction land into farmland). The land coupon system essentially establishes a market for generating and trading urban construction land quotas. Each land coupon unit permits an equivalent area of

⁵Typically at 55 Yuan/ m^2

⁶Firms are also permitted to resell their land coupons through the Chongqing Rural Land Exchange if they have held them for at least two years without fully utilizing the quota. Between 2012 and 2017, 13 such resale transactions were recorded.

farmland elsewhere in Chongqing to be developed into urban land, effectively facilitating a virtual spatial transfer of land-use rights. Through this mechanism, the total area of farmland in Chongqing is preserved, while rural residential land decreases to accommodate the expansion of urban development.

3 Data and Facts

3.1 Data

1. Land Coupon Transaction Dataset. The main data used in this paper is Chongqing Land Coupon Transaction Dataset, which is publicly available on the website of Chongqing Country Land Exchange. It documents land coupon transaction volume, value in each session. It also reveals information of both purchasing firms and farmers, such as name, location of the reclaimed rural construction land, compensation plan between farmers and rural collectives. I collect comprehensive land coupon transaction data from 2008 to 2024. Table 1 shows the descriptive statistics of land coupon suppliers. A typical supplier reclaim 300 m² of her rural residential land to farmland and get compensated for 62 thousand yuan.

Table 1. Characteristics of Land Coupon Suppliers

VARIABLES	Descriptive Statistics				
	(1) N	(2) mean	(3) sd	(4) min	(5) max
Area of reclaimed land (m ²)	474,047	301.6	188.3	10	1,136
Compensation (Yuan)	474,047	62,236	39,560	2,157	242,943
Gender (female=1)	99,489	0.168	0.374	0	1
Birth year	422,416	1,959	13.02	1,927	1,991

Note: This table reports basic characteristics of suppliers of land coupon. Data are from 2012–2024 compensation for land coupon sales.

2. Population Census. I use the population census to reveal rural-to-urban migration pattern in Chongqing.

3. Urban Land Transaction Dataset. The urban land transaction dataset provides information on the location, acquisition cost, floor area ratio, address of the urban land plot.

4. Statistical Yearbook. I collect information on population, employment, agriculture out and value-added, non-agriculture value added from the Chongqing Statistical Yearbook.

5. National Land Survey. The second and third national land survey provides detailed land cover data, include farmland, village land, urban construction land and

so on. I use this information to trace the land cover change in Chongqing and other provinces.

3.2 Facts

3.2.1 Spatial Pattern of Land Coupon Supply and Demand

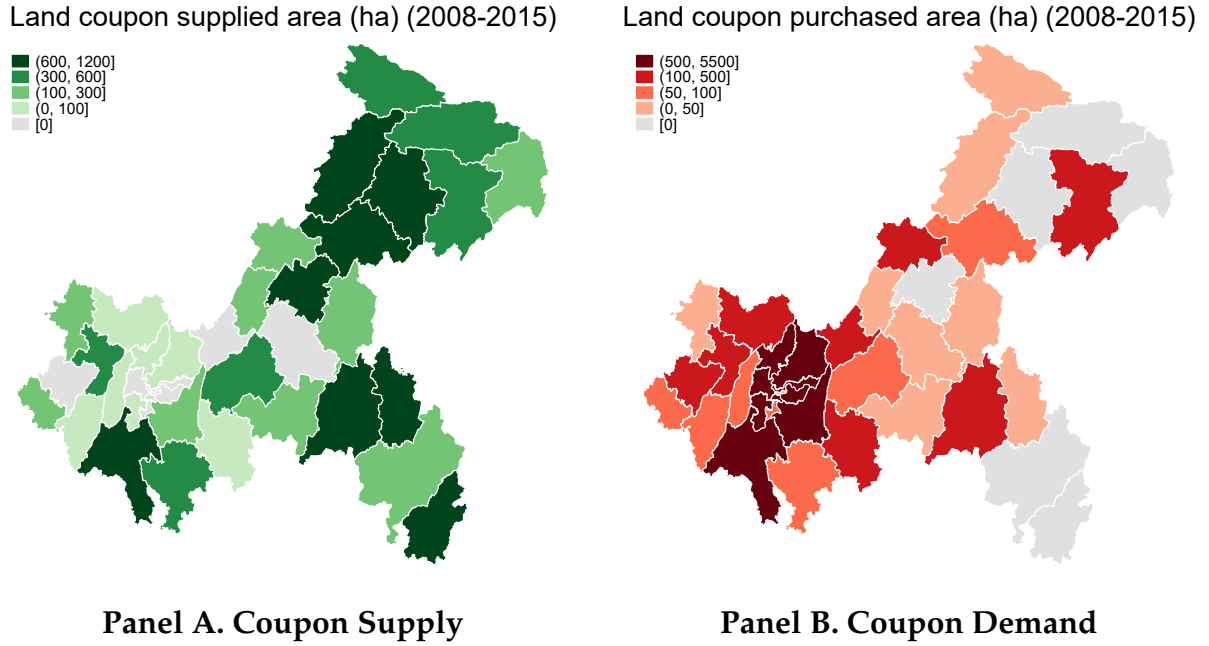


Figure 3. Spatial Distribution of Land Coupon Supply and Demand, 2008-2015

Notes: This figure shows the spatial pattern of land coupon supply and demand from 2008 to 2015.

Figure 3 illustrates the spatial distribution of land coupon supply and demand across counties in Chongqing from 2008 to 2015. Panel A shows that coupon supply is concentrated in more remote rural counties, where rural construction land can be reclaimed into farmland. In contrast, Panel B shows that coupon demand is concentrated in the more urbanized core and urban-fringe counties, where developers purchase coupons to obtain additional urban construction land quotas. This spatial separation between coupon creation and coupon use is a central feature of the reform: the land coupon market transfers development rights from rural areas with underutilized construction land to urbanizing areas with strong demand for land development.

3.2.2 Fact 1: Poor Regions Supply More Land Coupon

Figure 4 displays a clear negative relationship between agricultural value added per worker in 2008 and accumulated land coupon supply per agricultural hukou population from 2008 to 2015. This pattern suggests that counties with poorer agricultural conditions tend to supply more land coupons.

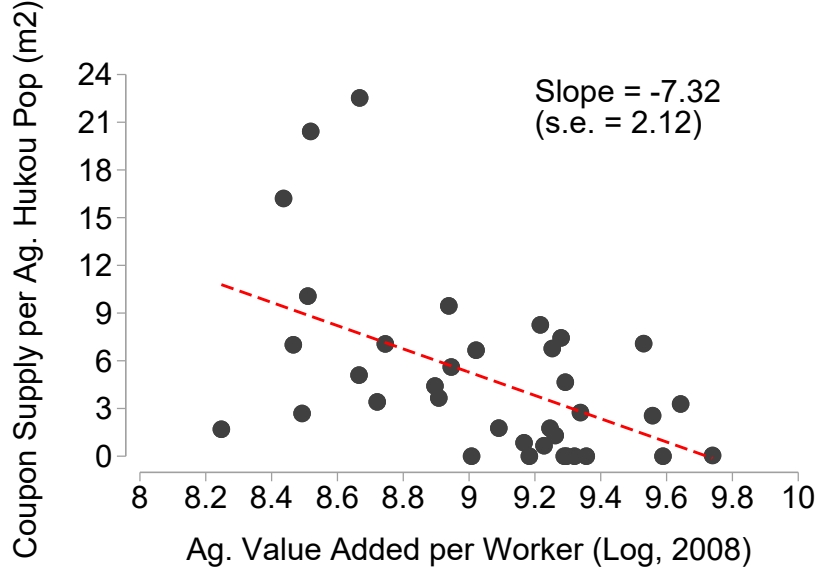


Figure 4. Per Capita Land Coupon Supply and Value Added Per Worker in Agriculture Sector

Notes: This figure displays the relationship between value added per worker in agriculture sector and accumulated per capita land coupon supply from 2008 to 2015. Each dot represents a county in Chongqing.

3.2.3 Fact 2a: Land Coupon Reform Promotes Structural Change

To show the effect of land coupon supply on structural change, I conduct a synthetic control experiment of agricultural employment share of Chongqing with the constructed one from other 30 provinces in China.

Let $i = 1$ denote Chongqing and $i = 2, \dots, J + 1$ denote the remaining Chinese provinces. The outcome variable Y_{it} is the share of employment in agriculture. The policy is take effect in year $T_0 = 2008$. The treatment effect for Chongqing at time $t > T_0$ is defined as

$$\alpha_{1t} = Y_{1t} - Y_{1t}^N, \quad (1)$$

where Y_{1t}^N denotes the counterfactual outcome in the absence of the policy.

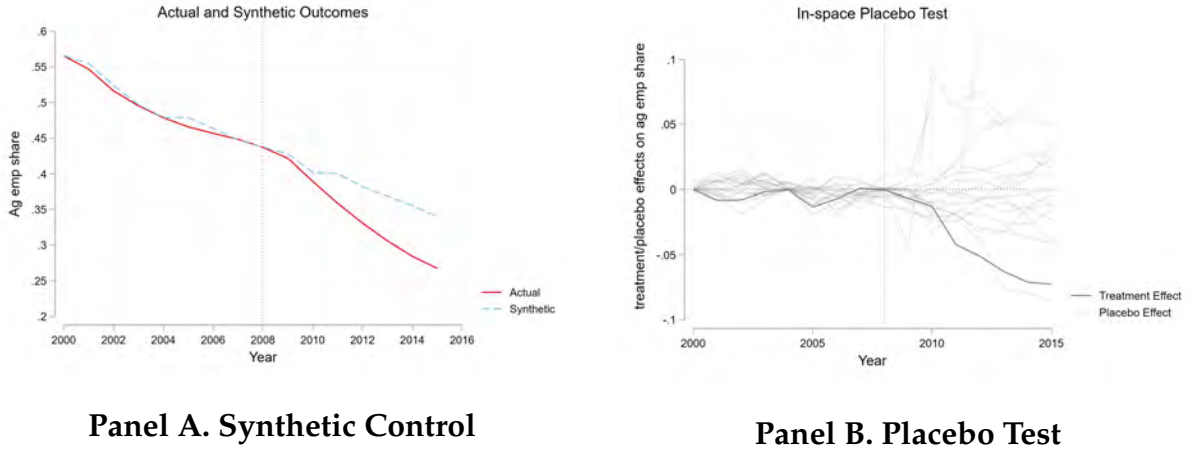
The synthetic control provides an estimate of Y_{1t}^N as a convex combination of untreated provinces:

$$\hat{Y}_{1t}^N = \sum_{j=2}^{J+1} w_j Y_{jt}, \quad w_j \geq 0, \quad \sum_{j=2}^{J+1} w_j = 1. \quad (2)$$

The weights $\{w_j\}$ are chosen to minimize the distance between Chongqing and the synthetic control in the pre-treatment period:

$$\min_{\{w_j\}} \sum_{t \in \{2000, 2002, 2004, 2006, 2008\}} \left(Y_{1t} - \sum_{j=2}^{J+1} w_j Y_{jt} \right)^2. \quad (3)$$

Panel A in Figure 5 plots the actual agricultural employment share in Chongqing and its synthetic control. The synthetic control closely tracks Chongqing's pre-treatment trajectory between 2000 and 2008, indicating a good pre-treatment fit. After 2008, Chongqing's agricultural employment share declines more rapidly than that of the synthetic control, generating a persistent post-treatment gap. The magnitude of the gap reaches approximately 6 percentage points, accounting for about one-fifth of the total decline in agricultural employment share over the period. This suggests that the policy has a quantitatively meaningful effect on structural change.



Panel A. Synthetic Control

Panel B. Placebo Test

Figure 5. Agricultural Employment Share in Chongqing: Actual vs. Synthetic Control

Notes: Panel A compares the observed agricultural employment share in Chongqing with a synthetic control constructed from a weighted average of other Chinese provinces. The vertical dashed line indicates the treatment year (2008). Panel B is the placebo test. The solid line shows the estimated treatment effect for Chongqing. Thin lines show placebo effects obtained by iteratively assigning treatment to each donor province.

To assess the validity of synthetic control, I conduct an in-space placebo test. Each donor province is iteratively assigned as if it were treated in the same year as Chongqing, and a synthetic control is constructed using the remaining provinces. This procedure generates a distribution of placebo treatment effects under the null hypothesis of no policy impact. Formally, for each placebo province i , the placebo effect is defined as

$$\hat{\alpha}_{it}^{\text{placebo}} = Y_{it} - \sum_{j \neq i} w_j^{(i)} Y_{jt}, \quad (4)$$

where $w_j^{(i)}$ denotes the synthetic control weights constructed for placebo unit i .

Panel B in Figure 5 plots the estimated treatment effect for Chongqing together with the placebo effects for all donor provinces. The absence of differential pre-trends prior to 2008 and the relatively large post-treatment divergence for Chongqing suggest that the estimated effect is unlikely to be driven by chance or common shocks.

3.2.4 Fact 2b: Land Coupon Reform Fosters Rural to Urban Migration

In addition to promoting structural change, the land coupon reform is associated with rural-to-urban migration. Because county-level migration patterns before the reform are not available from the 2005 population census, I use the 2010 and 2015 population censuses to measure rural-to-urban migration shares across counties in Chongqing. Figure 6 shows a negative relationship between rural-to-urban migration shares and initial agricultural value added per worker, especially in 2015, after the land coupon system had operated for several years. The weaker relationship in 2010 may reflect higher migration costs in poorer regions. Overall, Figure 6 provides suggestive evidence that the reform facilitated rural-to-urban migration.

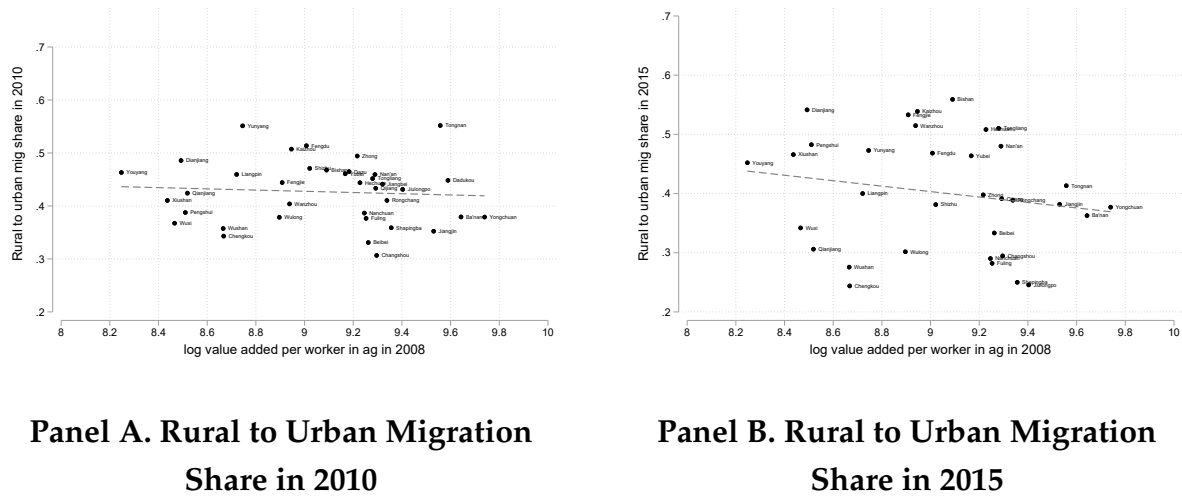


Figure 6. Rural to Urban Migration Share in 2010 and 2015

Notes: This figure plots the relationship between rural-to-urban migration share and value added per worker in agriculture sector. The migration data is from the population census. Each dot in the figure represents a county. Following Tombe and Zhu (2019) and Hao et al. (2020), I keep the sample with age more than 16 years old and define a migrant with leaving hukou place more than 180 days. Since I am only interested in the rural-to-urban migration, I only keep people with rural hukou in Chongqing. Panel A plots migration share in 2010 and Panel B plots migration share in 2015. The figure drops counties that never participated in land coupon supply as they are highly urbanized and almost no rural hukou holders.

3.2.5 Fact 3: Land Coupon Supply Enhances Agricultural productivity

The land coupon reform also improves agricultural productivity. Figure 7 shows regions supplied more land coupons experience larger increase in grain yield.

To summarize, this section revealed three stylized facts about land coupon system. First, regions with poor agriculture conditions tend to supply more land coupons. Second, land coupon reform promotes structural change as the agricultural employment share in Chongqing as a whole decrease 6 percentage points more compared with other provinces. Furthermore, land coupon reform foster rural-to-urban migration.

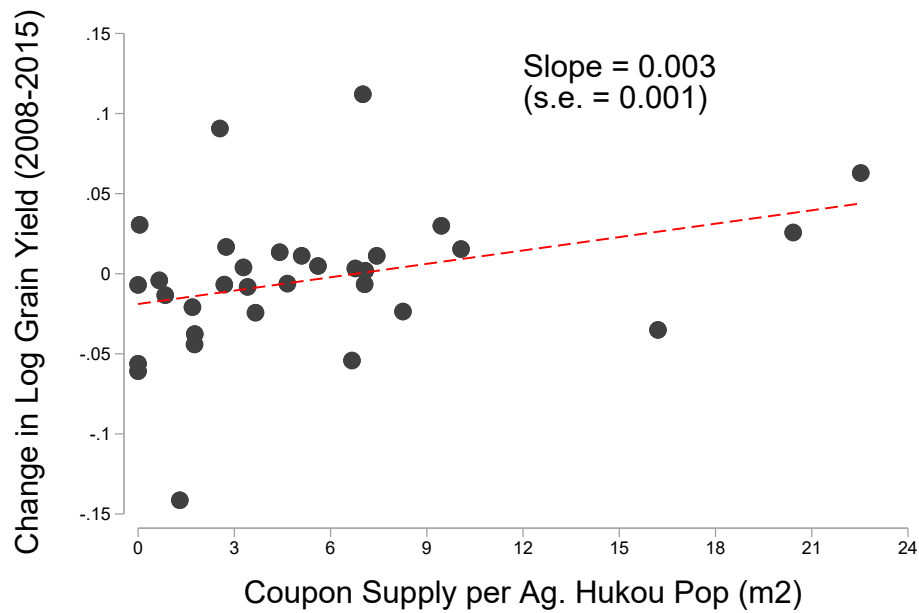


Figure 7. Per Capita Land Coupon Supply and Increase of Yield

Notes: This figure displays the relationship between accumulated per capita land coupon supply and the change in grain yield. Grain yield is calculated as the ratio of total grain output to grain sown area. Grain data are from the Chongqing Statistical Yearbook. The y-axis is the change in log grain yield between 2008 and 2015, and the x-axis is accumulated per capita land coupon supply from 2008 to 2015. Each dot represents a county in Chongqing. The figure drops counties that never participated in land coupon supply, as they are highly urbanized and have limited agricultural production.

Regions with poor agricultural conditions experience larger rural-to-urban migration. Third, the land coupon reform also enhances agriculture productivity as regions supply more land coupons witness larger increase in grain yield.

Motivated by the facts, I build a quantitative spatial model to analyze how land coupon reform affects rural-to-urban migration, aggregate agricultural productivity and welfare.

4 A Model with Land Coupon Market

My quantitative spatial model builds on [Tombe and Zhu \(2019\)](#) with two extensions. First, I introduce a tradable land coupon system that links rural land reclamation to urban land supply. Second, I allow individuals sort into sectors following [Lagakos and Waugh \(2013\)](#).

The model is static. There are N rural regions, one urban region in Chongqing, one urban region outside Chongqing. Let the set of regions be $\{1, \dots, N, u_{cq}, u_o\}$, where $n \in \{1, \dots, N\}$ indexes rural regions and $n = u_{cq}$ indexes the urban region in Chongqing, $n = u_o$ indexes the urban region outside Chongqing. Since this paper primarily focuses on the impact of the land coupon system on rural-urban migration and agricultural production, the term "urban region" refers exclusively to the Chongqing urban region unless otherwise specified. There are two sectors, agriculture and non-agriculture ($j \in \{ag, na\}$). Agricultural goods are produced in rural regions, and non-agricultural goods are produced in the urban region. Assume each region is a small and open economy, so the price of agriculture and non-agriculture goods are determined by the world price.

Each region is endowed with fixed land $\bar{S}_n$. In rural regions $n \in \{1, \dots, N\}$, the land endowment is partitioned into farmland (S_n^f), used in agricultural production, and rural residential land (S_n^h), used for rural housing. In the urban region within Chongqing, the land endowment is partitioned into urban farmland (S_u^f) and urban residential land (S_u^h), used for urban housing. Urban farmland can be converted to urban residential land by the representative developer at cost $C(S_u^h)$.

Before the land coupon reform, urban farmland was required to meet a minimum preservation threshold, denoted as $\underline{S}_u^f$.⁷ Consequently, urban land endowment is expressed as $\bar{S}_u = S_u^f + S_u^h$, subject to the constraint $S_u^f \geq \underline{S}_u^f$. Additionally, the conversion of rural residential land into rural farmland was strictly prohibited. After the introduction of the land coupon reform, rural residential land is permitted to be converted into rural farmland. Each unit of newly created rural farmland generates one unit of land coupon. The representative developer can purchase land coupon to meet the urban farmland preservation requirement. In this way, developer can choose the optimal amount of urban farmland to convert to urban residential land, not binding

⁷This reflects the Farmland Redline Policy in China.

by the urban farmland preservation. The farmland preservation requirement is subsequently relaxed, shifting the focus to maintaining aggregate farmland levels.

The economy consists of heterogeneous individuals who face a discrete occupational choice between the agricultural and non-agricultural sectors. Each individual is endowed with one unit of labor, which is supplied inelastically to a single sector. Specifically, an individual i born in rural region n draws farming ability $z_n^{ag}(i)$. For simplicity, the non-agricultural ability is one for all the workers born in rural regions. In addition to labor productivity, individual i born in rural region n is endowed with rural residential land δ_n^h and rural farmland δ_n^f .⁸ Rural residential land is permitted for own-use only, i.e., there is no market for rural residential land.⁹ Rural farmland can be rented-in and rented-out at local rental price q_n .¹⁰ The set of individuals born in rural region n is denoted as Ω_n . The rural residential land satisfies $S_n^h \equiv \int_{i \in \Omega_n} \delta_n^h di$. Similarly, the rural farmland satisfies $S_n^f \equiv \int_{i \in \Omega_n} \delta_n^f di$. Conditional on the realized productivity draws and land endowments, the individual makes a joint decision regarding occupation and migration.¹¹

4.1 Preference

Individuals derive utility from goods and housing following a Cobb-Douglas function.

$$U_n(i) = \left[(c_n^{ag}(i))^\varphi (c_n^{na}(i))^{1-\varphi} \right]^\alpha \left(s_n^h(i) \right)^{1-\alpha} \quad (5)$$

where $c_n^{ag}(i)$ and $c_n^{na}(i)$ are consumption of agricultural and non-agricultural goods. The price of agricultural good is p_{ag} and price of non-agricultural good is p_{na} . $s_n^h(i)$ is the size of housing. The budget constraint for individuals living in the urban region is $p_{ag}c_u^{ag}(i) + p_{na}c_u^{na}(i) + r_us_u^h(i) \leq I_{nu}(i)$ where $u \in \{u_{cq}, u_o\}$. $I_{nu}(i)$ is the nominal income of individual i born in region n and working and living in region u .

Since the rural residential land is assigned to farmers for free, the budget constraint for farmer i living in the rural region n is $p_{ag}c_n^{ag}(i) + p_{na}c_n^{na}(i) \leq I_{nn}(i)$. And the amount of rural housing utilized by farmers is $s_n^h(i) = \delta_n^h - s_n^{coupon}(i)$, where δ_n^h is rural residential land endowment and $s_n^{coupon}(i)$ is the amount of rural residential land converted to farmland (creation of land coupon).¹²

⁸Individuals born in the same rural regions are endowed with the same amount of farmland and rural residential land. Land endowment varies across regions.

⁹This captures rural residential land regulation in China.

¹⁰The implementation of the Rural Land Contracting Law (RLCL) in 2003 provided farmers with the legal right to rent out and rent in farmland (Chari et al., 2021; Chen et al., 2025).

¹¹Reflecting the institutional features of the Chinese land tenure system, land use rights are exclusively allocated to individuals with rural household registration (Hukou). Consequently, urban residents are precluded from acquiring rural land, and migration is modeled as a one-way decision from the rural to the urban sector.

¹²The Land Administration Law entitles each household to one plot of rural residential land. In practice, however, rural households may possess multiple plots of rural residential land due to inheritance or other factors. That's why in the model farmers who remain in rural areas are also permitted to

4.2 Production

Agricultural sector. Agricultural good is produced by individual farms and the production function for each farm operated by farmer i in region n is

$$y_n^{ag}(i) = (A_n^{ag} z_n^{ag}(i))^{1-\beta} s_n^f(i)^\beta \quad (6)$$

where $y_n^{ag}(i)$ is the output of agricultural goods of the farm operated by farmer i , $s_n^f(i)$ is the size of farmland operated by farmer i . The parameter $\beta \in (0, 1)$ governs the return to scale at the farm level. There are two sources of productivity affecting the farm technology: (i) the region-sector specific productivity A_n^{ag} , which is common for all farms in region n . A_n^{ag} captures factors like rainfall, slope of farmland, quality of soil and so on. (ii) the farmer's idiosyncratic productivity in agriculture $z_n^{ag}(i)$.

Non-agricultural sector. Non-agricultural good is produced by a representative firm in the urban region u in perfect competition with production function

$$Y_u^{na} = A_u^{na} L_u^{na} \quad (7)$$

where L_u^{na} is the total number of effective labor units employed in the non-agriculture sector, which is the sum of all individual productivity employed in the sector. Assume the non-agricultural productivity of rural-to-urban migrants is one, and for urban residents is $\bar{h}$, which captures wage gap between urban residents and rural-to-urban migrants.

4.3 Urban Residential Land Supply

A representative developer in Chongqing converts urban farmland into urban residential land at a cost of $C(S_u^h)$ and rents it to workers at a rental rate of r_u . Prior to the land coupon reform, the amount of urban farmland was required to satisfy a minimum preservation threshold, denoted as $\underline{S}_u^f$. Following the introduction of the land coupon reform, the developer can purchase land coupons to meet the aggregate farmland preservation requirement.

Land coupons are created through the conversion of rural residential land into rural farmland. Land coupon can be traded between farmers and the representative developer. Each unit of land coupon purchased grants the developer the right to convert one unit of urban farmland into urban residential land. Land coupons effectively establish a link between rural and urban residential land while ensuring that aggregate farmland levels are preserved.

The developer determines the optimal amount of urban residential land S_u^h to develop and the quantity of land coupons D_u^{coupon} to purchase, solving a profit maxi-

convert part of their rural residential land into rural farmland.

mization problem.

$$\begin{aligned} \max_{\{S_u^h, D_u^{coupon}\}} \quad & \pi(S_u^h) = r_u S_u^h - C(S_u^h) - t D_u^{coupon} \\ \text{s.t.} \quad & S_u^h = \bar{S}_u - \underline{S}_u^f + D_u^{coupon} \\ & 0 \leq S_u^h \leq \bar{S}_u \end{aligned} \quad (8)$$

The unit price of land coupon is denoted as t . The conversion cost $C(S_u^h)$ is a convex function of S_u^h . The optimal supply of urban residential land supply is

$$C'(S_u^{h*}) = r_u - t \quad (9)$$

where r_u is rental rate under land coupon reform. Demand for land coupon is

$$D_u^{coupon} = S_u^{h*} + \underline{S}_u^f - \bar{S}_u \quad (10)$$

4.4 Market Equilibrium

Farmer's profit maximization. Farmer i with productivity $z_n^{ag}(i)$ and endowment of farmland δ_n^f solves the following profit maximization problem

$$\max_{s_n^f(i)} \pi(z_n^{ag}(i), \delta_n^f) = p_{ag} (A_n^{ag} z_n^{ag}(i))^{1-\beta} s_n^f(i)^\beta - q_n (s_n^f(i) - \delta_n^f) \quad (11)$$

The first order condition implies optimal farm size of farmer i is

$$s_n^f(i)^* = \left(\frac{\beta p_{ag}}{q_n} \right)^{\frac{1}{1-\beta}} A_n^{ag} z_n^{ag}(i) \quad (12)$$

Equation (12) implies that farmer with higher productivity in the agriculture sector tends to run a larger farm size. The corresponding farm's optimal output and profit is

$$\begin{aligned} y_n^{ag}(i)^* &= \left(\frac{\beta p_{ag}}{q_n} \right)^{\frac{\beta}{1-\beta}} A_n^{ag} z_n^{ag}(i) \\ \pi_n^{ag}(i)^* &= (1 - \beta) \left(\frac{\beta}{q_n} \right)^{\frac{1}{1-\beta}} (p_{ag})^{\frac{1}{1-\beta}} A_n^{ag} z_n^{ag}(i) + q_n \delta_n^f \end{aligned} \quad (13)$$

Representative firm in the non-agriculture sector's profit maximization.

$$\max_{\{L_u^{na}\}} \pi(L_u^{na}) = p_{na} A_u^{na} L_u^{na} - w_u^{na} L_u^{na} \quad (14)$$

where w_u^{na} is wage per efficiency unit of labor in the non-agriculture sector in the urban

region u . The first order condition implies:

$$w_n^{na} = A_u^{na} \quad (15)$$

Thus, the labor income of rural-to-urban migrant is $p_{na}A_u^{na}$ and the labor income of urban resident is $p_{na}A_u^{na}\bar{h}$

4.4.1 Utility Maximization and Migration Decision

Individuals born in the rural regions decide the occupation and location that maximize her indirect utility. If she chooses to stay in the rural region, she chooses the optimal amount of land coupon supplied (converting part of rural residential land to farmland). If she chooses to work in the non-agricultural sector, she chooses whether living in the urban Chongqing u_{cq} or outside Chongqing u_o . The rural-to-urban migrant workers will convert all rural residential land to farmland and rent-out farmland regardless she livings within or outside Chongqing.

Indirect utility of rural-to-urban migrants

The nominal income of rural-to-urban migrant include three components: labor income in the non-agricultural sector, farmland rental income and land coupon transaction payment.¹³

$$I_{nu}(i) = p_{na}A_u^{na} + q_n(\delta_n^f + \delta_n^h) + \kappa t \delta_n^h, \quad (16)$$

where $u \in \{u_{cq}, u_o\}$. The term κ represents the share of the land coupon value distributed to the farmer.¹⁴

The optimal consumptions of are

$$c_u^{ag}(i)^* = \frac{\alpha \varphi I_{nu}(i)}{p_{ag}}, \quad c_u^{na}(i)^* = \frac{\alpha(1-\varphi)I_{nu}(i)}{p_{na}}, \quad s_u^h(i)^* = \frac{(1-\varphi)I_{nu}(i)}{r_u} \quad (17)$$

The rural-to-urban migrants suffer migration cost μ_{nu} and have idiosyncratic preference $\epsilon_{nu(i)}$ over the urban regions. The indirect utility of migrant i is

$$V_{nu}(i) = c_1 \frac{p_{na}A_u^{na} + q_n(\delta_n^f + \delta_n^h) + \kappa t \delta_n^h}{(p_{ag})^{\alpha\varphi} (p_{na})^{\alpha(1-\varphi)} (r_u)^{1-\alpha} \mu_{nu}} \cdot \epsilon_{nu(i)} \quad (18)$$

where $c_1 \equiv \alpha^\alpha (1-\alpha)^{1-\alpha} \varphi^{\alpha\varphi} (1-\varphi)^{\alpha(1-\varphi)}$.

Following Tombe and Zhu (2019), preference over urban locations $\epsilon_{nu(i)}$ follows Fréchet distribution with CDF $F_\epsilon(x) = e^{-x^{-\rho}}$, where ρ governs the degree of dispersion across individuals. A large ρ implies small dispersion. Denote the realized utility

¹³When rural residential land is converted to farmland, the newly created farmland can be rented-out by the farmer as well.

¹⁴The remaining share, $1 - \kappa$, accounts for the cost of reclaiming residential land into farmland and compensation to rural collectives.

$\bar{V}_{nu} = c_1 \frac{p_u^{na} A_u^{na} + q_n \delta_n^f + (q_n + \kappa t) \delta_n^h}{(p_u^{ag})^{\alpha\varphi} (p_u^{na})^{\alpha(1-\varphi)} (r_u)^{1-\alpha} \mu_{nu}}$ where $u \in \{u_{cq}, u_o\}$ and the total rural-to-urban migration share is m_{nu} . Given the Fréchet distribution of idiosyncratic preference over urban regions, the expected utility of migrants is

$$E[V_{nu}] = \Gamma(1 - \frac{1}{\rho}) [(\bar{V}_{n,cq})^\rho + (\bar{V}_{n,o})^\rho]^\frac{1}{\rho} \quad (19)$$

The rural to Chongqing urban migration share is

$$m_{n,cq} = \frac{(\bar{V}_{n,cq})^\rho}{(\bar{V}_{n,cq})^\rho + (\bar{V}_{n,o})^\rho} \cdot m_{nu} \quad (20)$$

Indirect utility of rural stayers

The nominal income of rural stayers include farm profits, farmland rental income and land coupon transaction compensation.

$$I_{nn}(i) = (1 - \beta) \left(\frac{\beta}{q_n} \right)^{\frac{\beta}{1-\beta}} (p_{ag})^{\frac{1}{1-\beta}} A_n^{ag} z_n^{ag}(i) + q_n \delta_n^f + (q_n + \kappa t) s_n^{coupon}(i) \quad (21)$$

The optimal consumptions of rural stayers are

$$c_n^{ag}(i)^* = \frac{\varphi I_{nn}(i)}{p_{ag}}, \quad c_n^{na}(i)^* = \frac{(1 - \varphi) I_{nn}(i)}{p_{na}} \quad (22)$$

The corresponding indirect utility is

$$V_{nn}(i) = c_2 \frac{[\pi_n^{ag}(i)^* + (q_n + \kappa t) s_n^{coupon}(i)]^\alpha [\delta_n^h - s_n^{coupon}(i)]^{1-\alpha}}{(p_n^{ag})^{\alpha\varphi} (p_n^{na})^{\alpha(1-\varphi)}}$$

where $c_2 \equiv \varphi^{\alpha\varphi} (1 - \varphi)^{\alpha\varphi}$. The first order condition of the above equation solves optimal land coupon supplied by rural stayers

$$s_n^{coupon}(i)^* = \max \left\{ 0, \alpha \delta_n^h - \frac{(1 - \alpha) \left[(1 - \beta) \left(\frac{\beta}{q_n} \right)^{\frac{\beta}{1-\beta}} (p_{ag})^{\frac{1}{1-\beta}} A_n^{ag} z_n^{ag}(i) + q_n \delta_n^f \right]}{q_n + \kappa t} \right\} \quad (23)$$

Farmers with large farming ability supplied less land coupons. Denote the cutoff farming ability for rural stayers not participated in land coupon supply as $\bar{z}_{n0}$

$$\bar{z}_{n0} \equiv \frac{\alpha(q_n + \kappa t) \delta_n^h - (1 - \alpha) q_n \delta_n^f}{(1 - \alpha)(1 - \beta) \left(\frac{\beta}{q_n} \right)^{\frac{\beta}{1-\beta}} (p_{ag})^{\frac{1}{1-\beta}} A_n^{ag}} \quad (24)$$

The indirect utility of rural stayers converted part of rural residential land is

$$V_{nn}(i) = c_1 \frac{(1 - \beta) \left(\frac{\beta}{q_n} \right)^{\frac{\beta}{1-\beta}} (p_{ag})^{\frac{1}{1-\beta}} A_n^{ag} z_n^{ag}(i) + q_n \delta_n^f + (q_n + \kappa t) \delta_n^h}{(p_{ag})^{\alpha\varphi} (p_{na})^{\alpha(1-\varphi)} (q_n + \kappa t)^{1-\alpha}} \quad (25)$$

The indirect utility of rural stayers not participating in the land coupon is

$$V_{nn}(i) = c_2 \frac{\left[(1 - \beta) \left(\frac{\beta}{q_n} \right)^{\frac{\beta}{1-\beta}} (p_{ag})^{\frac{1}{1-\beta}} A_n^{ag} z_n^{ag}(i) + q_n \delta_n^f \right]^\alpha (\delta_n^h)^{1-\alpha}}{(p_{ag})^{\alpha\varphi} (p_{na})^{\alpha(1-\varphi)}} \quad (26)$$

Given farming ability $z_n^{ag}(i)$, idiosyncratic preference over urban locations $\epsilon_{nu}(i)$, land endowment $\{\delta_n^f, \delta_n^h\}$, prices $\{p_{ag}, p_{na}, q_n, r_u, t\}$, individual i born in rural region n make occupation and migration decision. She chooses to migrate from the rural region n to the urban region u if $E[V_{nu}] \geq V_{nn}(i)$, otherwise she chooses to stay in the rural region n . Denote the fraction of workers born in rural region n and decides to migrate to the urban region as m_{nu} . The law of large numbers implies that

$$m_{nu} = \Pr\{E[V_{nu}] \geq V_{nn}(i)\} \quad (27)$$

4.4.2 Equilibrium

I focus on the competitive equilibrium of the model, which is defined as follows.

Definition 1: A competitive equilibrium is a set of prices $\{w_u^{na}, q_n, r_u, t\}$, a set of consumption bundles $\{c_n^{ag}(i), c_n^{na}(i), s_n^h(i), c_u^{ag}(i), c_u^{na}(i), s_u^h(i)\}$, a set of farmer's decision of farmland and output $\{s_n^f(i), y_n^{ag}(i)\}$, a set of migration flows $\{m_{n,cq}, m_{n,o}\}$, a set of labor inputs and output of the representative firm in the non-agriculture sector $\{L_u^{na}, Y_u^{na}\}$, urban residential land supply $\{S_u^h\}$, land coupon supply $\{S_n^{coupon}\}$ and land coupon demand $\{D_u^{coupon}\}$ such that:

(i) given prices and individual's endowment, $\{c_n^{ag}(i), c_n^{na}(i), s_n^h(i)\}$ solves farmers utility maximization problem subject to budget constraint; $\{c_u^{ag}(i), c_u^{na}(i), s_u^h(i)\}$ solves workers utility maximization problem subject to budget constraint.

(ii) given prices, $\{L_u^{na}\}$ solves representative firm in non-agriculture sector's profit maximization problem.

(iii) given prices and individual's endowment, $\{s_n^f(i)\}$ solves farmers' profit maximization problem.

(iv) given prices, $\{S_u^h\}$ and $\{D_u^{coupon}\}$ solves representative developer's profit maximization problem.

(v) given prices and individual's endowment of land, idiosyncratic preference over location, individual makes migration decision and land coupon participation decision,

m_{nu} represents the share of workers from rural region n migrating to the urban region u .

(vi) markets clear:

(a) urban residential land market in Chongqing:

$$S_u^h = \int_{i \in \Omega_u^{na}} s_u^h(i) di \quad (28)$$

where Ω_u^{na} is the set of workers living in urban Chongqing region.

(b) farmland market in each rural region:

$$\bar{S}_n^f + S_n^{coupon} = \int_{i \in \Omega_{nn}} s_n^f(i) di \quad \forall n \in \{1, \dots, N\} \quad (29)$$

where Ω_{nn} is the set of rural stayers

(c) coupon market:

$$\sum_{n=1}^N \int_{i \in \Omega_{nu}} \delta_n^h di + \sum_{n=1}^N \int_{i \in \Omega_{nn}} s_n^{coupon}(i) di = D_u^{coupon} \quad (30)$$

where $D_u^{coupon} = S_u^{h*} + \underline{S}_u^f - \bar{S}_u$

The full market clearing conditions are shown in Appendix B

4.5 Special Case: without Land Coupon

The baseline model presents an economy with land coupons. The economy without land coupons is similar to the baseline model in terms of preferences and production. The major difference is that without a land coupon market, the maximum amount of urban residential land is constrained by the urban farmland preservation requirement.

4.5.1 Urban Residential Land Supply without Land Coupon Reform

The representative developer converts urban farmland into urban residential land at cost $C(S_u^h)$ and rents it to workers at rental rate $r_{u,0}$ subject to the minimum-preservation requirement $\underline{S}_u^f$. The developer's profit maximum problem is

$$\begin{aligned} \max_{\{S_u^h\}} \quad & \pi(S_u^h) = r_{u,0} S_u^h - C(S_u^h) \\ \text{s.t.} \quad & 0 \leq S_u^h \leq \bar{S}_u - \underline{S}_u^f \end{aligned} \quad (31)$$

where $r_{u,0}$ represents the urban residential rental rate in the absence of land coupon reform.

4.5.2 Migration Decision without Land Coupon Reform

Nominal income of individual i born in region n who chooses to work in non-agriculture sector $I_{nu}(i)$ consists two parts: (i) labor income in the non-agriculture sector A_u^{na} ; (ii)

rent revenue of farmland $q_{n,0}\delta_n^f$.

$$I_{nu,0}(i) = p_{na}A_u^{na} + q_{n,0}\delta_n^f \quad (32)$$

where $q_{n,0}$ is the rental rate of farmland without land coupon reform.

The indirect utility is

$$V_{nu,0}(i) = c_1 \frac{p_{ag}A_n^{na} + q_{n,0}\delta_n^f}{(p_{ag})^{\alpha\varphi}(p_{na})^{\alpha(1-\varphi)}(r_{u,0})^{1-\alpha}\mu_{nu}} \cdot \epsilon_{nu}(i) \quad (33)$$

Denote the realized utility $\bar{V}_{nu,0} = c_1 \frac{p_{ag}A_n^{na} + q_{n,0}\delta_n^f}{(p_{ag})^{\alpha\varphi}(p_{na})^{\alpha(1-\varphi)}(r_{u,0})^{1-\alpha}\mu_{nu}}$ where $u \in \{u_{cq}, u_o\}$ and the total rural-to-urban migration share is m_{nu} . Given the Fréchet distribution of idiosyncratic preference over urban regions, the expected utility of migrants is

$$E[V_{nu,0}] = \Gamma(1 - \frac{1}{\rho}) [(\bar{V}_{n,cq,0})^\rho + (\bar{V}_{n,o,0})^\rho]^\frac{1}{\rho} \quad (34)$$

The rural to Chongqing urban migration share is

$$m_{n,cq,0} = \frac{(\bar{V}_{n,cq,0})^\rho}{(\bar{V}_{n,cq,0})^\rho + (\bar{V}_{n,o,0})^\rho} \cdot m_{nu,0} \quad (35)$$

Nominal income of rural stayers is

$$I_{nn,0}(i) = (1 - \beta) \left(\frac{\beta}{q_{n,0}} \right)^{\frac{\beta}{1-\beta}} (p_{ag})^{\frac{1}{1-\beta}} A_n^{ag} z_n^{ag}(i) + q_{n,0}\delta_n^f \quad (36)$$

For farmers choose to stay in the rural region, her indirect utility is

$$V_{nn,0}(i) = c_2 \frac{\left[(1 - \beta) \left(\frac{\beta}{q_{n,0}} \right)^{\frac{\beta}{1-\beta}} p_{ag}^{\frac{1}{1-\beta}} A_n^{ag} z_n^{ag}(i) + q_{n,0}\delta_n^f \right]^\alpha}{(p_{ag})^{\alpha\varphi}(p_{na})^{\alpha(1-\varphi)}} (\delta_n^h)^{1-\alpha} \quad (37)$$

Individual i chooses the region to maximize her indirect utility based on equation (33) and equation (37). She chooses to migrate from the rural region n to the urban region u if $E[V_{nu,0}] \geq V_{nn,0}(i)$, otherwise she chooses to stay in the rural region n . Denote the fraction of workers born in rural region n and decides to migrate to the urban region as $m_{nu,0}$, where $m_{nu,0}$ satisfies

$$m_{nu,0} = \Pr\{E[V_{nu,0}] \geq V_{nn,0}(i)\} \quad (38)$$

4.6 Model Implied Predictions

The model delivers the following predictions.

Prediction 1 (Land coupon supply). Regions with lower agricultural productivity A_n^{ag} supply more land coupons.

Prediction 2 (Migration). Conditional on migration costs, the migration share m_{nu} is initially higher in regions with lower A_n^{ag} . The land coupon reform reinforces this trend by further increasing migration shares in these regions, thereby encouraging rural-to-urban migration.

Prediction 3 (Agricultural productivity). Average labor productivity in the agricultural sector increases after the land coupon reform due to the reallocation of farmers.

5 Calibration Strategy

I calibrate the model in two steps. First, I parameterize the distributions for individual heterogeneous productivity in agriculture and non-agriculture sector, rural farmland and residential land endowment, urban construction cost. Second, I calibrate the parameters of the model to match the empirical moments from the land coupon transaction data, migration data and aggregate data.

5.1 Parameterization

The parametric distributions that I need to specify for individuals in the model are agriculture and non-agriculture ability, rural farmland and residential land endowment. I also need to specify the functional form for the urban construction cost.

1. Ability Distribution Following [Lagakos and Waugh \(2013\)](#), each individual i born in rural region n draws $z_n^{ag}(i)$ independently from Fréchet distribution:

$$F(z_n^{ag}) = e^{-(z_n^{ag})^{-\theta}}, \quad \text{with } \theta > 1.$$

where θ controls the dispersion of individual ability in each sector, a higher value of θ means smaller dispersion of abilities.

2. Urban Construction Cost. I assume the urban construction cost function takes the following quadratic functional form:

$$C(S_u^h) = \gamma_0 + \gamma_1 S_u^h + \frac{\gamma_2}{2} (S_u^h)^2$$

where s_n^h is the amount of urban farmland converted to urban residential land.

5.2 Calibration

5.2.1 Calibration of Parameters

- 1. Expenditure Share.** Following Tombe and Zhu (2019), I set the agriculture good's share in consumption φ to 0.095 and goods' share in utility α to 0.87.
- 2. Land's Share in Agriculture Production.** I calibrate the farmland share in agriculture production β to 0.54 as in Adamopoulos et al. (2022).
- 3. Ability Dispersion.** Lagakos and Waugh (2013) calibrate the dispersion of farming ability θ is 5.3.
- 4. Idiosyncratic Location Preference Dispersion** Following Tombe and Zhu (2019), the dispersion of idiosyncratic preference over location ρ is 1.5.
- 5. Land Coupon Compensation Share to Farmers** Using the land coupon transaction data, I calibrate the land coupon compensation share to farmers κ is 0.7.
- 6. The Wage Ratio between Urban Residents and Rural-to-urban Migrants** Using population census in 2005, I find the wage ratio between residents with Chongqing urban hukou and rural-to-urban migrants working in the non-agricultural sector is 1.15.
- 7. Urban Construction Cost.** The urban construction cost corresponding to urban residential land acquisition cost. I estimate the parameters on urban construction land using urban residential land auction data.¹⁵ I estimate the parameters on urban construction land using the following regression specification. $Cost_{int}$ ¹⁶ is the payment value of the land plot, s_{int} is the size of the land. The control variables include floor area ratio and distance to the county centroid. I also control for the county and year fixed effect. The sample includes all urban residential land transaction records in Chongqing from 2000 to 2023, dropping observations with negative values in cost and size.

$$Cost_{int} = \gamma_0 + \gamma_1 s_{int} + \frac{\gamma_2}{2} s_{int}^2 + \mathbf{X}'_{int} \boldsymbol{\beta} + \mu_n + \delta_t + \varepsilon_{int} \quad (39)$$

I estimate the urban construction cost parameters γ_1 and γ_2 as 534 and 22, respectively.

5.3 Calibration of Exogeneous Variables

- 1. Individual Land Endowment.** I estimate the individual rural farmland endowment δ_n^f in each region as the farmland area divided by the number of population with

¹⁵Data source: <https://www.landchina.com>.

¹⁶I discount the cost of land acquisition using price index from Brandt and Holz (2006) and the base year is 2008.

Table 2. *Parameters on Urban Construction Cost*

	(1) land cost
land area	534.109*** (196.675)
land area sq	10.806*** (3.530)
floor area ratio	48.423 (71.212)
dist to center	-6.983* (3.863)
Constant	3098.608** (1185.941)
Year FE	Yes
County FE	Yes
Observations	8435
R^2	0.685
Standard errors in parentheses	
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$	

Table 3. *Summary of Model Parameter Calibration*

Parameter	Description	Value	Source
φ	Agriculture good's share in consumption	0.095	Tombe and Zhu (2019)
α	Good's expenditure share	0.87	Tombe and Zhu (2019)
β	Land's share in agriculture production	0.54	Adamopoulos et al. (2022)
θ	Ability dispersion in ag	5.3	Lagakos and Waugh (2013)
ρ	Elasticity of migration	1.5	Tombe and Zhu (2019)
κ	Coupon compensation share to farmers	0.7	Coupon Transaction
$\bar{h}$	wage ratio bwt urban residents and rural-to-urban migrants	1.15	Population Census in 2005
$\gamma_0, \gamma_1, \gamma_2$	Parameters on developer's construction cost	3099, 534, 22	Land Transaction Data on Urban Residential Land Parcel

rural hukou in each county in Chongqing. The farmland data is taken from the third National Land Survey Data. The population data is sourced from Chongqing Statistical Yearbook. I estimate the individual rural residential land endowment δ_n^h by taking average of the land coupon transaction size in each region and divided the average rural household size in each region from population census 2015.

2. Population I calibrate the population born in Chongqing urban region $\bar{N}_{u,cq}$ as the number of people with urban hukou in Chongqing in 2015; population born in Chongqing rural region $\bar{N}_n$ as the number of people with rural Chongqing hukou in each county. Population data is taken from Chongqing Statistic Yearbook.

3. Urban Land Without land coupon reform, the maximum amount of urban residential land can be developed is constrained by the urban farmland preservation requirement $\bar{S}_u - \underline{S}_u^f$. The amount of urban residential land can be developed corresponding to the urban construction quota allocated by central government. I calibrate $\bar{S}_u - \underline{S}_u^f$ from Chongqing urban land construction plan.

4. Price of Goods Following Gai et al. (2025), I calibrate the price of goods p_{ag} and p_{na} in 2015, which is 11.252 and 7.482, respectively.

5. Values in Urban Region Outside Chongqing I use a weighed-average approach to estimate wage in urban region outside Chongqing $w_{u,o}$. The weight is the migration share from rural Chongqing to each prefecture in China in 2000. And wage for non-agriculture sector in each prefecture in 2015 is taken from City Statistic Yearbook. The calibrated $w_{u,o} = 64937$, which means the weighed average wage is 64937 yuan per year.

Similarly, I construct rent for urban housing in urban region outside Chongqing $r_{u,o}$. The weight is the same. I have collected the average rent for urban housing in each province from China Household Finance Survey. The calibrated $r_{u,o} = 270.95$, which means 270.95 yuan per m^2 in each year.

5.4 Recovering Unobservables and Model Fit

5.4.1 Recovering Unobservable Variables

I recover the migration costs μ_{nu} and regional productivities A_n^{ag} and A_u^{na} by matching county-level rural-to-urban migration shares, county-level agricultural value added, and aggregate non-agricultural value added in Chongqing in the benchmark year 2015.

5.4.2 Model Fit

The calibration targets the main empirical moments used in the quantitative analysis: county-level agricultural output, rural-to-urban migration shares, aggregate non-agricultural output, and aggregate land coupon supply. These moments discipline the

regional productivity and migration-cost parameters that determine the quantitative response to the land coupon reform.

I can also solve farmland rental price q_n and land coupon price t from the model and compare them with the data to further check model fitness.

6 Quantitative Analysis

To discipline the quantitative role of land market institutions in shaping migration and agricultural productivity, I conduct three counterfactual policy experiments: (i) shut down the land coupon market (ii) reduce the farmland preservation requirements, and (iii) reduce spatial frictions in labor mobility. Together, these experiments allow me to compare market-based, quantity-based, and labor-based policy instruments, and to isolate the mechanisms through which land institutions affect rural-to-urban migration, agricultural efficiency and aggregate welfare.

6.1 No Land Coupon Market

The first counterfactual scenario considers an economy without the land coupon market. I solve the baseline model with land coupons and compare it against the equilibrium outcomes in the absence of a land coupon market. The outcomes of interest include the rural-urban migration share, aggregate labor productivity in the agricultural sector, and aggregate welfare. This exercise reveals the overall impact of the land coupon reform. Unlike conventional land policies, the land coupon reform simultaneously (i) expands the urban residential land supply, (ii) reallocates farmland within rural areas, and (iii) transfers land value gains to rural households via compensation. Consequently, it directly affects both migration incentives and agricultural production decisions.

6.2 Reduce Urban Farmland Preservation Requirement

The second policy experiment I plan to conduct involves directly relaxing urban farmland preservation requirements. This policy allows urban developers to optimally determine the amount of urban residential land to develop, thereby increasing the urban land supply, decreasing urban land rental rates, and attracting rural-urban migrants. It is instructive to compare this quantity-based relaxation of farmland preservation with the market-based mechanism of rural land reclamation and urban land supply.

6.3 Reduce Migration Costs

This experiment lowers rural to urban migration cost, capturing policies that reduce migration barriers such as relaxation of hukou. If migration costs remain high, the effectiveness of the land coupon system could be significantly limited. Consequently, examining the interplay between migration and land policies is of significant interest.

7 Conclusion

This paper studies how land market institutions shape migration and agricultural productivity under food-security constraints. I examine the Chongqing Land Coupon Reform, a market-based policy that links rural land reclamation to urban land development through tradable land coupons. By relaxing the spatial rigidity of farmland preservation requirements, the reform connects remote rural areas to urban expansion and enables the capitalization of underused rural residential land.

Using comprehensive land coupon transaction data, I document that areas with poorer agricultural conditions supply more land coupons and experience greater rural-to-urban migration and faster grain-yield growth. To quantify the aggregate effects of the reform, I develop a quantitative spatial model with endogenous migration, heterogeneous agricultural productivity, and regulated land conversion that captures key features of China's land system.

Counterfactual exercises show that land and labor mobility frictions jointly shape structural transformation and aggregate agricultural productivity. The findings suggest that market-based land institutions can reduce the distortions created by food-security-oriented land-use regulations and improve the spatial allocation of land and labor. More broadly, the paper highlights how land market design can help reconcile farmland preservation with urbanization.

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Appendix

Appendix A Additional Results

Appendix A.1 Rural population and village land in other provinces

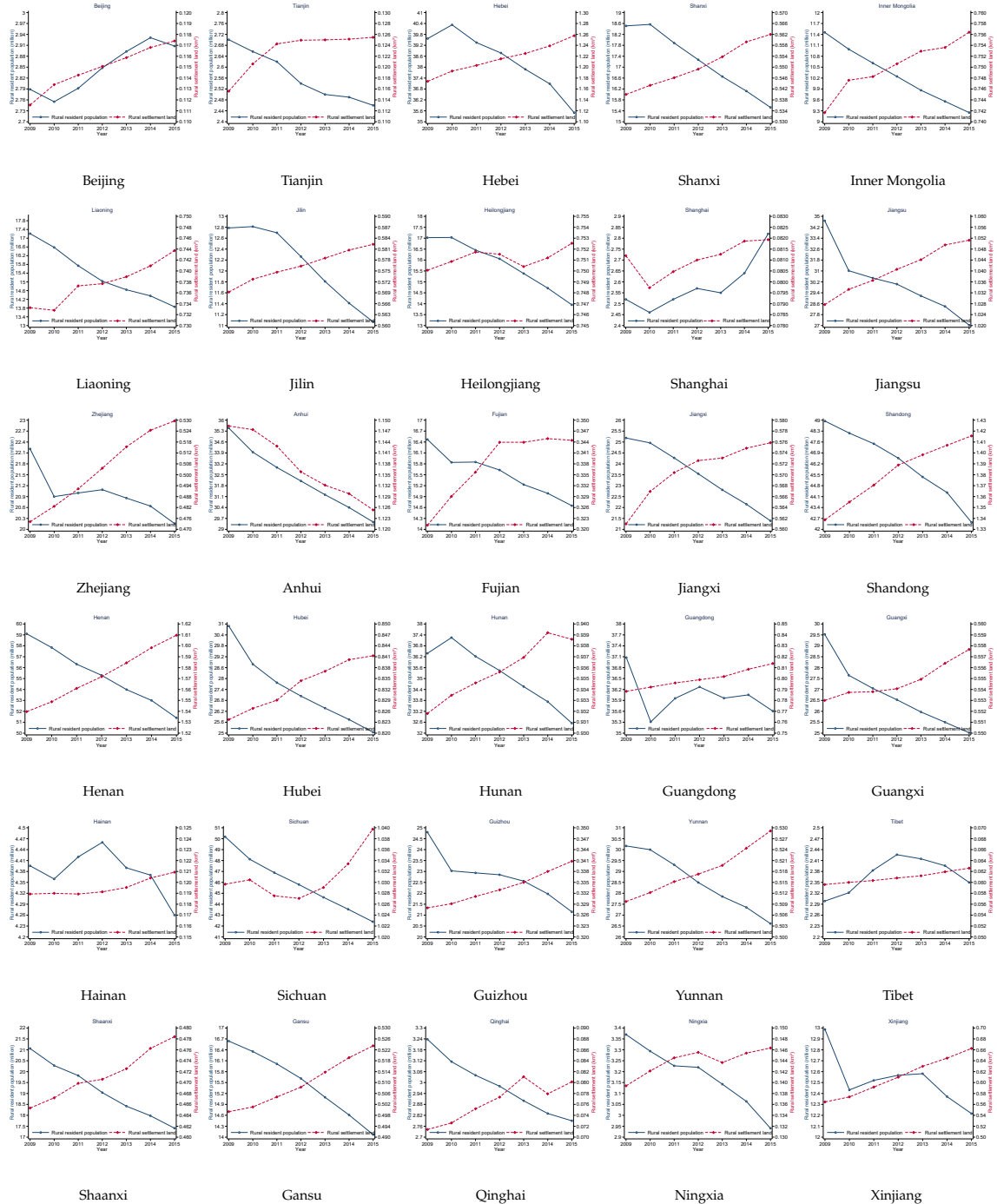


Figure A1. Rural Resident Population and Rural Settlement Land across Provinces

Notes: Each panel plots rural resident population and rural settlement land area for one province over time. Provinces are ordered by administrative codes. China and Chongqing are excluded.