

Land-Use Policy as Industrial Policy: Firm Selection, Spatial Misallocation, and Rural-Urban Redistribution¹

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Abstract

This paper studies how preferential allocation of urban land to manufacturing affects productivity, output and welfare through firm selection and rural-urban migration. Using evidence from China's primary urban land market, I document that prefectures with larger industrial land price discounts allocate more land and employment to manufacturing and sustain more firms, yet have lower average productivity and only modestly higher manufacturing output. Firm-level patterns point to weaker selection, while rural migrants account for much of the associated manufacturing employment. I develop and calibrate a spatial equilibrium model with heterogeneous firms, rural-urban migration and land allocation between industrial and residential uses to quantify the aggregate and distributional consequences of industrial land price discounts. Equalizing within-prefecture land prices between industrial and residential uses reduces manufacturing output by 5.2% but raises average manufacturing productivity by about 7% through stronger firm selection. Urban welfare rises by 2.3%, mainly driven by cheaper housing, whereas rural welfare falls by 0.6% as urban manufacturing labor demand contracts. A welfare-maximizing land allocation that preserves manufacturing output raises aggregate welfare by 0.8% while reducing the aggregate industrial land share by only 0.5 percentage points. These results highlight the importance of where industrial land is allocated and how firm selection and migration shape the distributional consequences of industrial policy.

Keywords: industrial land; place-based policy; rural-urban migration; spatial misallocation; firm selection

JEL codes: D24; J61; L52; R38; R58

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1 Introduction

Governments commonly use place-based policies to support certain locations and sectors. A central question is whether these policies attract firms and create jobs in targeted areas ([Busso et al., 2013](#); [Criscuolo et al., 2019](#)). Yet local expansion does not necessarily translate into higher aggregate productivity or welfare: some local gains may reflect the relocation of economic activity from elsewhere rather than the creation of new activity ([Kline and Moretti, 2014](#); [Fajgelbaum and Gaubert, 2020](#)). Changes in wages and land prices also redistribute policy benefits across workers, landowners, and firms ([Suárez Serrato and Zidar, 2016](#)). Firm heterogeneity adds another dimension to this assessment, as the productivity and spatial distribution of firms shape aggregate outcomes ([Gaubert, 2018](#)). Evaluating a policy that lowers local production costs therefore requires understanding not only where production takes place, but also which firms operate and who takes the additional jobs.

This paper studies the aggregate and distributional consequences of land-use policy as a form of place-based industrial policy. Allocating more land to industrial production directly lowers firms' land costs, but its ultimate effects depend on equilibrium adjustments of other margins, including residential land supply and housing costs, wages, firm entry and exit, and workers' sectoral and location choices. These considerations are particularly relevant in developing economies, where rural workers can supply additional manufacturing labor but face barriers to urban employment and residence.

China's primary urban land market, in which local governments sell land-use rights, provides a rich setting for this analysis. Urban land is owned by the state, and local governments designate its use before sale. These designations segment the market across uses, allowing local governments to influence both manufacturing costs and housing supply through land allocation. Between 2007 and 2013, industrial parcels accounted for approximately 40 percent of transacted urban construction land. Industrial land also sells at substantially lower prices than residential land. Existing research links these allocation and pricing patterns to fiscal incentives and local economic objectives ([He et al., 2022](#); [Henderson et al., 2022](#); [Lu et al., 2024](#)). Following [He et al. \(2022\)](#), I use parcel-level transactions from 2007 to 2013 to estimate industrial land prices relative to residential prices, adjusting for observable parcel characteristics, location, and lease duration. The pooled estimate implies that industrial land transacts at approximately 37 percent of the price of comparable residential land. The estimated discounts vary substantially across prefectures, administrative jurisdictions encompassing urban districts and surrounding

counties. Their magnitude and spatial variation allow me to examine how land allocation relates to manufacturing activity.

The empirical patterns distinguish manufacturing presence from manufacturing productivity. Prefectures with larger industrial land price discounts allocate a greater share of transacted land to industrial use, have more manufacturing firms, and devote a larger share of employment to manufacturing. Their manufacturing workforces also contain a larger share of rural migrants. This source of labor is quantitatively important: rural migrants account for a substantial share of manufacturing employment in 2010. Employer-provided dormitories offer migrants housing at rents well below market levels, often at no charge. These arrangements help sustain migrant labor supply to manufacturing despite relatively high urban housing rents.

Prefectures with larger discounts nevertheless have lower manufacturing output per worker; therefore, the expansion in manufacturing land and workers does not proportionately translate to output. Firm-level evidence further connects land price discounts to selection. Among firms entering during 2007-2013, the negative relationship between productivity and the land price discount is concentrated near the bottom of each prefecture's entrant productivity distribution. The relationship becomes weaker moving toward the most productive entrants. Among firms operating in 2006, survival is generally higher in high-discount prefectures. During the first three years of follow-up, the survival gap is larger among initially less productive firms. Together, these patterns indicate that the greater manufacturing presence in high-discount prefectures includes a larger share of marginal producers.

Land allocation in one prefecture also affects other locations as workers adjust their location choices. To quantify the aggregate production and welfare consequences of industrial land discounts, I develop a spatial equilibrium model with heterogeneous manufacturing firms, rural-urban migration, and land allocation between industrial production and housing. Manufacturing firms differ in productivity and use industrial land both as a variable input and as a fixed operating requirement. Entry and profit-dependent survival determine the number and productivity distribution of active producers. Urban workers choose their location and employment in manufacturing or local services. Rural workers choose between remaining in the rural economy and migrating to an urban manufacturing job, subject to destination-specific migration frictions. The two groups differ in their exposure to urban housing costs. Competitive developers produce housing services using residential land and structures capital. Each prefecture has a fixed urban land endowment, so allocating land to industrial production affects

both firms' costs and housing prices.

I calibrate the model to 276 Chinese prefectures and an aggregate rural location. Matching estimated land price discounts, manufacturing output per worker, industrial land per firm, urban worker allocations, and rural migration patterns allows me to recover local fundamentals and the implied baseline land allocation. I then conduct two counterfactual exercises to evaluate the observed land-use policy.

First, I consider a competitive land market within each prefecture, in which industrial and residential land prices are equalized and land allocation adjusts endogenously. Equalizing local land prices strengthens firm selection but contracts manufacturing. The number of active firms falls by 21.1 percent, while average manufacturing TFP rises by approximately 7 percent. Operating productivity cutoffs rise most in groups of prefectures with larger baseline discounts. Manufacturing employment falls by 0.95 percent, much less than the number of firms, and the remaining firms operate at a larger average scale. Manufacturing output nevertheless falls by 5.2 percent. Improved productivity among active firms does not offset the reduction in industrial land and the number of producers.

The welfare consequences differ sharply across worker groups. Urban consumption-equivalent welfare rises by 2.27 percent. Although urban workers' wage income falls as manufacturing contracts, lower housing costs more than offset this loss. Rural welfare, by contrast, falls by 0.63 percent because lower manufacturing wages and fewer urban employment opportunities outweigh the smaller benefit from lower destination housing costs. Rural migrants account for roughly 90 percent of the decline in manufacturing employment. Equalizing land prices therefore improves the productivity composition of manufacturing and benefits urban households, while reducing manufacturing output and rural households' access to the gains from urban employment.

The second exercise asks whether an alternative land allocation can preserve manufacturing output while improving welfare for both groups. I solve a planner's problem that chooses industrial land shares across prefectures to maximize population-weighted welfare, while requiring aggregate manufacturing output to remain at its baseline level. The resulting allocation raises population-weighted consumption-equivalent welfare by 0.82 percent, with gains of 1.26 percent for urban households and 0.11 percent for rural households. Manufacturing employment also rises modestly. These gains accompany a decline of only 0.5 percentage points in the national industrial land share. Substantial scope for welfare improvement therefore remains even when manufacturing output is preserved and aggregate industrial land allocation changes little.

The output-preserving allocation continues to feature discounted industrial land, but the geography of support changes substantially. Industrial land expands where additional manufacturing output can be supported at a lower marginal welfare cost and contracts in more costly locations. The resulting spatial allocation depends on local productivity fundamentals, housing scarcity and the equilibrium responses of firms and workers. Rural migrants broadly follow manufacturing opportunities, while urban workers also respond to lower housing costs in locations that release industrial land for residential use.

Taken together, the results reveal a central tradeoff in place-based industrial policies. Preferential industrial land supports more manufacturing firms, expands manufacturing employment, and creates migration opportunities for rural workers. Part of this expansion, however, is sustained by the continued operation of relatively unproductive firms. Its benefits and costs also differ across urban and rural households. Evaluating such policies therefore requires accounting for which firms operate, where production occurs, and who gains or loses from the resulting adjustment, alongside their local effects on output and employment.

Literature Review The paper speaks to several strands of the literature. A large literature studies how land zoning and land regulation affect land values, aggregate and spatial distributions of economic activities, including productivity, employment, wages, population and demographic distribution, etc. ([Stull, 1974](#); [McMillen and McDonald, 2002](#); [Ahlfeldt et al., 2015](#); [Shertzer et al., 2016](#); [Hsieh and Moretti, 2019](#); [Parkhomenko, 2023](#); [Duranton et al., 2015](#); [Duranton and Puga, 2023](#); [Song, 2025](#)). [Turner et al. \(2014\)](#) discuss the welfare implications through housing supply, and a few discussions focus on the optimal land policy design ([Rossi-Hansberg, 2004](#); [Arkolakis, 2016](#)). [Hsieh and Moretti \(2019\)](#) show how housing supply constraints limit worker reallocation toward productive cities and reduce aggregate output. [Harari \(2020\)](#) brings the discussion to the development context, and [Blakeslee et al. \(2022\)](#) show that rezoning agricultural land for industrial use promotes firm creation, employment and non-agricultural activity in India. The productivity consequences of land institutions also connect to the broader literature on resource misallocation. In agriculture, [Chen \(2017\)](#) shows how restrictions on land transfers distort occupational choice, and [Adamopoulos et al. \(2024\)](#) emphasize that land market frictions affect both resource allocation across producers and selection across sectors. I examine these selection considerations in urban manufacturing, where allocating land to industry also affects housing supply. This links the productivity distribution of active firms to the spatial allocation of production and the welfare of urban and rural households.

The paper is closely aligned with the literature on place-based policy and heterogeneous firms in space. Place-based policy usually helps promote local investment and output, employment and wages through firm and worker sorting (Busso et al., 2013; Combes et al., 2012; Behrens et al., 2014; Gaubert, 2018; Gaubert et al., 2025). However, the aggregate impacts complicate the discussion of these local policies. The impacts may spill over to nearby locations, either strengthening or weakening the effectiveness of place-based policy (Kline and Moretti, 2014; Fajgelbaum and Gaubert, 2020). Fajgelbaum et al. (2019) also show how geographically heterogeneous policy wedges generate spatial misallocation in general equilibrium. One major debate on the place-based policy is that the policies do not pass through fully to their intended beneficiaries. Criscuolo et al. (2019) show that the local subsidies benefit small firms and lead to aggregate productivity loss. Another reason is that any place-specific shocks will be more or less absorbed jointly by adjustment at the price margin; Suárez Serrato and Zidar (2016) estimate that firm owners end up capturing only around 40% of the tax cut benefit, with the rest split between worker wage gains and gains to landowners. Those unintended losses will partially offset or even overturn the positive gains. This paper complements the literature by studying how the place-based policy affects average productivity and welfare distribution through the change in firms' production cost, with a local pro-manufacturing land allocation policy as an example. The paper emphasizes that whether the policy can be fully passed through and achieve the targeted goals largely depends on local labor and housing supply.

The paper complements a growing literature on firm selection and misallocation. Hsieh and Klenow (2009), Restuccia and Rogerson (2008) and Bartelsman et al. (2013) start the pioneering work in misallocation by measuring the dispersion of incumbent firm productivity and size. Another strand of work emphasizes the misallocation through firm dynamics and firm selection (Hopenhayn and Rogerson, 1993; Foster et al., 2008, Coşar et al., 2016; Buera et al., 2011; Jaef, 2018; Midrigan and Xu, 2014). This paper is closely linked to two recent papers. Adamopoulos et al. (2022) study misallocation and endogenous selection in the Chinese agricultural land market, demonstrating that land institutions can affect aggregate productivity through occupational producer selection, not merely through the land quantity. Yang (2021) shows that endogenous selection will magnify the impacts of distortions on productivity loss by creating too many low-productivity active firms and too many productive inactive firms. This paper connects the abstract selection distortion to a measurable policy, an implicit urban industrial land discount through land allocation, and quantifies its consequences for productivity and welfare.

The paper is also related to the literature on the aggregate and distributional effects of labor supply and internal migration. Starting with the foundational model of migration as the long-run local labor-supply response in [Topel \(1986\)](#), several studies show that labor market adjustments matter substantially to local economic activity ([Bryan and Morten, 2019](#)), spatial misallocations ([Munshi and Rosenzweig, 2016](#)), wage and employment adjustment ([Monras, 2020](#)), as well as the distribution of benefits and welfare among heterogeneous groups ([Suárez Serrato and Zidar, 2016](#); [Notowidigdo, 2020](#); [Lagakos et al., 2023](#)). Migration patterns and migration costs play an important role in labor market adjustments, especially labor supply responses. [Howard \(2020\)](#) further shows that migration does more than shift labor supply; it also shifts local goods demand and housing. The channel is more than strengthened in the developing context as there exist a large potential rural labor supply and rural-urban migration ([Cadena and Kovak, 2016](#); [Tombe and Zhu, 2019](#); [Fan, 2019](#); [Imbert and Papp, 2020](#); [Garriga et al., 2023](#)). This paper shows that rural-urban migration and the resulting local labor supply response are essential in shaping the aggregate and distributional effects of place-based policies.

Finally, the paper complements the study of the Chinese land market. [Lichtenberg and Ding \(2009\)](#) explore the incentives of agriculture-to-urban land conversion, while [Yu \(2019\)](#) studies its welfare consequences. Another strand of literature focuses on the causes and consequences of observed pro-manufacturing urban land allocation and discounted industrial land in China. Empirical studies identify a series of explanations, including auction mechanism design ([Cai et al., 2013, 2017](#); [Li, 2019](#); [Chen and Kung, 2019](#)), local economic growth incentives ([Henderson et al., 2022](#); [Tao et al., 2010](#); [Cai et al., 2024](#)), future tax revenue incentives ([He et al., 2022](#)), spillovers ([Tian et al., 2022](#)), firm sorting and spatial clustering under comparative advantage and agglomeration ([Fei, 2020](#)). With a quantitative structural model featuring endogenous land allocation decisions, [Henderson et al. \(2022\)](#), [Lin and Zheng \(2024\)](#) and [Lu et al. \(2024\)](#) demonstrate that local authorities' preferences over economic performance and industrial land, rather than households' welfare, will rationalize the observed land allocation and pricing pattern. This paper complements the study by examining the impacts of China's urban land allocation on average productivity and output through the interaction of heterogeneous firm selection and rural-urban migration channels. The paper also indicates opposite welfare effects of the urban land allocation between rural and urban households.

The remainder of the paper proceeds as follows. Section 2 describes the institutional setting, and Section 3 introduces the data. Section 4 documents the empirical patterns, and Section 5 develops the selection and labor-supply mechanism. Section 6 presents and calibrates the

spatial model. Section 7 reports the counterfactuals, and Section 8 concludes.

2 Institutional Background

Urban land in China is owned exclusively by the state, while rural land is generally collectively owned. Reforms beginning in the late 1980s, including *Land Administration Law of the People’s Republic of China*, established a system of transferable land-use rights while retaining state ownership. This paper focuses on the primary urban land market, in which local governments grant firms and real estate developers the right to use a parcel for a specified period in exchange for payments³.

2.1 Land Allocation

The supply of new urban land is constrained by higher-level land-use plans and annual construction land quotas. Within this framework, local governments have substantial discretion in organizing the supply of urban land and determining each parcel’s designated uses, including industrial production, housing, commercial activities, and public infrastructure.

A parcel’s designated use is specified before its land-use rights are offered to buyers. Purchasers must develop and use the parcel according to the contract and applicable planning requirements. Changing its use requires government approval, revision of the contract, and adjustment of the associated payment. Typically, the purchase of land-use rights involves an upfront lump-sum payment, with installments allowed over a short period⁴.

Table 1 shows that among all land traded from 2007 to 2013, 25% of the urban construction land is zoned for residential use, 10% for commercial services, and nearly 40% is allocated for industrial purposes⁵. Local governments have both fiscal and economic incentives to influence land allocation. They receive revenue from land grants, while industrial investment can generate future tax receipts and contribute to local economic growth. Existing research shows how public finance considerations and local officials’ incentives to promote economic performance shape the allocation of land between industrial and residential uses (He et al., 2022; Henderson et al., 2022).

³In this paper, the word “transfer”, “transaction”, or “trade” will only refer to trade in usage rights, rather than ownership. Therefore, it is equivalent to a long-term leasing contract. With few exceptions, usually the leasing term is 70 years for residential land, 50 years for industrial land, and 40-50 years for commercial land. According to PRC Civil Code Article 359, the term of the right to use land shall be renewed upon expiration. The payment, reduction, or exemption of the renewal fee shall be handled in accordance with the provisions of laws and administrative regulations.

⁴See Appendix A.2 for more details about the process of government land allocation decisions.

⁵Table C.1 summarizes contextual indicators of industrial land share in some other countries.

These incentives help explain the use of land supply to attract industrial investment.

Table 1: Land Use Share: 2007-2013

	Mean	SD	Min	Max	N
Residential	0.251	0.103	0.028	0.934	330
Industrial	0.391	0.140	0.018	0.764	330
Commercial	0.101	0.081	0.012	0.857	330
Others	0.256	0.155	0.013	0.858	330

Notes: The table summarizes the area shares of primary-market land transactions designated for residential, industrial, commercial, and other uses in 2007-2013. For each prefecture, a use's share is its transacted area divided by the total area transacted for all uses across all sample years. The table reports the unweighted mean, standard deviation, minimum, and maximum across 330 prefectures. The statistics describe transacted land rather than the existing land stock.

2.2 Land Market Segmentation and Price Formation

Reforms during the 2000s⁶ expanded the use of public bidding in the primary land market. In 2002, the central government required land for commercial activities and housing developed for market sale to be supplied through public tenders, auctions, and listing⁷. The requirement was extended to industrial land in 2006. Following these regulatory changes, 42.6% of industrial land and 82.3% of residential land transactions have been conducted via the three market-oriented transaction methods during 2007-2013, as shown in Table C.2.

Since local governments specify each parcel's use before the land is offered for public bidding, restrictions on converting land between uses keep industrial and residential land markets segmented. Within this system, local governments can influence firms' costs by adjusting industrial land supply, while shaping the scope for housing development through the amount of land supplied for residential use.

2.3 Rural-Urban Migration

The employment and welfare consequences of industrial land allocation depend partly on workers' ability to take up urban jobs and the cost of living in cities. In China, rural-urban migration is shaped by the household registration system, known as *hukou*. The registration system distinguished rural from urban status and linked individuals to particular localities. Moving to a city for work did not automatically confer local urban registration. Rural migrants

⁶*Provisions on Assignment of State-owned Land Use Rights by Means of Bidding, Auction and Listing* (Order No. 11, Ministry of Land and Resources, April 2002)

⁷See details on transaction methods in appendix A.3.

could therefore work in cities while facing restricted access to local public services and social benefits. Requirements for obtaining local registration also differed across cities, with larger cities generally maintaining more stringent requirements.

Housing arrangements are another relevant feature of migrant employment. Employer-provided accommodation, including dormitories, was common among rural migrant workers, and many received accommodation free of charge⁸.

3 Data

The empirical analysis primarily documents patterns across Chinese prefectures, supplemented by firm-level evidence on productivity and firm dynamics. A prefecture is an administrative jurisdiction that typically includes an urban core and surrounding districts and counties. It is therefore broader than a single built-up city. I exclude autonomous prefectures and county-level jurisdictions administered directly by provincial governments. Those prefectures typically receive preferential policies that differ from those applied to regular prefectures. The main matched sample contains 276 prefectures.

3.1 Plot-level Land Transaction Data

I use parcel-level records of primary market land transactions from the [China Land Market website](#)⁹. Each record¹⁰ reports the transaction price, parcel area, designated use, transaction method, date, land-quality tier, land source¹¹, and geographic location.

The land-price analysis focuses on residential and industrial parcels transacted between 2007 and 2013¹². I exclude observations with missing or non-positive prices and those with unit prices above RMB 100,000 per square meter, and those with missing or invalid values for the characteristics required in the hedonic regression. There is a total number of 639,701 records incorporated in the final sample.

I link parcel locations to NASA's SRTMGL1 Version 3 elevation data, which have a spatial

⁸See details in [2012 National Migrant Worker Monitoring Survey Report](#).

⁹The *Norms on the Assignment of State-owned Land Use Rights by Means of Bidding, Auction, and Listing (Trial)* issued by the Ministry of Land and Resources in 2006 require all urban land transactions to be publicly disclosed.

¹⁰Appendix A.5 provides an example of a transaction record.

¹¹Appendix A describes the categorical land characteristics.

¹²Figure B.3 shows a clear tradeoff between industrial and residential land shares, whereas the tradeoff between commercial land shares is much weaker.

resolution of approximately 30 meters, to construct elevation and slope for each parcel. I also identify the nearest urban-center coordinates, which I combine with land coordinates to measure each parcel’s distance to the city center. These characteristics enter the hedonic regression described in Section 4.1.

Table C.2 compares selected characteristics of residential and industrial parcels. Its first two columns report pooled parcel means. The third column reports average industrial-residential differences for parcels transacted in the same prefecture and year. It shows whether the differences in the pooled means also appear within local markets. Industrial parcels are farther from the city center on average. In contrast, the large pooled elevation difference is almost absent in the within-prefecture comparison.

3.2 Annual Surveys of Industrial Firms (ASIF)

The Annual Surveys of Industrial Firms (ASIF) are conducted by China’s National Bureau of Statistics (NBS). The survey covers industrial enterprises meeting the applicable reporting criteria¹³. I restrict the analysis to manufacturing firms. To make the sample comparable across years, I further restrict the analysis to firms with annual sales revenue above RMB 20 million throughout the analysis.

The records contain firm identifiers, location, industry classification, establishment year, and detailed production and financial information including gross output, sales revenue, employment, and capital stock. I clean the data following Brandt et al. (2012), excluding observations with fewer than five employees and with invalid or missing inputs required for productivity estimation.

I utilize the data to document firm-level patterns in productivity and firm dynamics. I measure labor productivity as the log of output per worker and use the Solow residuals as the baseline measure of total factor productivity. I also construct alternative measures using the procedures of Levinsohn and Petrin (2003) and Akerberg et al. (2015). Tables C.3 and C.4 compare the productivity measures at the firm and prefecture levels, respectively. Labor productivity, the Solow residual, and the LP and ACF measures exhibit strong positive correlations, with the relationship even stronger after aggregation. These comparisons quantify the agreement among the productivity measures.

¹³From 1998 to 2006, the reporting population included all state-owned enterprises and non-state-owned enterprises with annual revenue of at least 5 million RMB. During 2007-2010, the 5 million RMB threshold applied regardless of ownership. The threshold increased to 20 million RMB in 2011.

3.3 China Migrants Dynamic Survey (CMDS)

I use the 2011-2013 waves of the China Migrants Dynamic Survey (CMDS), a national survey administered by the National Health Commission. The survey covers all 31 provinces, and records respondents' demographic characteristics, household registration (*hukou*) status, employment, migration history, income, housing, household expenditure, and sampling weights.

For each survey year, I use the sampling weights to estimate the joint distribution of employed rural migrants across destination prefectures and sectors. I distinguish manufacturing from other nonagricultural employment and average the annual shares equally across 2011-2013. I combine these shares with the 2010 national migrant-worker benchmark and census employment totals to estimate rural migrants' shares in each urban employment sector. Table 2 reports that roughly 12% of workers in manufacturing are rural migrants. The survey's income and expenditure information also informs the share of migrant household income spent at the destination and the housing share of local expenditure. Table C.6 reports these moments.

3.4 Prefecture-Level Data

2010 Population Census of China (County-Level Tabulations). I obtain prefecture-level population, migration, and sectoral employment totals from the county-level tabulations of the 2010 Population Census. These totals provide the population and employment benchmarks used with the CMDS to construct rural migrants' shares of sectoral employment. See details in Appendix A.6.

China City Statistical Yearbooks. I supplement these sources with annual socioeconomic statistics from the China City Statistical Yearbooks for 2007-2013, including population density, number of manufacturing firms, sectoral output and employment, GDP per capita, and public finances. Unless otherwise noted, annual prefecture-level variables are averaged over 2007-2013, while census employment measures refer to 2010. Monetary variables are expressed in 2010 yuan. Table 2 reports the summary statistics of each variable.

4 Stylized Facts

This section documents how industrial land pricing varies across prefectures and how this variation relates to manufacturing activity and the composition of firms and workers. I first estimate industrial land price discounts relative to residential land, adjusting for observable parcel

Table 2: Summary Statistics for the Main Prefecture Outcomes

Variable	N	Mean	Std. dev.	Min	Max
Panel A. Land allocation					
Industrial land share	276	0.593	0.115	0.058	0.902
Residential parcel size (ha)	276	2.69	3.14	0.09	46.41
Industrial parcel size (ha)	276	4.69	2.49	1.26	29.23
Residential land price (yuan/m ²)	276	1,139.22	952.81	96.51	7,375.08
Industrial land price (yuan/m ²)	276	163.51	94.08	17.26	1,231.68
Residential parcels	276	209	307	9	2,799
Industrial parcels	276	127	117	7	685
Panel B. Manufacturing activity					
Number of manufacturing firms	276	1,209	1,584	25	10,996
Manufacturing employment share	276	0.264	0.130	0.000	0.751
Rural migrant share in manufacturing	276	0.123	0.192	0.003	0.824
Average firm size (employees)	276	120.93	99.04	7.89	899.64
Mean log TFP	276	5.389	0.373	1.937	5.924
Exit rate	276	0.231	0.071	0.000	0.483
Panel C. Socioeconomic characteristics					
Urban population (thousands)	276	2,054.57	1,654.23	216.36	10,641.41
Population density (persons/km ²)	276	416.77	304.64	5.10	2,522.52
GDP per capita (yuan)	276	32,809.15	23,776.48	5,568.56	150,671.09
Fiscal self-sufficiency	276	0.478	0.228	0.074	1.089

Notes: The table reports unweighted summary statistics across 276 prefectures in the main matched sample. Industrial land share is industrial transacted area divided by the combined industrial and residential transacted area. Unless otherwise indicated, annual variables are averaged over 2007-2013; manufacturing employment shares use the 2010 Population Census. Rural migrant shares in manufacturing are constructed from the 2011-2013 CMDS and 2010 benchmarks as described in Appendix A.6. Nominal variables are expressed in 2010 yuan. Parcel areas are measured in hectares. Fiscal self-sufficiency is defined as the ratio of fiscal revenue to fiscal expenditure in each prefecture. Prefecture-level productivity is the employment-weighted average of firm-level Solow Residuals estimated using ASIF data.

characteristics. I then examine land allocation, manufacturing employment, and productivity before turning to firm entry and incumbent survival.

4.1 Industrial Land Price Discount

Land market segmentation allows industrial and residential land prices to differ even though local governments are encouraged to supply land through public bidding. Figure B.2 shows that the average residential land price is more than twice the industrial land price in 2007. Furthermore, the residential land prices rose sharply between 2007 and 2013, while the industrial land prices increased more slowly. Because the two types of parcels also differ in location and other characteristics, I use a hedonic regression to construct a comparable measure of their relative prices.

Following He et al. (2022), I estimate:

$$\log(P_{ipt}) = \theta \text{Ind}_{ipt} + \boldsymbol{\eta}'_0 \mathbf{X}_{ip} + \text{Ind}_{ipt} \times \boldsymbol{\eta}'_1 \mathbf{X}_{ip} + \gamma_{pt} + \epsilon_{ipt} \quad (1)$$

The dependent variable $\log(P_{ipt})$ is the log unit transaction price of parcel i in prefecture p in year t , adjusted for the length of the land-use right: $\log(P_{ipt}) = \log(P_{ipt}^{\text{raw}}) - \log[1 - (1 + r)^{-T_i}]$, where T_i is the reported lease term, and the discount rate is $r = 0.05$. Ind_{ipt} is the parcel's designated use with $\text{Ind}_{ipt} = \mathbf{1}\{\text{parcel } i \text{ is designated for industrial use}\}$. $\mathbf{X}_{ip}$ is a collection of parcel controls including parcel area, distance to the city center, slope, and elevation, with continuous characteristics entering in levels and squares, as well as indicators for transaction method, land-quality tier, and land source¹⁴. I center the controls at pooled reference parcel characteristics and interact them with the industrial-use indicator, allowing the relationship between characteristics and prices to differ by land use. Prefecture-by-year fixed effects γ_{pt} are included to absorb local factors common to the two uses in a given year.

Table 3: Industrial Land Price Discounts

	(1)	(2)	(3)	(4)
	log(price)	log(price)	log(price)	log(price)
industrial land	-1.346*** (0.049)	-1.346*** (0.037)	-0.997*** (0.089)	-0.932*** (0.183)
Prefecture $\times$ Year FE	Y	Y	Y	Y
Land Controls	Y	Y	Y	Y
Land Controls $\times$ Prefecture		Y		Y
Land Controls $\times$ Ind_{ipt}			Y	Y
Mean Dep. Var	5.46	5.46	5.46	5.46
R^2	0.439	0.596	0.458	0.643
N	639,701	639,701	639,701	639,701

Notes: The sample contains 639,701 industrial and residential parcel transactions in 2007-2013. The dependent variable is the log unit transaction price adjusted for lease length as described in Section 4.1. The reported coefficient is on the industrial use indicator. Controls include parcel area, distance to the city center, slope, and elevation in levels and squares, and indicators for transaction method, land-quality tier, and land source. Controls are centered at pooled reference parcel characteristics. All columns include prefecture-by-year fixed effects. Columns (2) and (4) add interactions between parcel characteristics and prefecture indicators. Columns (3) and (4) add interactions between parcel characteristics and the industrial use indicator. Standard errors clustered by prefecture are reported in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

With this specification, the coefficient θ is the negative of the industrial land price discount in

¹⁴See Appendix A.4 for detailed descriptions of land characteristic measures.

log points at the reference parcel characteristics.

$$\theta \equiv \log(\hat{P}_{\text{ind}}) - \log(\hat{P}_{\text{res}})$$

where $\hat{P}_{\text{ind}}$ and $\hat{P}_{\text{res}}$ are predicted prices of a parcel with characteristics $\mathbf{X}$, if designated for industrial and residential uses, respectively. Table 3 reports estimates under alternative specifications. In column (3), the coefficient -0.997 implies an adjusted industrial-to-residential price ratio of $\frac{\hat{P}_{\text{ind}}}{\hat{P}_{\text{res}}} = e^{-0.997} \approx 0.37$. Industrial land is therefore priced at about 37 percent of comparable residential land in this specification.

Throughout the remainder of the paper, I define the industrial land price discount as

$$\text{Price Discount} \equiv -\theta$$

Therefore, a larger discount corresponds to a lower industrial land price relative to residential land.

Are industrial land price discounts this large in every prefecture, or do they vary across regions? I then estimate prefecture-specific industrial land price discounts with the same specification, by allowing the coefficient θ to vary across prefectures:

$$\log(P_{ipt}) = \theta_p \text{Ind}_{ipt} + \boldsymbol{\eta}'_0 \mathbf{X}_{ip} + \text{Ind}_{ipt} \times \boldsymbol{\eta}'_1 \mathbf{X}_{ip} + \gamma_{pt} + \epsilon_{ipt} \quad (2)$$

Figure 1 shows substantial dispersion across prefectures. The estimated discount is positive in 91.3 percent of samples. Its interquantile range extends from 0.516 to 1.295 log points, corresponding to industrial-to-residential price ratios of approximately 0.6 and 0.27, respectively. Table C.5 reports additional distributional statistics.

Large industrial land price discounts are not confined to economically lagging regions. Panel C of Table 4 shows that high-discount prefectures have larger urban populations, greater population density, and somewhat higher GDP per capita than low-discount prefectures. Average GDP per capita is approximately 33,800 yuan in the high-discount group, compared with 31,800 yuan in the low-discount group, at 2010 prices. High-discount prefectures also have higher fiscal self-sufficiency. The maps in figure B.4 complement these comparisons: large discounts are found in coastal as well as inland prefectures.

Local governments can favor industrial production through the allocation of urban land between

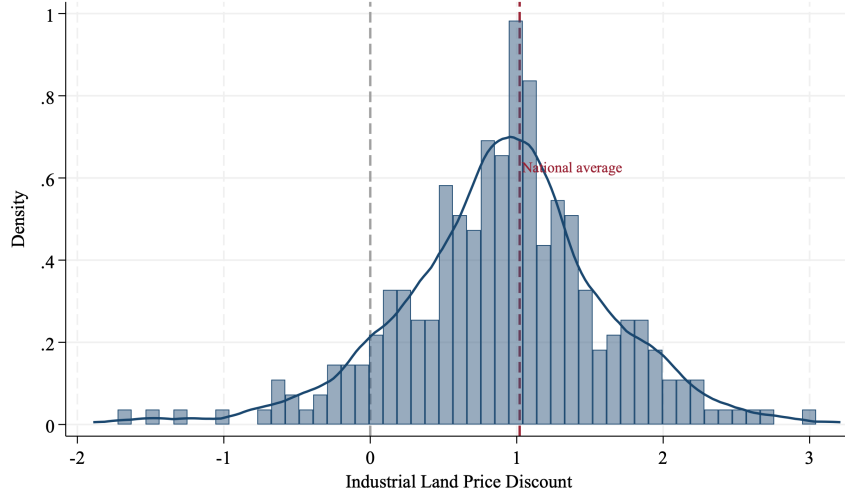


Figure 1: Distribution of Industrial Land Price Discount across Prefectures

Notes: The figure shows the distribution of estimated industrial land price discounts across the 276 prefectures in the main sample. The discount is $-\theta_p$ from equation (2) estimated using industrial and residential land transactions in 2007-2013. Positive values indicate lower industrial prices relative to residential prices at the common reference parcel characteristics. The red dashed line marks the pooled national estimate from Table 3 column (3). The grey dashed line marks the equal adjusted prices with $-\theta_p = 0$. Each prefecture receives equal weight.

industrial and residential uses. The pricing pattern is accompanied by differences in land allocation. Figure 2 shows that prefectures with larger discounts devote a larger share of transacted land to industrial use. Here the industrial land share is the area transacted for industrial use divided by the combined area transacted for industrial and residential uses. Approved development zone area provides a complementary measure of government land allocation: transacted industrial land share reflects completed land transfers, whereas approved zone boundaries capture land formally designated for industrial development. Appendix Figure B.6 shows that the ratio of approved national- and provincial-level development zone area to urban construction land is higher in larger-discount groups¹⁵.

Land prices provide an important channel through which allocation decisions affect firms and workers: industrial land costs enter firms' production and operating decisions, while the allocation of residential land affects housing supply and workers' location choices. I therefore use the estimated industrial land price discount as the main empirical measure of preferential industrial land-use policy, to organize the evidence on firm and worker outcomes.

¹⁵The establishment and spatial boundaries of recognized development zones are subject to government review and approval. The national development-zone catalogue and accompanying administrative guidance document the approved areas and boundaries of these zones (National Development and Reform Commission, Ministry of Land and Resources, and Ministry of Construction, 2007)

Table 4: Prefecture Characteristics by Industrial Land Price Discount

Variable	Low discount	High discount
Panel A. Land allocation		
Industrial land share	0.582	0.605
Residential parcel size (ha)	2.39	2.99
Industrial parcel size (ha)	4.93	4.46
Residential land price (yuan/m ²)	896.52	1,381.92
Industrial land price (yuan/m ²)	165.24	161.79
Residential parcels	273	145
Industrial parcels	95	158
Panel B. Manufacturing activity		
Number of manufacturing firms	902	1,515
Manufacturing employment share	0.230	0.297
Rural migrant share in manufacturing	0.109	0.138
Average firm size (employees)	128.17	113.69
Mean log TFP	5.405	5.374
Exit rate	0.248	0.214
Panel C. Socioeconomic characteristics		
Urban population (thousands)	1,871.70	2,237.45
Population density (persons/km ²)	331.15	502.39
GDP per capita (yuan)	31,825.17	33,793.13
Fiscal self-sufficiency	0.432	0.524

Notes: The table reports unweighted means for prefectures classified as low- and high-discount by the median of the estimated industrial land price discount. Industrial land share is industrial transacted area divided by the combined industrial and residential transacted area. Annual variables are averaged over 2007-2013, except for manufacturing employment shares from the 2010 Population Census. Rural migrant shares in manufacturing are constructed from the 2011-2013 CMDS and 2010 benchmarks described in Appendix A.6. Nominal variables are expressed in 2010 yuan. Other variable definitions follow Table 2.

4.2 Price Discount and Manufacturing Activity

This section examines how manufacturing activities vary with the industrial land discount. Figure 3 shows that prefectures with larger industrial price discounts are associated with an expanded manufacturing sector. In particular, prefectures with larger industrial land price discounts have more manufacturing firms, and a larger manufacturing employment share. The remaining evidence examines how this greater manufacturing presence is reflected in worker composition and firm productivity.

Worker Composition

Rural migrant workers play an essential role in manufacturing production in China. In 2010, there were approximately 88 million rural migrants working in the urban manufacturing sector. Figure 4a shows that rural migrants account for a larger share of manufacturing employment in

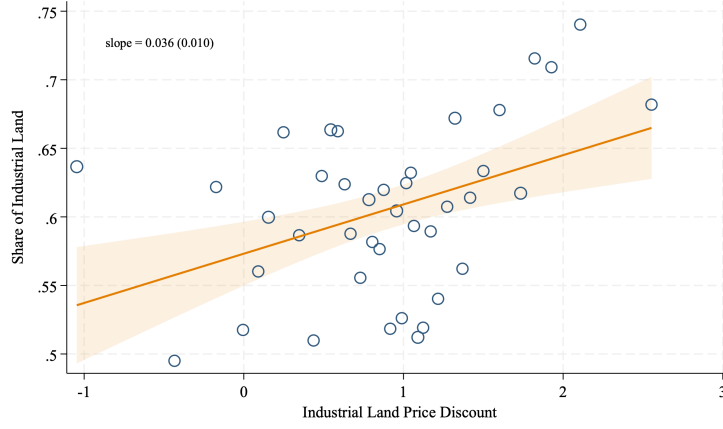


Figure 2: Land Allocation and Industrial Land Price Discount

Notes: Prefectures are sorted by the estimated industrial land price discount, and divided into 50 approximately equal-sized bins. Each point reports the bin means of the discount and industrial land's share of the combined area transacted for industrial and residential uses. Land shares are averaged over 2007-2013. The line and reported slope are estimated by OLS using the underlying prefecture-level observations rather than the bin means. Shading denotes a 95% confidence band. Each prefecture receives equal weight.

prefectures with larger discounts, suggesting that rural migrants take up most of the additional job opportunities brought by discounted industrial land. Therefore, instead of competing with alternative service sectors for urban workers, manufacturing firms promote employment through the extensive margin by stronger migrant participation rather than a pronounced wage gradient. Figure 4b shows that manufacturing wages, by comparison, vary little with the discount: the slope is -0.005 with a standard error of 0.026.

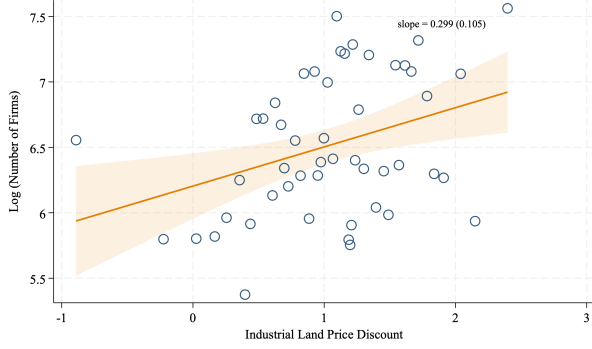
Labor Productivity and Entrant Composition

However, greater manufacturing activity is accompanied by lower labor productivity, as displayed in Figure 5. Therefore, the expansion effects do not translate proportionately to manufacturing output. Appendix Figure B.5 shows a weaker positive relationship between industrial land discount and total manufacturing output. Together, these patterns distinguish the scale of manufacturing activity from the productivity of the firms and workers engaged in it.

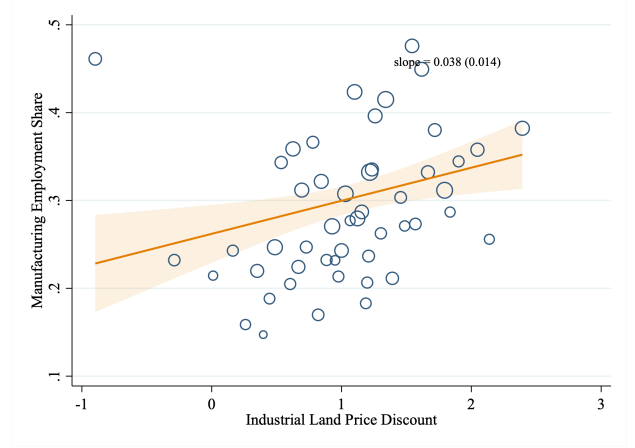
I examine entrant productivity to understand this composition margin. Within each prefecture, I rank all firms entering during 2007-2013 by productivity, and divide them into decile groups accordingly. For each decile group g , I estimate

$$\log(\text{TFP}_{ispt}) = \beta_g \text{Price Discount}_p + \gamma_{st} + \epsilon_{ispt}$$

where i indexes firms, s two-digit manufacturing industries, p prefectures, and t years.



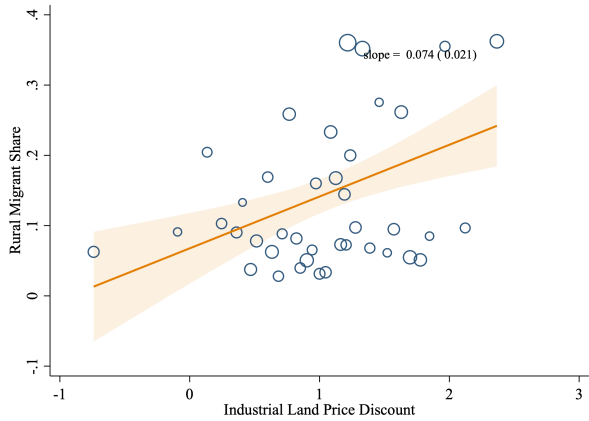
(a) Number of Manufacturing Firms



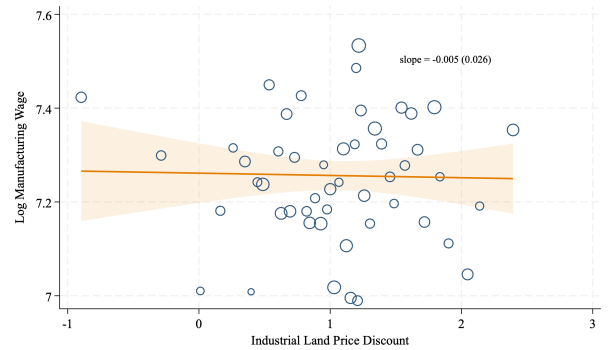
(b) Manufacturing Employment Share

Figure 3: Manufacturing Activity and Industrial Land Price Discount

Notes: Prefectures are sorted by the estimated industrial land price discount, and divided into 50 approximately equal-sized bins. Each point reports the bin means of the discount and the outcome. Panel (a) plots the log number of manufacturing firms, using annual data averaged over 2007-2013 from China City Statistical Yearbooks. Panel (b) plots manufacturing employment as a share of gross employment in primary, secondary and tertiary sectors in the 2010 Population Census. The lines and reported slopes are estimated by OLS using the underlying prefecture-level observations rather than the bin means. Shading denotes 95 percent confidence bands. Each prefecture receives equal weight.



(a) Rural Migrant Share in Manufacturing



(b) Manufacturing Wage

Figure 4: Manufacturing Worker Composition and Wages

Notes: Prefectures are sorted by the estimated industrial land price discount, and divided into 50 approximately equal-sized bins. Each point reports the bin means of the discount and the outcome. Panel (a) plots rural migrants as a share of manufacturing employment, constructed from survey-weighted destination and sector shares in the 2011-2013 CMDS and the 2010 population and migrant-worker benchmarks described in Appendix A.6. Panel (b) plots the log of the average annual manufacturing wage in each prefecture over 2007-2013, calculated from ASIF firm-level wage data and expressed in 2010 yuan. The lines and reported slopes are estimated by OLS using the underlying prefecture-level observations. Shading denotes 95% confidence bands. Each prefecture receives equal weight.

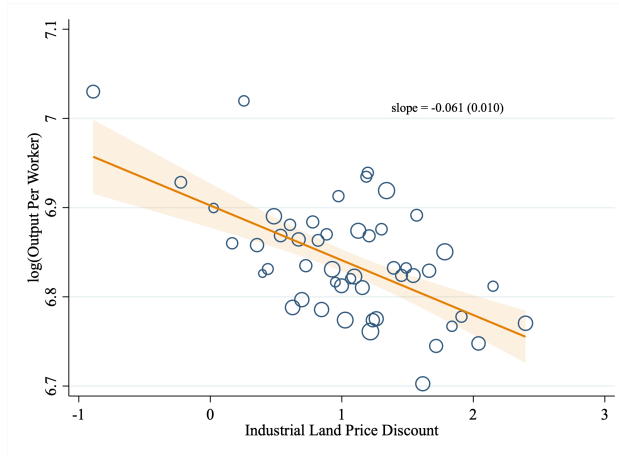


Figure 5: Manufacturing Labor Productivity and Industrial Land Price Discount

Notes: Prefectures are sorted by the estimated industrial land price discount, and divided into 50 approximately equal-sized bins. Each point reports the bin means of the discount and log manufacturing output per worker. Prefecture-level labor productivity is constructed as the log of aggregate manufacturing output divided by the number of manufacturing workers, and averaged over 2007-2013. Output is measured in 2010 yuan. The line and reported slope are estimated by OLS using the underlying prefecture-level observations. Shading denotes a 95% confidence band. Each prefecture receives equal weight.

Productivity is measured by the Solow residual¹⁶, and γ_{st} denotes industry-by-year fixed effects. Each coefficient compares entrant productivity across prefectures at the same position in their local entrant distributions.

Figure 6 shows that the negative productivity relationship is concentrated at the bottom of the entrant distribution. The coefficients are most negative in the lowest deciles and become smaller in magnitude moving up the distribution. At the top, the estimates are close to zero or positive, with confidence intervals that include zero. High-discount prefectures therefore differ most clearly in the productivity of their least productive entrants. The pattern is consistent with weaker selection into production, rather than a uniform productivity difference across all entrants.

Incumbent Survival

Discounted industrial land also impacts incumbent firms through the survival margin. Figure 7 follows firms operating in 2006. I assign firms to quintiles of their initial productivity using pooled rankings and divide prefectures into high and low discount groups at the median discount. Each panel reports the high-minus-low difference in survival rates at a horizon of one to six years. Survival is higher in high-discount prefectures for most productivity groups and horizons. During the first three years, the gap is generally larger among initially less productive firms.

¹⁶The results are robust to alternative TFP measures including standard LP and ACF approaches.

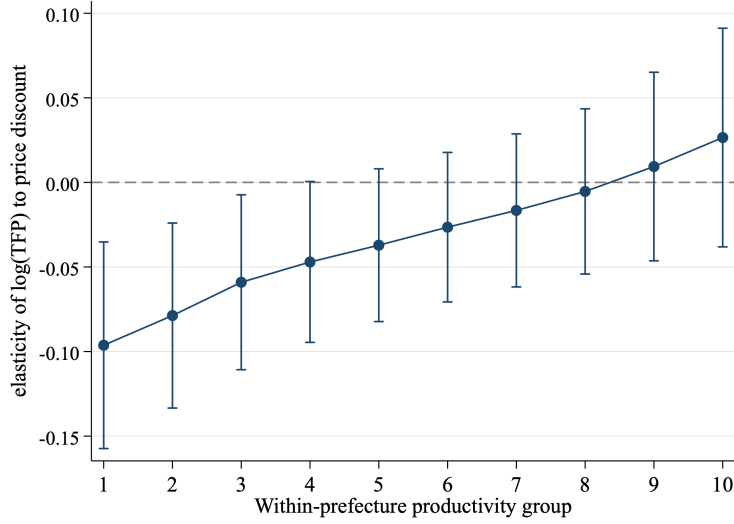


Figure 6: New Entrants' Distribution vs. Industrial Land Price Discount

Notes: Within each prefecture, I rank all firms that entered during 2007-2013 by productivity and divide them into decile groups. For each decile group, I regress firm-level total factor productivity (TFP) on estimated prefecture industrial land price discounts; each point on the figure represents the estimated coefficient within each decile productivity group, with the bars representing the 95% confidence intervals.

At longer horizons, survival gaps remain positive across the distribution, but the productivity gradient is less pronounced. Appendix Figure B.7 reports the corresponding comparison for the 2000 cohort. That cohort does not exhibit the same concentration of larger early survival gaps among less productive firms.

Taken together, the evidence links larger industrial land discounts to a greater manufacturing presence, stronger migrant participation, and a larger role for less productive firms at both entry and survival margins. These patterns motivate a framework in which land costs affect firm selection while migration, wages, and housing costs jointly determine the employment and welfare consequences.

5 Mechanism

Lower industrial land costs can support entry and continued operation by less productive firms. The effect on selection nevertheless depends on how other costs adjust. An expansion of manufacturing raises labor demand, which can increase wages. If additional industrial land is supplied at the expense of residential land, housing costs may also rise and reduce a location's attractiveness to workers. The net effect therefore depends on employment, wage, and housing market responses.

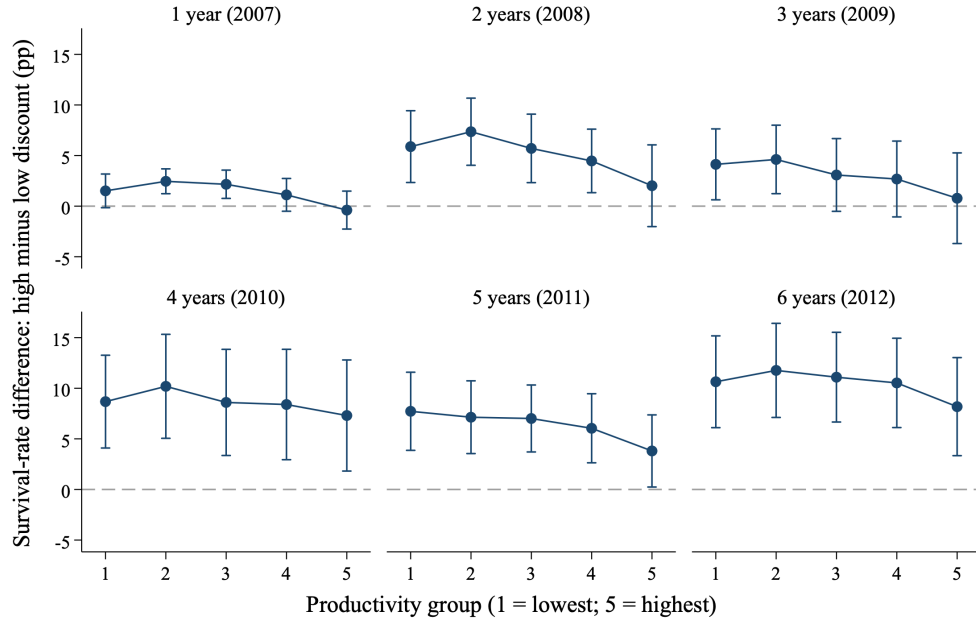


Figure 7: Incumbent Survival Differences by Initial Productivity

Notes: The sample consists of manufacturing firms operating in 2006. Firms are assigned to quintiles of their 2006 TFP using pooled rankings. Group 1 contains the least productive firms while group 5 contains the most productive firms. Prefectures are classified as high- or low-discount according to whether their estimated 2007-2013 industrial land price discount is above or below the median across prefecture samples. Each point reports the high-minus-low difference in survival rates for the corresponding productivity quintile, in percentage points. Panels report horizons of one to six years after 2006, covering 2007-2012. A firm is classified as surviving in year t if it is observed in the sample in a subsequent year. The sample is restricted to firms with annual sales revenue above RMB 20 million, so this measure captures continued sample presence above the sales threshold. Vertical bars denote 95% confidence intervals based on standard errors clustered at the prefecture level.

5.1 A Simple Model of Selection and Labor-Market Adjustment

Consider a continuum of manufacturing firms operating under monopolistic competition and CES demand, with elasticity of substitution $\sigma > 1$. Firms differ in productivity z and use labor as their only variable production input. This exercise isolates the role of the fixed land requirement, while the full model also allows land to enter variable production costs. Let w denote the wage. Firms' variable profits are

$$\pi_v(z) = \frac{\bar{R}}{\sigma} \left(\frac{z}{w} \right)^{\sigma-1}$$

where $\bar{R}$ summarizes demand shifters, including aggregate expenditure and the price index, and is held fixed in this illustration. Each active firm also requires a fixed quantity of industrial land l_m^0 , priced at r_m . A firm operates when variable profits are large enough to cover this fixed operating cost. The productivity cutoff is therefore

$$\pi_v(z) \geq r_m l_m^0 \quad \Rightarrow \quad z^*(w, r_m) = w \left(\frac{\sigma r_m l_m^0}{\bar{R}} \right)^{\frac{1}{\sigma-1}}$$

Holding the wage and demand fixed, a lower industrial land price r_m ¹⁷ reduces the cutoff productivity z^* directly. Firms with lower productivity can then cover the fixed cost of operation.

Wages and employment

To illustrate labor-market adjustment, suppose local labor demand and supply have constant elasticities:

$$\log L^D = \log A(r_m) - \epsilon_D \log w, \quad \log L^S = \log B + \epsilon_S \log w$$

where $\epsilon_D > 0$, $\epsilon_S \geq 0$, and B holds living costs and outside opportunities fixed. Let

$$\epsilon_A \equiv -\frac{\partial \log A}{\partial \log r_m} > 0$$

denote the outward shift in labor demand induced by a lower industrial price at a given wage. This shift can include changes in the number and scale of active firms, which is taken as given

¹⁷Assuming the residential land price remains fixed, a reduction in industrial land price r_m corresponds to a larger industrial land price discount.

in this parsimonious model. Then the manufacturing wage and employment responses are

$$\frac{d \log w}{d \log r_m} = -\frac{\epsilon_A}{\epsilon_D + \epsilon_S}, \quad \frac{d \log L}{d \log r_m} = -\frac{\epsilon_A \epsilon_S}{\epsilon_D + \epsilon_S}$$

For a finite positive labor supply elasticity, both wages and employment increase when industrial land prices fall. A more elastic labor supply reduces the wage response and increases the employment response.

Firm Selection

Combining the wage response with the cutoff condition gives the total effect of the industrial land price on firm selection:

$$\begin{aligned} \frac{d \log z^*}{d \log r_m} &= \frac{1}{\sigma - 1} - \frac{\epsilon_A}{\epsilon_D + \epsilon_S} \\ d \ln z^* &= \frac{d \ln w}{d \ln r_m} d \ln r_m + \frac{1}{\sigma - 1} d \ln r_m = \left[-\frac{\epsilon_A}{\epsilon_D + \epsilon_S} + \frac{1}{\sigma - 1} \right] d \ln r_m \end{aligned}$$

Therefore, a reduction in industrial land price weakens firm selection ($d \ln z^* < 0$) if and only if the local labor supply elasticity exceeds the threshold

$$\epsilon^* \equiv \epsilon_A(\sigma - 1) - \epsilon_D$$

When $\epsilon_S > \epsilon^*$, the direct saving in land costs exceeds the wage increase induced by stronger labor demand.

5.2 Employment Adjustment and Rural-Urban Migration

An implication from the simple model is that firms' responses to a relatively cheap industrial land price depend on local labor supply elasticity, which determines both equilibrium wage and employment adjustment. The labor market evidence in Section 4.2 helps motivate this mechanism. Prefectures with larger discounts have higher manufacturing employment shares and greater rural-migrant representation in manufacturing; therefore, rural migration can make local labor supply more elastic by allowing manufacturing employment to expand through the arrival of workers from outside the urban sector. Average manufacturing wages show little systematic association with discounts: the slope in Figure 4b is -0.005 with a standard error of 0.026. These patterns are consistent with substantial employment adjustment and a modest wage response. When local governments allocate more land to industrial use, they also create employment opportunities that attract rural migrants. The presence of a large pool of potential

rural workers makes the labor supply elastic, limiting wage increases despite a stronger labor force. As a result, cheap industrial land can lower effective production costs and support the survival of marginal, less productive firms.

6 Model

In this section, I build a stationary spatial equilibrium model to quantify how the allocation of urban land affects manufacturing activity, firm selection, and household welfare. Manufacturing firms differ in productivity and use industrial land for both production and a fixed operating requirement. Workers respond to local wages and living costs through sectoral reallocation and rural-urban migration. Housing combines residential land with structures capital, so expanding industrial land changes both firms' costs and households' cost of living.

The framework connects the firm-selection mechanism in [Melitz \(2003\)](#) to the interactions between production, worker mobility, and local land scarcity emphasized in quantitative spatial models ([Redding and Rossi-Hansberg, 2017](#)).

6.1 Model Environment and Land Policy

There are J urban prefectures, indexed by $i, j \in \{1, 2, \dots, J\}$, and one pooled rural location, indexed by 0. The economy contains $\bar{N}^U$ urban workers with *urban hukou*, and $\bar{N}^R$ workers with *rural hukou*. Their *hukou* registration status does not change when they move. Each urban prefecture produces differentiated manufacturing varieties, a local service good, and housing services. Manufacturing varieties are traded frictionlessly across the nation. Workers live and work in the same prefecture.

Prefecture j has a fixed endowment of developable urban land, $\bar{L}_j$, divided between industrial land $L_{m,j}$ and residential land $L_{h,j}$:

$$\bar{L}_j = L_{m,j} + L_{h,j}$$

Let $r_{m,j}$ and $r_{h,j}$ denote the land prices of the two types of land. Local land-use restrictions permit these prices to differ. I summarize the local land allocation by the industrial land price discount

$$\chi_j = \log(r_{h,j}) - \log(r_{m,j})$$

A larger χ_j means a larger industrial land discount. In the baseline model, χ_j is given and

disciplined by the endogenous allocation of land between residential and industrial uses. The counterfactuals can instead prescribe $L_{m,j}$, in which case χ_j is an equilibrium outcome. These are alternative ways of specifying land policy: for a given exercise, the model imposes either a land price discount or a land allocation. This allows the paper to focus on the productivity and welfare consequences without explicitly modelling the specific local government objectives.

6.2 Production

6.2.1 Manufacturing Sector

Manufacturing Demand

Each manufacturing firm produces a differentiated variety ω . All varieties are tradable across the nation. With elasticity of substitution $\sigma > 1$, the national manufacturing composite is a CES aggregation across all varieties:

$$C_m = \left[\sum_j \int_{\omega \in \Omega_j} c_m(\omega)^{\frac{\sigma-1}{\sigma}} d\omega \right]^{\frac{\sigma}{\sigma-1}}$$

where Ω_j is the set of active varieties produced in prefecture j . With the frictionless trade assumption, each variety has the same destination price in every prefecture. Therefore, the composite price index is the same across locations, which is then set as the numeraire and is normalized to 1:

$$P_{m,j} = P_m = \left[\sum_j \int_{\omega \in \Omega_j} p_{m,j}(\omega)^{1-\sigma} d\omega \right]^{\frac{1}{1-\sigma}} \equiv 1 \quad (3)$$

Let E_m denote total expenditure on the composite. The demand and revenue for each variety priced at p_j in prefecture j are

$$q_j(\omega) = E_m P_m^{\sigma-1} p_j(\omega)^{-\sigma}, \quad \mathcal{R}_j(\omega) = E_m P_m^{\sigma-1} p_j(\omega)^{1-\sigma} \quad (4)$$

Technology

A manufacturing firm with productivity z combines labor n_m and variable industrial land l_m according to

$$q = z n_m^\alpha l_m^{1-\alpha}, \quad 0 < \alpha < 1$$

Urban and rural workers are perfect substitutes within manufacturing and receive the same local wage $w_{m,j}$. The unit cost of the input bundle is

$$c_{I,j} = \alpha^{-\alpha} (1 - \alpha)^{-(1-\alpha)} w_{m,j}^\alpha r_{m,j}^{1-\alpha}$$

Monopolistic competition implies a constant markup $\frac{\sigma}{\sigma-1}$ over marginal cost

$$p_j(z) = \frac{\sigma}{\sigma-1} \frac{c_{I,j}}{z}$$

where $\frac{c_{I,j}}{z}$ is the firm's marginal cost with productivity z . Firms' aggregate revenue is therefore

$$\mathcal{R}_j(z) = E_m P_m^{\sigma-1} \left(\frac{\sigma}{\sigma-1} \frac{c_{I,j}}{z} \right)^{1-\sigma}$$

In addition to variable industrial land, each active firm requires a fixed amount $l_{m,j}^0$ of industrial land every period, independently of its output. A firm's operating profit is therefore

$$\pi_j(z) = \frac{\mathcal{R}_j(z)}{\sigma} - r_{m,j} l_{m,j}^0$$

Industrial land thus affects both variable production costs and the fixed cost of remaining in operation. The fixed requirement accounts for a larger share of revenue among less productive firms, making selection an important margin of adjustment.

Entry, Survival and Firm Selection

New Entrants There is an infinite number of ex ante identical prospective entrants in every prefecture. Prospective entrants in prefecture j incur a sunk cost of $c_{e,j}$ units of manufacturing labor and then draw their productivity z from a Pareto distribution $G_j(z)$ with density $g_j(z)$:

$$G_j(z) = 1 - \left(\frac{z_{\min,j}}{z} \right)^{\lambda_z}, \quad z \geq z_{\min,j} > 0, \quad \lambda_z > 0 \quad (5)$$

The location-specific lower bound $z_{\min,j}$ captures productivity fundamentals, while the shape parameter λ_z is common across prefectures. Productivity remains fixed over a firm's life. Successful entrants then choose optimal land and labor to produce, and thereafter evolve according to the same process as incumbent firms.

Incumbent Firms Each period, active firms face an exit probability that decreases with their

profitability

$$\delta_j(z) = \delta_{\min} + \frac{\delta_{\max} - \delta_{\min}}{1 + (\pi_j(z))^{1/\delta_1}}, \quad 0 < \delta_{\min} < \delta_{\max} < 1, \quad \delta_1 > 0 \quad (6)$$

The lower bound $\delta_{\min}$ guarantees that this value remains finite.

Successful Entry With no time discounting, the value of an operating firm upon entry is

$$v_j(z) = \frac{\pi_j(z)}{\delta_j(z)}$$

Since $v_j(z)$ is non-decreasing in productivity, there exists a cutoff productivity level z_j^* for each prefecture such that only new entrants with their productivity draw above z_j^* will stay in the market.

$$\pi_j(z_j^*) = 0 \quad (\text{ZCP})$$

Define $\underline{z}_j = \max\{z_j^*, z_{\min,j}\}$ which represents the lowest productivity of an active firm in prefecture j . With the assumption of an infinite supply of entrants, ex ante potential entrants' expected value should exactly cover the sunk entry cost in equilibrium

$$\int_{\underline{z}_j}^{\infty} v_j(z) g_j(z) dz = w_{m,j} c_{e,j} \quad (\text{FE}) \quad (7)$$

Stationary Firm Distribution

Let $M_{e,j}$ be the number of prospective entrants that pay the entry cost each period, and let M_j be the mass of active producers. Stationarity requires inflows at each productivity to equal exits.

$$M_j \mu_j(z) \delta_j(z) = M_{e,j} g_j(z), \quad z \geq \underline{z}_j$$

The density of active firms and the entrant-to-incumbent ratio are therefore

$$\mu_j(z) = \frac{g_j(z)/\delta_j(z)}{\int_{\underline{z}_j}^{\infty} g_j(z)/\delta_j(z) dz}, \quad z \geq \underline{z}_j, \quad \frac{M_{e,j}}{M_j} = \left[\int_{\underline{z}_j}^{\infty} \frac{g_j(z)}{\delta_j(z)} dz \right]^{-1} \quad (8)$$

The number of successful entrants is $M_{e,j} [1 - G_j(\underline{z}_j)]$. The distribution of active firms differs from that of successful entrants because more profitable firms remain in operation longer.

The restriction $\lambda_z > \sigma - 1$ ensures finite firm-side revenue and input demands at finite positive prices. Appendix D.3 establishes this condition and derives the aggregation formulas. Aggregate

operating profits exactly cover aggregate entry costs in stationarity, so there is no net profit dividend to households.

6.2.2 Local Urban Non-manufacturing Sector

A competitive local sector produces the non-manufacturing goods with labor as the only production input.

$$Q_{s,j} = z_{s,j} N_{s,j}^U, \quad p_{s,j} = \frac{w_{s,j}}{z_{s,j}}$$

where $z_{s,j} > 0$ is exogenous productivity and $w_{s,j}$ is the local wage. Only urban workers supply labor to this sector in the model.

6.3 Workers

6.3.1 Urban Workers

Urban-hukou workers are ex ante identical and perfectly mobile across prefectures. They reside and work in the same prefecture.

Consumption and deterministic utility

Urban workers employed in prefecture j and sector $k \in \{m, s\}$ consume the manufacturing composite $c_{m,kj}$, the local non-manufacturing good $c_{s,kj}$, and housing services $c_{h,kj}$ with Cobb-Douglas preferences

$$U(c_{kj}) = c_{m,kj}^{\beta_m} c_{s,kj}^{\beta_s} c_{h,kj}^{\beta_h}$$

where $\beta_m, \beta_s, \beta_h > 0$ are their expenditure shares with $\beta_m + \beta_s + \beta_h = 1$. Each urban worker receives the same land-revenue transfer T . The deterministic utility from employment in sector k and prefecture j is therefore

$$V_{k,j}^U = \frac{w_{k,j} + T}{P_m^{\beta_m} p_{s,j}^{\beta_s} p_{h,j}^{\beta_h}} \quad k \in \{m, s\}$$

Sectoral Choice

Conditional on living in prefecture j , worker ζ receives a sector-specific Fréchet taste shock $\epsilon_{k,j}(\zeta)$

$$Pr(\epsilon_{k,j}(\zeta) \leq \epsilon) = e^{-A_{k,j}^U \epsilon^{-\nu}}, \quad A_{k,j}^U > 0, \quad \nu > 1$$

The sectoral inclusive value and conditional employment shares are

$$V_j^U = \left[\sum_{k \in \{m,s\}} A_{k,j}^U (V_{k,j}^U)^\nu \right]^{1/\nu}, \quad \pi_{k|j}^U = \frac{A_{k,j}^U (w_{k,j} + T)^\nu}{\sum_{r \in \{m,s\}} A_{r,j}^U (w_{r,j} + T)^\nu} \quad (9)$$

Prefecture Choice

Workers also receive a prefecture-specific Fréchet taste shock $\xi_j(\zeta)$ with shape $\kappa > 1$ and scale $B_j > 0$. The resulting population and employment allocations are

$$\pi_j^U = \frac{N_j^U}{\bar{N}^U} = \frac{B_j (V_j^U)^\kappa}{\sum_{i=1}^J B_i (V_i^U)^\kappa} \quad (10)$$

Urban population and sectoral employment in prefecture j are therefore

$$N_j^U = \bar{N}^U \pi_j^U, \quad N_{k,j}^U = N_j^U \pi_{k|j}^U \quad (11)$$

The parameters ν and κ govern within-prefecture sectoral adjustment and relocation across prefectures. When $\nu = \kappa$, the joint employment shares coincide with a single Fréchet choice over prefecture-sector pairs. The appendix provides the derivation with the nested formulation.

Urban Welfare

Ex ante urban welfare, before the realization of either location or sector preferences, is proportional to

$$W^U = \left[\sum_{j=1}^J B_j (V_j^U)^\kappa \right]^{1/\kappa} \quad (12)$$

6.3.2 Rural Workers

The rural economy contains $\bar{N}^R$ workers. Each rural worker may stay in the rural location and receive reservation utility V_0^R , or migrate to an urban prefecture and work in the destination manufacturing sector. Rural migrants receive $w_{m,j}$ and do not receive the land-revenue transfer T . A migrant spends a fraction $\rho \in (0, 1)$ of earnings at the urban destination and remits the remainder to the rural household. Within local expenditure, the shares $\beta_m^R, \beta_s^R, \beta_h^R > 0$ sum to one and may differ from urban workers' shares. With a Cobb-Douglas allocation between destination consumption and rural consumption, rural migrants' deterministic indirect utility

from migrating and working in prefecture j is therefore

$$V_j^R = \frac{w_{m,j}}{(P_m^{\beta_m^R} p_{s,j}^{\beta_s^R} p_{h,j}^{\beta_h^R})^\rho (P_0^R)^{1-\rho}}$$

where P_0^R is the exogenous rural consumption price index. Thus migrants' exposure to the urban housing-service price is $\rho\beta_h^R$, compared with β_h for urban workers.

Rural Migrants' Location Choice

Since rural migrants do not have full access to social welfare and public services such as social security, health care, education, etc., let

$$B_j^R = \frac{B_j}{\tau_j}$$

denote the attractiveness of prefecture j to rural migrants, where τ_j summarizes limited access to public services due to hukou restrictions, distance, and other destination-specific barriers.

Conditional on migrating, rural workers also receive an idiosyncratic Fréchet taste draw with the same shape parameter κ , and scale parameter B_j^R . The share of rural workers migrating to prefecture j is

$$\pi_j^R = \frac{B_j^R (V_j^R)^\kappa}{(V_0^R)^\kappa + \sum_i B_i^R (V_i^R)^\kappa}, \quad N_{m,j}^R = \bar{N}^R \pi_j^R \quad (13)$$

and the share of workers staying in the rural economy is

$$\pi_0^R = \frac{(V_0^R)^\kappa}{(V_0^R)^\kappa + \sum_i B_i^R (V_i^R)^\kappa}, \quad N_0^R = \bar{N}^R \pi_0^R \quad (14)$$

Rural Welfare

Ex ante rural welfare includes both migrants and workers who remain rural:

$$W^R = \left[(V_0^R)^\kappa + \sum_j B_j^R (V_j^R)^\kappa \right]^{1/\kappa} \quad (15)$$

Land policy therefore affects manufacturing employment through urban sector choice, urban relocation, and rural migration. Wages adjust jointly with these quantities. A more responsive supply of migrant labor can accommodate stronger labor demand with a smaller wage increase.

6.4 Housing Service

Let urban disposable income and migrants' local expenditure in prefecture j be

$$I_j^U = w_{m,j}N_{m,j}^U + w_{s,j}N_{s,j}^U + TN_j^U, \quad E_j^R = \rho w_{m,j}N_{m,j}^R$$

Total expenditure on housing services is

$$E_{h,j} = \beta_h I_j^U + \beta_h^R E_j^R$$

In each prefecture, competitive developers combine residential land and structures capital $K_{h,j}$ to produce a flow of housing services:

$$H_j = z_{h,j} L_{h,j}^{\gamma_h} K_{h,j}^{1-\gamma_h}, \quad 0 < \gamma_h < 1$$

where $z_{h,j}$ is housing productivity and γ_h is the land share in housing costs. Structures capital is elastically supplied at a common user cost $R_K > 0$, expressed in manufacturing units. Capital payments do not enter the incomes of the modelled urban and rural households. Taking input prices as given, developers' optimality conditions and local housing-market clearing imply

$$p_{h,j} H_j = E_{h,j}, \quad r_{h,j} L_{h,j} = \gamma_h E_{h,j}, \quad R_K K_{h,j} = (1 - \gamma_h) E_{h,j}$$

Consequently, the housing and residential land prices in prefecture j are

$$p_{h,j} = \frac{1}{z_{h,j}} \left(\frac{r_{h,j}}{\gamma_h} \right)^{\gamma_h} \left(\frac{R_K}{1 - \gamma_h} \right)^{1-\gamma_h}, \quad r_{h,j} = \frac{\gamma_h E_{h,j}}{L_{h,j}}$$

Only a fraction γ_h of housing expenditure accrues to residential land; the remainder pays for structures. Holding housing expenditure and productivity fixed, a one-percent reduction in residential land raises the housing service price by γ_h percent.

6.5 Market Clearing and Stationary Equilibrium

Land Revenue

A national land authority rebates revenue from industrial and residential land equally to urban workers:

$$T = \frac{\sum_j (r_{m,j} L_{m,j} + r_{h,j} L_{h,j})}{\bar{N}^U} = \frac{\sum_j (r_{m,j} L_{m,j} + \gamma_h E_{h,j})}{\bar{N}^U}$$

This common rebate abstracts from local fiscal retention while retaining the income effects of land revenue.

Labor Market

Manufacturing employment includes workers producing varieties and workers undertaking entry; therefore

$$N_{m,j}^U + N_{m,j}^R = M_{e,j}c_{e,j} + M_j \int_{z_j}^{\infty} n_{m,j}(z)\mu_j(z)dz \quad (16)$$

Local non-manufacturing goods-market clearing requires

$$w_{s,j}N_{s,j}^U = \beta_s I_j^U + \beta_s^R E_j^R$$

The worker-counting identities are

$$N_{m,j}^U + N_{s,j}^U = N_j^U, \quad \sum_j N_j^U = \bar{N}^U$$

for urban workers, and

$$\sum_j N_{m,j}^R + N_0^R = \bar{N}^R$$

for rural workers.

Land Market Clearing

Industrial land demand includes variable production land and the fixed operating requirement:

$$L_{m,j} = M_j \int_{z_j}^{\infty} [l_{m,j}(z) + l_{m,j}^0] \mu_j(z)dz$$

The prefecture's fixed developable urban land endowment is divided between industrial and residential uses

$$L_{h,j} + L_{m,j} = \bar{L}_j \quad (17)$$

Manufacturing Goods

With frictionless national trade, manufacturing trade need not balance separately in every prefecture. Instead, the integrated national goods market clears. Aggregate manufacturing

expenditure is

$$E_m = \sum_j (\beta_m I_j^U + \beta_m^R E_j^R)$$

and demand for each variety is given by equation (4). Together with the CES price index in equation (3), these conditions imply national manufacturing market clearing.

Stationary Equilibrium Given worker endowments $(\bar{N}^U, \bar{N}^R)$, rural fundamentals (V_0^R, P_0^R) , and urban prefecture fundamentals $\{B_j, \tau_j, A_{m,j}^U, A_{s,j}^U, z_{\min,j}, z_{s,j}, \bar{L}_j, l_{m,j}^0, c_{e,j}\}_j$, and industrial land price discounts $\{\log(r_{h,j}) - \log(r_{m,j})\}_j$, and preference and technology parameters, a stationary equilibrium is a collection of land allocations $\{L_{m,j}, L_{h,j}\}_j$, worker allocations $\{N_{m,j}^U, N_{s,j}^U, N_{m,j}^R\}_j$ and N_0^R , wages and prices $\{w_{m,j}, w_{s,j}, r_{m,j}, r_{h,j}, p_{s,j}\}_j$, housing quantities $\{H_j\}_j$ and a national transfer T , and firm objects $\{\underline{z}_j, M_j, M_{e,j}\}_j$ such that (1) workers choose locations and sectors optimally; (2) firms price, enter, operate, and exit optimally and the distribution of firms is stationary; (3) land, labor, housing, local services, and national manufacturing goods markets clear; (4) the land authority's transfer budget balances, up to a normalization.

The quantitative exercises compare stationary equilibria, allowing entry, survival, wages, housing supply, and worker allocation to adjust together. Appendix E.4 sets out a numerical solution algorithm.

6.6 Calibration

This section outlines the calibration of the quantitative model. I calibrate a reference economy with 276 urban prefectures and one aggregate rural location. I first assign common preference and technology parameters, then invert the model to recover prefecture fundamentals that reproduce the baseline targets. Table 5 summarizes the parameters, their sources, and the moments used in the inversion.

6.6.1 Parameter Calibration

Panel A of Table 5 reports the externally calibrated parameters. Urban expenditure shares are $(\beta_m, \beta_s, \beta_h) = (0.40, 0.35, 0.25)$. I set the housing share to 0.25 based on expenditure data from the National Bureau of Statistics (NBS), and allocate the remaining expenditure between manufacturing and local non-manufacturing goods using their relative value-added shares in 2010. The local non-manufacturing sector aggregates value added from all non-agricultural sectors other than manufacturing.

Table 5: Calibration and Model Inversion

Model Parameters		Value	Source/Moments
<i>Panel A: Externally Calibrated</i>			
$\beta_m, \beta_s, \beta_h$	urban expenditure shares	(0.4, 0.35, 0.25)	National Bureau of Statistics (NBS)
$\beta_m^R, \beta_s^R, \beta_h^R$	rural expenditure shares	(0.47, 0.41, 0.12)	NBS and CMDS
α	labor share in production	0.88	Tombe and Zhu (2019)
$\kappa = \nu$	location-sectoral choice elasticity	1.5	Tombe and Zhu (2019)
σ	elasticity of substitution	4	Hsieh and Ossa (2016)
λ_z	productivity shape parameter	3.5	Hsieh and Ossa (2016)
ρ	rural migrants' destination expenditure share	0.42	CMDS
γ_h	land share in housing	0.25	National Bureau of Statistics
$(\delta_{\min}, \delta_{\max}, \delta_1)$	exit rule parameters	(0.05, 0.5, 3)	ASIF
<i>Panel B: Internally Calibrated</i>			
$\{L_{m,j}^L\}_j$	land allocation		estimated land price discount
$\{z_{\min,j}\}_j$	productivity fundamentals		manufacturing output per worker
$\{l_{m,j}^0\}_j$	fixed operating land requirement		industrial land per firm
$\bar{B}_j = B_j z_{s,j}^{\beta_s \kappa}$	composite amenity		population distribution
$\{A_{m,j}^U, A_{s,j}^U\}_j$	Urban worker sector preference shifter		sectoral emp share: urban workers
V_0^R	rural reservation utility		rural-urban migration ratio
$\{\tau_j\}_j$	migration cost		rural migrants' destination share
<i>Panel C: Normalization</i>			
$\{c_{e,j}\}_j$	entry cost	$\{1\}_j$	—
P_0^R	rural consumption price index	1	—

Notes: Panel A reports preference, technology, mobility, and exit parameters assigned from external evidence or estimated outside the model inversion. Panel B lists the prefecture fundamentals and equilibrium land allocations recovered to match the baseline targets. Panel C reports normalizations and scale choices. Baseline land allocations reproduce the estimated prefecture-specific industrial land price discounts. The moment targets are described in Sections 3 and 6.6 and Appendix A.6.

Rural migrants have different destination expenditure shares. Table C.6 uses the 2011-2013 CMDS to estimate the fraction of household income spent at the destination ρ , and the housing share of that local expenditure β_h^R . The annual estimates average approximately 0.42 and 0.12, respectively. I preserve the urban manufacturing-to-services expenditure ratio within migrants' remaining destination expenditure:

$$\beta_m^R = (1 - \beta_h^R) \frac{\beta_m}{\beta_m + \beta_s} \simeq 0.47, \quad \beta_s^R = (1 - \beta_h^R) \frac{\beta_s}{\beta_m + \beta_s} \simeq 0.41$$

I set the labor share in manufacturing production to $\alpha = 0.88$. Using the non-agricultural labor and land shares of 0.22 and 0.03 reported by Tombe and Zhu (2019), the implied share within these two inputs is $\frac{0.22}{0.22+0.03} = 0.88$. The urban location-choice and sector-choice elasticities are set to $\kappa = \nu = 1.5$, using their migration-elasticity estimate as the benchmark. The baseline specification is consistent with the joint-choice formulation discussed in D.4. The robustness exercises allow the two elasticities to vary separately.

The elasticity of substitution across manufacturing varieties is $\sigma = 4$, and the Pareto productivity shape parameter governing the dispersion of firm productivity is set to $\lambda_z = 3.5$. The baseline

satisfies $\lambda_z > \sigma - 1$, which ensures that the relevant firm-side aggregates are finite. I set the residential land cost share in housing production to $\gamma_h = 0.25$. This parameter governs the response of housing-service prices to residential land scarcity.

The exit rule is disciplined by the relationship between profitability and continued sample presence in ASIF. I rank firms by deflated profits, divide them into 50 bins, and calculate the average exit rate in each bin. The highest and lowest profit bins discipline the lower and upper exit probabilities, while δ_1 is chosen to match the empirical elasticity of exit probability to profitability across bins. The baseline values are $(\delta_{\min}, \delta_{\max}, \delta_1) = (0.05, 0.5, 3)$.

6.6.2 Model Inversion

Based on the externally calibrated parameters, Panel B of Table 5 summarizes the data moments that are exactly matched to invert the model fundamentals.

The inversion recovers prefecture fundamentals jointly with the baseline equilibrium. Given the estimated prefecture-specific industrial land price discounts,

$$\chi_j = \log(r_{h,j}) - \log(r_{m,j})$$

I solve for the allocation of each prefecture's land between manufacturing and housing that reproduces this observed relative price. Thus, baseline industrial land shares are equilibrium outcomes chosen to match the estimated discounts.

I recover the manufacturing productivity shifter $z_{\min,j}$ from manufacturing output per worker in each prefecture. Given the model's selection mechanism, this shifter captures remaining productivity differences across prefectures. The fixed operating land requirement in each prefecture $l_{m,j}^0$ is disciplined by industrial land use per firm.

The distribution of urban workers identifies a composite of local amenities and non-manufacturing productivity. Let

$$\tilde{y}_j = \left[\sum_{k \in \{m,s\}} A_{k,j}^U (w_{k,j} + T)^\nu \right]^{1/\nu}$$

denote the sectoral income inclusive value before deflating by local consumption prices. Substituting $p_{s,j} = \frac{w_{s,j}}{z_{s,j}}$ into the location choice equation gives

$$N_j^U \propto B_j z_{s,j}^{\beta_s \kappa} \left[\frac{\tilde{y}_j}{P_m^{\beta_m} w_{s,j}^{\beta_s} p_{h,j}^{\beta_h}} \right]^\kappa$$

Without credible information on prefecture-level local service prices, population distribution identifies the composite $\tilde{B}_j = B_j z_{s,j}^{\beta_{s,j} \kappa}$ rather than B_j and $z_{s,j}$ separately. I therefore recover the composite $\tilde{B}_j$ to match the distribution of urban workers across prefectures.

Urban sectoral employment shares identify the relative sectoral preference shifters. I normalize $A_{m,j}^U = 1$ and recover $A_{s,j}^U$ to match urban workers' manufacturing employment share within each prefecture. The target construction is described in Appendix A.6.

Finally, I recover the rural outside option V_0^R and destination frictions τ_j from the aggregate migration rate and distribution of migrants across urban destinations. The rural outside option disciplines the total number of migrants; destination frictions discipline where they work. These targets use the rural migrant employment estimates described in Appendix A.6.

6.6.3 Normalization and Scale Choices

Table 5 Panel C lists parameters that are not separately identified from the available moments, and are therefore normalized appropriately.

First, I normalize the entry cost $c_{e,j}$ to one in every prefecture. Combining the stationary distribution of firms (8) with the free entry condition (7) gives

$$\begin{aligned} w_{m,j} c_{e,j} &= \int_{z_j}^{\infty} \pi_j(z) \mu_j(z) dz = \int_{z_j}^{\infty} \pi_j(z) \frac{M_j}{M_{e,j}} \frac{g_j(z)}{\delta_j(z)} dz \\ \Rightarrow w_{m,j} c_{e,j} M_{e,j} &= M_j \underbrace{\int_{z_j}^{\infty} \pi_j(z) \frac{g_j(z)}{\delta_j(z)} dz}_{\text{incumbent firm average profit}} \end{aligned}$$

Aggregate operating profits therefore equal the labor cost of entry. The calibration does not independently target the flow of all entrants paying the entry cost $M_{e,j}$. I use the common entry requirement in the baseline and let the model determine the entry flow.

I also normalize the rural consumption price index to $P_0^R = 1$. Define $V_j^R = \frac{\tilde{V}_j^R}{(P_0^R)^{1-\rho}}$; then equation (14) implies that the share of the rural labor force that remains in the rural sector can be written as

$$\pi_0^R = \frac{(V_0^R (P_0^R)^{1-\rho})^\kappa}{(V_0^R (P_0^R)^{1-\rho})^\kappa + \sum_i B_i^R (\tilde{V}_i^R)^\kappa}$$

Therefore, a common rural price affects every migrant destination's utility through the factor $(P_0^R)^{1-\rho}$. Baseline migration choices identify this factor only relative to the rural outside option, so its level can be absorbed into the calibrated value of V_0^R . Both objects remain fixed in the

land policy counterfactuals.

7 Counterfactual Analyses

This section uses the calibrated model to quantify the aggregate and distributional consequences of land-use policy. The first equalizes industrial and residential land prices within every prefecture. It evaluates how the observed price discounts affect manufacturing, firm selection, migration, and welfare. The second chooses land allocations to maximize population-weighted welfare while keeping national manufacturing output at its baseline level. It asks whether that output can be produced with a land allocation that delivers higher welfare.

The exercises reveal two distinct features of the baseline policy. Discounted industrial land supports many active manufacturing firms and sustains rural access to urban employment, but weakens firm selection and raises housing costs. At the same time, its spatial allocation leaves room to improve welfare while preserving manufacturing output and avoiding the rural welfare loss generated by equalizing local land prices.

7.1 Equalizing Industrial and Residential Land Prices

I first set $\chi_j = 0$ in every prefecture and solve for the resulting stationary equilibrium. The land allocation shares for industrial and residential uses adjust until the two uses face the same transaction price, with firm entry and survival, employment, migration, wages, housing supply, and transfers adjusting in equilibrium.

7.1.1 Manufacturing Activity, Firm Selection, and Productivity

Table 6 reports a substantial contraction in industrial land alongside a smaller decline in manufacturing activity. The national industrial land share falls by 18.01 percentage points, manufacturing employment falls by 0.95 percent, and manufacturing output falls by 5.16 percent. The number of active firms declines by 21.1 percent. Firm numbers therefore respond much more strongly than aggregate employment or output, implying an increase in average firm scale.

Table 6: Aggregate Effects by Equalizing Industrial and Residential Land Prices

<i>Panel A. Manufacturing output and its components</i>						
	Agg mfg output	Manufacturing employment			Output per worker	avg TFP
		Total	No. firms	Avg firm size		
Effect (%)	−5.16	−0.95	−21.10	+20.15	−4.21	+6.97

<i>Panel B. Employment, land allocation, and migration</i>				
	Urban mfg emp	Rural-migrant mfg emp	Agg ind land share	Rural migration rate
Effect	−0.22%	−1.50%	−18.01 p.p.	−0.585 p.p.

<i>Panel C. Welfare</i>			
	Aggregate Welfare	Urban welfare	Rural welfare
Effect	+1.16%	+2.27%	−0.63%

Notes: The table reports changes from the calibrated baseline to the stationary equilibrium in which industrial and residential land prices are equal within each prefecture. Panel A and the employment outcomes in Panel B report ordinary percentage changes. Changes in the national industrial land share $\sum_j L_{m,j} / \sum_j \bar{L}_j$, and the rural migration rate are reported in percentage points. Panel C reports consumption-equivalent welfare changes. Average manufacturing TFP is constructed using the model-consistent CES aggregator. Average firm size is manufacturing employment per active firm.

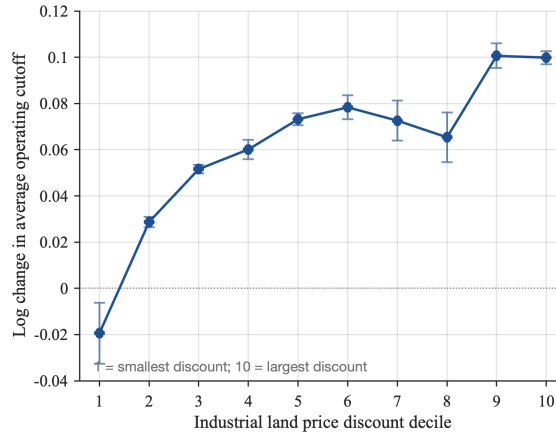


Figure 8: Change in cutoff TFP by Price Discount Decile

Notes: Prefectures are assigned to deciles of the baseline industrial land price discount, from smallest to largest. Each point reports the log change in the mean operating productivity cutoff for prefectures in the corresponding decile, comparing the equal-price equilibrium with the calibrated baseline. The horizontal zero line indicates no change.

The substantial manufacturing contraction is accompanied by stronger selection. Figure 8 orders prefectures from the smallest baseline discount in decile 1 to the largest in decile 10. The operating productivity cutoff rises in all but the lowest-discount decile, and the largest increases occur toward the high-discount end of the distribution. Model-consistent average manufacturing TFP rises by 6.97 percent. Appendix Figure B.10 shows the corresponding change in the distribution of active firm productivity.

Selection gains do not eliminate the production cost of withdrawing industrial land and reducing the number of active producers. Aggregate manufacturing output and output per worker fall despite the improvement in the productivity composition of firms. The baseline policy therefore supports manufacturing partly by accommodating more producers, including firms near the operating cutoff.

7.1.2 Employment, Migration and Distributional Welfare

Most of the manufacturing employment decline occurs among rural migrants. Urban manufacturing employment falls by 0.22 percent, whereas rural migrant manufacturing employment falls by 1.5 percent. Translated into the number of jobs, approximately 26,000 urban workers reallocate from manufacturing to the local service sector, while roughly 240,000 fewer rural workers migrate to urban prefectures, accounting for the remaining 90.2 percent of manufacturing job loss. Therefore, rural migrants account for roughly 90 percent of the national manufacturing employment decline.

This asymmetry produces opposite welfare effects for the two groups of workers. Urban consumption-equivalent welfare rises by 2.27 percent, whereas rural welfare falls by 0.63 percent. Population-weighted aggregate welfare rises by 1.16 percent. Figure 9 decomposes the welfare effects into underlying income and price components. Urban workers lose wage income as manufacturing contracts and receive a smaller land-revenue transfer, but benefit from lower local nonmanufacturing prices and, in particular, cheaper housing as more land is allocated towards residential use and housing supply expands. The housing price contribution more than offsets the income losses.

Rural households also benefit from lower destination prices, but their exposure to urban housing costs is smaller. The fall in manufacturing wages and urban employment opportunities instead dominates their welfare responses. Lower returns to manufacturing migration lower the rural migration rate by 0.585 percentage points, reducing rural ex ante welfare.

This experiment makes the distributional tradeoff explicit. In the model, industrial land discounts sustain rural access to manufacturing employment while accommodating less productive firms and limiting residential land supply. Equalizing prices improves urban welfare and average firm productivity, but lowers manufacturing output and rural welfare.

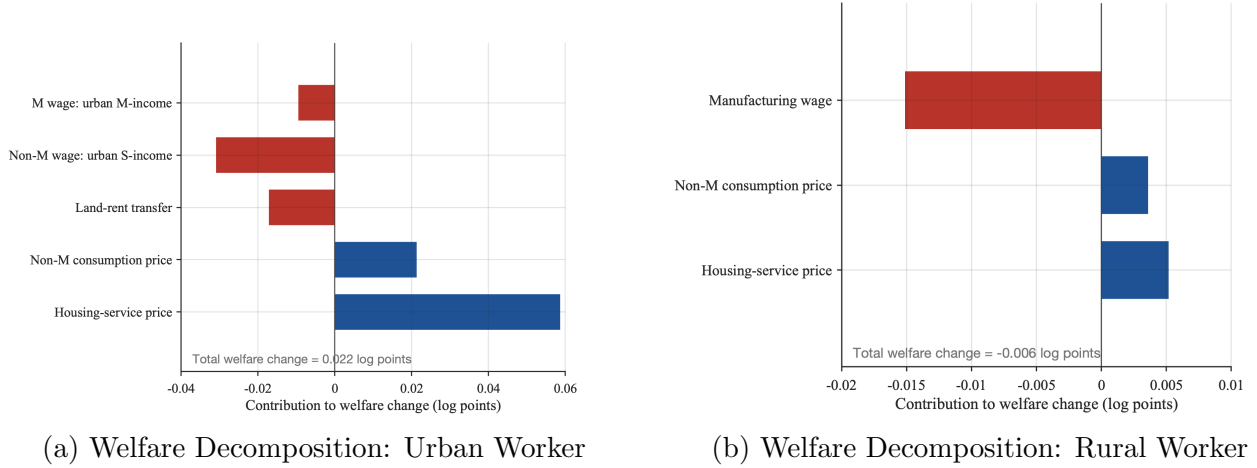


Figure 9: Welfare Decomposition

Notes: Panels (a) and (b) decompose the change in ex ante log welfare between the calibrated baseline and equal-price equilibria for urban and rural workers, respectively, using Shapley decomposition. Components distinguish manufacturing wage income, local-service wage income, the urban land-revenue transfer, local service prices, and housing service prices, as applicable to each group. Positive contributions raise welfare. Contributions are measured in log points.

7.1.3 Spatial Adjustment

The national contraction conceals substantial differences across prefectures. Appendix Figure B.9 maps the change in each prefecture's industrial land share: shares fall across much of the country, but increase in some prefectures. Equalizing local land prices therefore produces an uneven spatial reallocation as well as a decline in the national industrial share.

Figure B.11 panel (a) shows that industrial land contracts more in large-discount deciles. Panels (c) and (d), which instead rank prefectures by their productivity fundamentals, show larger average contractions in industrial land and manufacturing employment in low-productivity groups. This suggests that although more manufacturing output is generated by this preferential land allocation, those additional production resources may not be directed to the most productive places. Employment need not move one-for-one with industrial land: the manufacturing employment response across discount deciles in panel (b) is not monotonic.

7.2 Land Allocation with a Manufacturing-Output Target

The local competitive land market changes both the level and location of manufacturing production, and allocates the production factors towards prefectures with higher productivity fundamentals. However, productivity alone is not a sufficient efficiency criterion. The welfare impact of industrial land also depends on housing scarcity, migration frictions, and the general equilibrium effects of residential land crowd-out. Therefore, to isolate the industrial land spatial

allocation from the government’s objective of supporting manufacturing, this section evaluates whether the baseline manufacturing output can be supported at a lower welfare cost. I then let a planner choose industrial land in each prefecture to maximize population-weighted welfare, subject to a national manufacturing output target. Land allocation is the planner’s only policy instrument; prices, firm selection, employment allocation, and rural-urban migration adjust endogenously in equilibrium.

This is a constrained welfare benchmark¹⁸. Maintaining manufacturing output leaves room for land policy to favor industrial production while permitting its location to change. It therefore provides a benchmark for distinguishing the welfare cost of supporting manufacturing from the additional cost generated by poorly targeted cheap industrial land.

Table 7: Output-Target Welfare-maximizing vs. Baseline

Panel A. Manufacturing output and its components						
	Agg mfg output	Manufacturing employment			Output per worker	avg TFP
		Total	No. firms	Avg firm size		
Effect (%)	0	+0.25	−1.96	+2.26	−0.25	+0.97
Panel B. Employment, land allocation, and migration						
	Urban mfg emp	Rural-migrant mfg emp	Agg ind land share	Rural migration rate		
Effect	+0.24%	+0.26%	−0.50 p.p.	0.10 p.p.		
Panel C. Welfare						
	Aggregate welfare	Urban welfare		Rural welfare		
Effect	+0.82%	+1.26%		+0.11%		

Notes: The table reports changes from the calibrated baseline to the planner allocation that maximizes population-weighted log welfare subject to national manufacturing output being fixed at its baseline level. Industrial land in each prefecture is the policy instrument; prefecture land endowments and the remaining fundamentals are fixed. Panel A and the employment outcomes in Panel B report ordinary percentage changes. Changes in the national industrial land share and rural migration rate are reported in percentage points. Panel C reports consumption-equivalent welfare changes. Average manufacturing TFP is constructed using the model-consistent CES aggregator. Average firm size is manufacturing employment per active firm.

7.2.1 Aggregate Effects

Table 7 summarizes the aggregate effects of the output-target allocation. Population-weighted consumption-equivalent welfare rises by 0.82 percent while national manufacturing output remains at its baseline level. Urban welfare rises by 1.26 percent and rural welfare by 0.11 percent. Manufacturing employment increases by 0.25 percent, and the national industrial

¹⁸Appendix E.4.2 describes the algorithm used to solve the planner’s problem.

land share declines by only 0.5 percentage points. The small net land adjustment accompanies substantial reallocation across prefectures.

The employment expansion includes both urban and rural workers. Urban manufacturing employment rises by 0.24 percent and rural migrant manufacturing employment by 0.26 percent. Urban sectoral reallocation accounts for about 40 percent (28,000 jobs) of the national increase and additional rural migration for about 60 percent (41,000 jobs). The rural migration rate rises by approximately 0.1 percentage points. The planner therefore preserves manufacturing output while improving welfare for both groups and modestly expanding rural access to urban manufacturing work.

The composition of production also changes. The number of active manufacturing firms falls by 1.96 percent, average firm size rises by 2.26 percent, and average manufacturing TFP rises by 0.97 percent. Taken together, these results indicate a small improvement in firm selection and a substantial welfare gain from rearranging production across space, suggesting that the main inefficiency lies in where industrial land is allocated rather than in its aggregate quantity. Table C.7 reports the aggregate effects of a stricter planner problem that fixes both aggregate manufacturing output and industrial land at their baseline levels, which produces nearly the same employment, productivity and welfare effects, confirming that the gain comes primarily from reallocating industrial land across prefectures, rather than reducing its national total.

7.2.2 Welfare-output Elasticities and Land Reallocation

The planner's optimality condition indicates where industrial land should be allocated. Let W denote the population-weighted log consumption-equivalent welfare objective:

$$W = \omega^U \log(W^U) + \omega^R \log(W^R)$$

where ω^U and ω^R are urban and rural worker weights with $\omega^U + \omega^R = 1$. The planner maximizes W subject to $\log Y = \log Y^{\text{data}}$ where Y is national manufacturing output and Y^{data} its data baseline value. For an interior allocation, the first-order condition for prefecture j is

$$\frac{\partial W}{\partial L_{m,j}} + \psi \frac{\partial \log Y}{\partial L_{m,j}} = 0$$

Define the prefecture-specific welfare-output elasticity as

$$\psi_j = -\frac{\partial W / \partial L_{m,j}}{\partial \log Y / \partial L_{m,j}} = -\frac{\partial W}{\partial \log Y}$$

The derivatives incorporate all general-equilibrium responses to marginal industrial land, including changes in prices, firm entry, employment, sectoral choice, and migration. Where additional industrial land raises national output, ψ_j measures the marginal welfare cost per unit of log manufacturing output generated by increasing industrial land in prefecture j .

At the output-target optimum, the planner equalizes $\psi_j = \psi^*$ across prefectures. At the optimum, ψ^* is approximately 0.39, implying that a marginal 1 percent increase in the output target lowers the welfare equivalent by approximately 0.39 percent locally around the constrained optimum.

Figure 10 orders prefectures from the smallest to the largest baseline discount. The baseline marginal welfare cost increases across these deciles. It is close to zero in low-discount prefectures and rises substantially as the price discount increases. The largest observed discounts are therefore concentrated in groups where additional manufacturing output carries a higher marginal welfare cost. Appendix Figure B.14 displays the two derivatives underlying the ratio. The welfare derivative falls strongly across discount deciles, whereas the marginal output response has no comparable monotonic pattern.

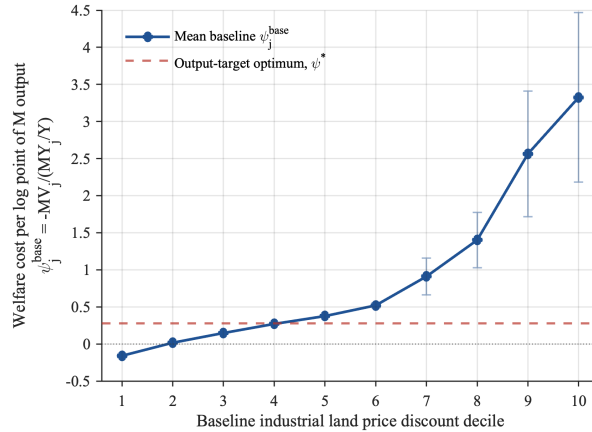


Figure 10: Welfare Cost for Additional Output by Price Discount Decile

Notes: Prefectures are grouped into deciles of the baseline industrial land price discount, from smallest to largest. Each point represents the mean baseline marginal welfare cost within each decile. The number indicates the percentage of welfare loss from supporting additional manufacturing output through that prefecture. The dashed line marks the common welfare cost at the output-target welfare-maximizing allocation.

Therefore, in the planner's welfare-maximizing allocation, Figure 11a shows the planner withdrawing industrial land from high welfare cost groups and increasing it in low welfare cost

groups. The reallocation shifts support toward locations where the output target can be met at lower marginal welfare cost. Figure B.12 further shows the spatial distribution of industrial land reallocation.

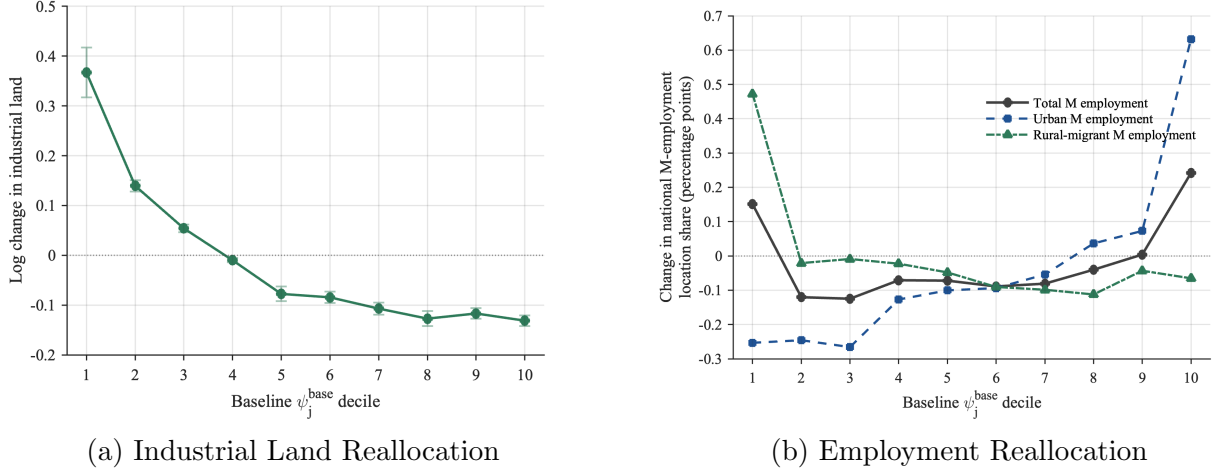


Figure 11: Production Factor Reallocation versus Marginal Welfare Cost

Notes: Prefectures are grouped into deciles of the baseline marginal welfare cost ψ_j , from lowest to highest. Panel (a) reports changes in log industrial land between the baseline and output-target allocation. Panel (b) reports changes in prefectures' share of manufacturing employment, separately for all workers, urban workers, and rural migrants, in percentage points. Horizontal zero lines indicate no change.

7.2.3 Urban and Rural Employment Reallocation

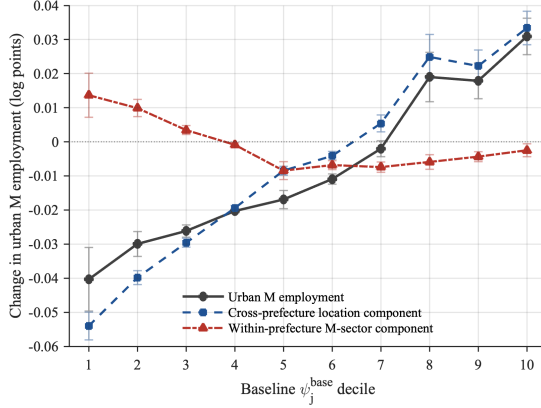
Urban and rural workers respond to this land reallocation through different margins. Figure 11b shows rural migrant manufacturing employment shifting toward prefectures with low baseline welfare cost, broadly following the reallocation of industrial land. Urban manufacturing employment moves in the opposite direction: it rises where industrial land is withdrawn and falls where industrial land expands.

Figure 12a separates urban manufacturing employment into the location and sectoral-choice components according to

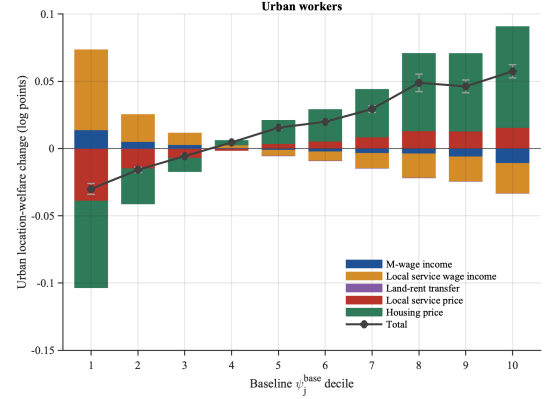
$$\Delta \log N_{m,j}^U = \Delta \log N_j^U + \Delta \log \pi_{m|j}^U$$

In prefectures that release industrial land, additional residential land lowers housing costs and attracts urban workers. Figure 12b shows that the housing price component is the main contributor to the improvement in these locations' urban attractiveness. Within prefectures, sectoral choice moves toward manufacturing in land-receiving locations and away from manufacturing in land-losing locations. The location response is larger, so it determines the net pattern of urban manufacturing employment. Figure B.13a shows the spatial reallocation of

urban workers, indicating that the planner will incentivize workers to move towards eastern coastal regions.



(a) Urban Worker Reallocation



(b) Urban Worker Welfare Decomposition

Figure 12: Urban Worker Reallocation and Welfare Decomposition

Notes: Prefectures are grouped into deciles of the baseline marginal welfare costs, from lowest to highest. Panel (a) decomposes urban manufacturing employment changes into the location and sectoral-choice components. Panel (b) decomposes changes in consumption-equivalent urban worker welfare using Shapley decomposition. All changes compare the output-target allocation with the calibrated baseline and are measured in log points.

Rural migrants place less weight on destination housing costs. Figure 13 shows that higher manufacturing wages in land-receiving groups outweigh the associated increase in housing and local service prices. Rural migrant destination utility rises, attracting migrants even as higher housing costs make the same locations less attractive to urban workers. Figure B.13b further validates that the rural migrants' spatial reallocation exactly replicates the industrial land spatial reallocation.

The planner therefore reallocates industrial land and the two worker groups in different directions. Migrants supply manufacturing labor in expanding industrial locations, while urban workers are drawn toward the housing gains in locations that release land for residential use.

7.2.4 Industrial Land Price Discounts

The output-constrained allocation retains positive industrial land price discounts while changing their distribution. Figure 14a shows a modestly lower mean discount and a much more concentrated distribution than in the baseline. Therefore, what is inefficient is not necessarily the existence of industrial land discounts; it is the magnitude of the wedges and their spatial targeting instead. Figure 14b further shows that the welfare-maximizing land price discount is nearly uncorrelated with the baseline discount. Many prefectures offer industrial land at an unnecessarily deep discount, while the locations that can support manufacturing output at

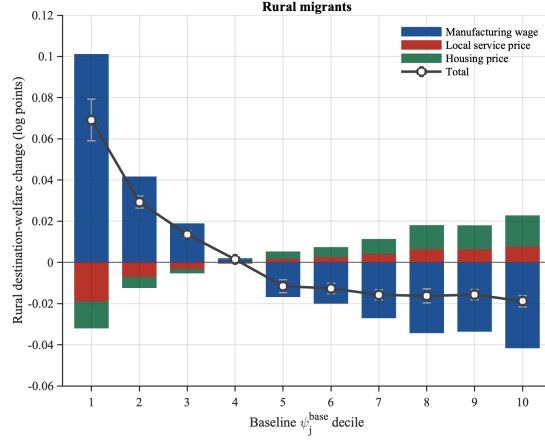
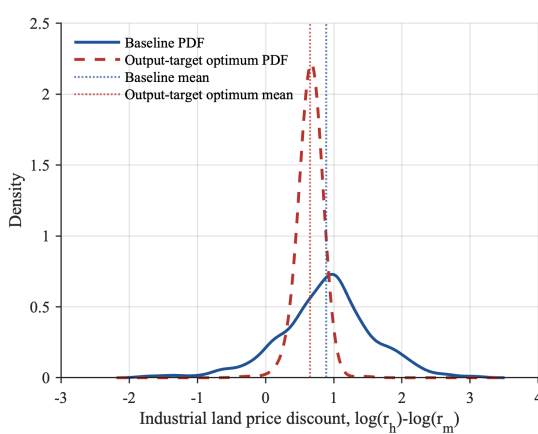


Figure 13: Rural Migrants' Welfare Decomposition

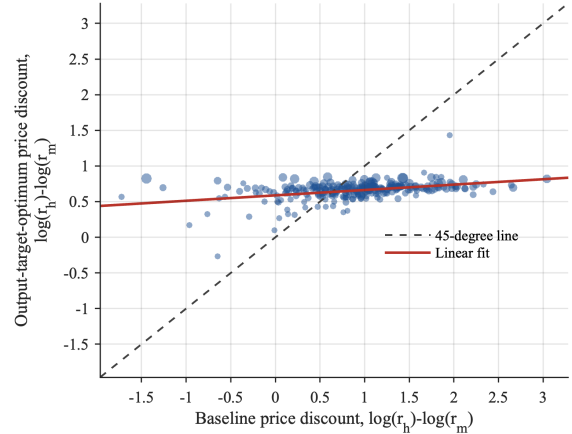
Notes: Prefectures are grouped into deciles of the baseline marginal welfare cost, from lowest to highest. Bars decompose changes in rural migrants' destination utility into manufacturing wage, local service wage, and housing service components. The line reports the total change in log destination utility between the baseline and output-target allocations. Positive values indicate a more attractive urban destination.

lower welfare cost are not systematically favored.

Taken together, the welfare-maximizing allocation under the output target thus combines continued support for manufacturing with different spatial targeting. The observed geography of discounts provides little guidance to the constrained-optimal geography. Better targeting, rather than uniform elimination of industrial land support, can raise aggregate welfare, improve welfare for both urban and rural households, and maintain rural access to manufacturing employment.



(a) PD Distribution



(b) Industrial Land Price Discount

Figure 14: Industrial Land Price Discount: Output-Target vs. Baseline

Notes: Panel (a) compares the cross-prefecture distributions of industrial land price discounts in the calibrated baseline and output-target allocation. Vertical lines mark their respective means. Panel (b) plots each prefecture's output-target discount against its baseline discount, together with the 45-degree line and a linear fit. Discounts are defined as $\log(r_{h,j}) - \log(r_{m,j})$. Positive values indicate a lower industrial land price relative to the residential land price.

7.3 Robustness

This section assesses the sensitivity to the parameters governing production, housing supply, and worker mobility. The first exercise varies $\alpha, \sigma, \lambda_z, \kappa, \nu$ and γ_h one at a time over five-point grids. For each alternative parameter value, I recalibrate the baseline to the same data targets and recompute the competitive local land market counterfactual. Appendix Figures B.15 to B.17 report the results. The main qualitative findings remain stable. Eliminating the within-prefecture industrial land price discount reduces aggregate manufacturing output and total employment, raises average manufacturing TFP, and shifts land toward housing. Urban welfare rises and rural welfare falls, while population-weighted aggregate welfare increases. The manufacturing labor share α , the elasticity of substitution across manufacturing varieties σ , and the residential land cost share in housing production γ_h account for much of the variation in the estimated magnitudes. The rural migration elasticity η is particularly important for the employment and migration responses. Variations in the urban location and sectoral elasticities have smaller effects on most reported outcomes.

I next examine whether interactions among these parameters can overturn the main findings. Because λ_z and σ jointly determine the upper tail of the firm revenue and size distributions with the restriction $\lambda_z > \sigma - 1$, I select low and high values spanning empirically plausible ranges for α, γ_h, η and the linked (λ_z, σ) block, and implement a full 2^4 factorial design. Appendix Figures B.18 to B.19 report the range and mean of the counterfactual effects, together with the baseline result. The main aggregate and welfare conclusions remain unchanged. Across the joint specifications, eliminating the within-prefecture industrial land discount reduces manufacturing output by approximately 3.5 to 8 percent and the number of manufacturing firms by 15 to 32 percent, while raising average manufacturing TFP by roughly 5 to 12 percent. The aggregate industrial land share falls in every specification. Urban consumption-equivalent welfare rises by approximately 1.5 to 3.2 percent, whereas rural welfare falls by about 0.4 to 1.0 percent. Nevertheless, population-weighted aggregate welfare increases by approximately 0.7 to 1.7 percent across all specifications.

The labor and housing market responses are also broadly stable. Rural-migrant manufacturing employment declines across all 16 specifications, housing supply increases, and housing prices and sectoral wages fall. The only sign ambiguity concerns urban manufacturing employment: its response is quantitatively small and ranges from a modest decline to a slight increase. This reflects alternative combinations of the urban location and sectoral reallocation margins, but it

does not overturn the decline in total manufacturing employment. Overall, the joint exercise therefore preserves the paper’s central selection and distributional results.

8 Conclusions

This paper studies how urban land allocation shapes industrial development through firm selection, worker mobility, and housing cost. In China, larger industrial land price discounts are associated with more manufacturing firms and employment, greater rural-migrant participation, and lower output per worker. Firm-level patterns link these differences to the productivity of entrants and the continued operation of less productive incumbents. These findings motivate a framework in which the value of industrial land support depends on which firms it sustains and which workers can take the jobs it creates.

The quantitative model highlights a tradeoff between stronger selection and access to manufacturing employment. Equalizing the local industrial and residential land prices raises average manufacturing TFP by about 7 percent, but reduces manufacturing output by 5.2 percent, and the number of active producers by 21.1 percent. Urban households gain from lower housing cost as their consumption-equivalent welfare rises by 2.27 percent. Rural welfare falls by 0.63 percent as manufacturing wages and migration opportunities decline. Industrial land support therefore has distributional benefits that are not captured by its effects on average firm productivity alone.

Furthermore, the paper shows that land-use policy can deliver higher welfare for both groups while preserving national manufacturing output. Consumption-equivalent welfare increases by 1.26 percent for urban households and 0.11 percent for rural households, while the industrial land share falls by only 0.5 percentage points. The allocation continues to favor industrial use in many locations, with different spatial targeting. The welfare cost of supporting manufacturing depends on housing scarcity, worker reallocation as well as production responses. Accounting for these costs makes it possible to preserve manufacturing output while improving household welfare and maintaining rural access to urban employment.

More broadly, the evaluation of industrial policy should account for firm composition, spatial allocation, and the distribution of gains from urban growth. Local manufacturing expansion is an incomplete measure of success when it changes selection and raises the cost of housing. Rural-urban migration can accommodate additional labor demand and spread the benefits of manufacturing employment, while also allowing marginal firms to remain in operation. The

design of land policy must account for these interactions.

The analysis compares stationary equilibria. Extending the framework to transitional dynamics would clarify how the short-run costs of firm exit, migration, and land conversion relate to the longer-run gains from reallocation. Estimating worker mobility and sectoral- choice responses with richer worker-level data would further discipline the magnitude and distribution of these gains.

References

- Akerberg, D. A., K. Caves, and G. Frazer (2015). Identification properties of recent production function estimators. *Econometrica* 83(6), 2411–2451.
- Adamopoulos, T., L. Brandt, C. Chen, D. Restuccia, and X. Wei (2024). Land security and mobility frictions. *The Quarterly Journal of Economics* 139(3), 1941–1987.
- Adamopoulos, T., L. Brandt, J. Leight, and D. Restuccia (2022). Misallocation, selection, and productivity: A quantitative analysis with panel data from china. *Econometrica* 90(3), 1261–1282.
- Ahlfeldt, G. M., S. J. Redding, D. M. Sturm, and N. Wolf (2015). The economics of density: Evidence from the berlin wall. *Econometrica* 83(6), 2127–2189.
- Arkolakis, C. (2016). Optimal city structure. In *2016 Meeting Papers*, Number 301. Society for Economic Dynamics.
- Bartelsman, E., J. Haltiwanger, and S. Scarpetta (2013). Cross-country differences in productivity: The role of allocation and selection. *American economic review* 103(1), 305–334.
- Behrens, K., G. Duranton, and F. Robert-Nicoud (2014). Productive cities: Sorting, selection, and agglomeration. *Journal of Political Economy* 122(3), 507–553.
- Blakeslee, D., R. Chaurey, R. Fishman, and S. Malik (2022). Land rezoning and structural transformation in rural india: Evidence from the industrial areas program. *The World Bank Economic Review* 36(2), 488–513.
- Brandt, L., J. Van Biesebroeck, and Y. Zhang (2012). Creative accounting or creative destruction? firm-level productivity growth in chinese manufacturing. *Journal of development economics* 97(2), 339–351.
- Bryan, G. and M. Morten (2019). The aggregate productivity effects of internal migration: Evidence from indonesia. *Journal of Political Economy* 127(5), 2229–2268.
- Buera, F. J., J. P. Kaboski, and Y. Shin (2011). Finance and development: A tale of two sectors. *American economic review* 101(5), 1964–2002.
- Busso, M., J. Gregory, and P. Kline (2013). Assessing the incidence and efficiency of a prominent place based policy. *American Economic Review* 103(2), 897–947.

- Cadena, B. C. and B. K. Kovak (2016). Immigrants equilibrate local labor markets: Evidence from the great recession. *American Economic Journal: Applied Economics* 8(1), 257–290.
- Cai, H., J. V. Henderson, and Q. Zhang (2013). China’s land market auctions: evidence of corruption? *The Rand journal of economics* 44(3), 488–521.
- Cai, H., Z. Wang, and Q. Zhang (2017). To build above the limit? implementation of land use regulations in urban china. *Journal of Urban Economics* 98, 223–233.
- Cai, S., J. Lu, and F. Chen (2024). The impact of economic growth target management on land supply: Evidence from china. *Available at SSRN 4855126*.
- Chen, C. (2017). Untitled land, occupational choice, and agricultural productivity. *American Economic Journal: Macroeconomics* 9(4), 91–121.
- Chen, T. and J. K.-s. Kung (2019). Busting the “princelings”: The campaign against corruption in china’s primary land market. *The Quarterly Journal of Economics* 134(1), 185–226.
- Combes, P.-P., G. Duranton, L. Gobillon, D. Puga, and S. Roux (2012). The productivity advantages of large cities: Distinguishing agglomeration from firm selection. *Econometrica* 80(6), 2543–2594.
- Coşar, A. K., N. Guner, and J. Tybout (2016). Firm dynamics, job turnover, and wage distributions in an open economy. *American Economic Review* 106(3), 625–663.
- Criscuolo, C., R. Martin, H. G. Overman, and J. Van Reenen (2019). Some causal effects of an industrial policy. *American Economic Review* 109(1), 48–85.
- Duranton, G., E. Ghani, A. G. Goswami, and W. Kerr (2015). The misallocation of land and other factors of production in india.
- Duranton, G. and D. Puga (2023). Urban growth and its aggregate implications. *Econometrica* 91(6), 2219–2259.
- Fajgelbaum, P. D. and C. Gaubert (2020). Optimal spatial policies, geography, and sorting. *The Quarterly Journal of Economics* 135(2), 959–1036.
- Fajgelbaum, P. D., E. Morales, J. C. Suárez Serrato, and O. Zidar (2019). State taxes and spatial misallocation. *The Review of Economic Studies* 86(1), 333–376.
- Fan, J. (2019). Internal geography, labor mobility, and the distributional impacts of trade. *American Economic Journal: Macroeconomics* 11(3), 252–288.

- Fei, X. (2020). The misallocation in the chinese land market.
- Foster, L., J. Haltiwanger, and C. Syverson (2008). Reallocation, firm turnover, and efficiency: Selection on productivity or profitability? *American Economic Review* 98(1), 394–425.
- Garriga, C., A. Hedlund, Y. Tang, and P. Wang (2023). Rural-urban migration, structural transformation, and housing markets in china. *American Economic Journal: Macroeconomics* 15(2), 413–440.
- Gaubert, C. (2018). Firm sorting and agglomeration. *American Economic Review* 108(11), 3117–3153.
- Gaubert, C., P. Kline, D. Vergara, and D. Yagan (2025). Place-based redistribution. *American Economic Review* 115(10), 3415–3450.
- Harari, M. (2020). Cities in bad shape: Urban geometry in india. *American Economic Review* 110(8), 2377–2421.
- He, Z., S. T. Nelson, Y. Su, A. L. Zhang, and F. Zhang (2022). *Industrial land discount in China: a public finance perspective*. National Bureau of Economic Research.
- Henderson, J. V., D. Su, Q. Zhang, and S. Zheng (2022). Political manipulation of urban land markets: Evidence from china. *Journal of Public Economics* 214, 104730.
- Hopenhayn, H. and R. Rogerson (1993). Job turnover and policy evaluation: A general equilibrium analysis. *Journal of political Economy* 101(5), 915–938.
- Howard, G. (2020). The migration accelerator: Labor mobility, housing, and demand. *American Economic Journal: Macroeconomics* 12(4), 147–179.
- Hsieh, C.-T. and P. J. Klenow (2009). Misallocation and manufacturing tfp in china and india. *The Quarterly journal of economics* 124(4), 1403–1448.
- Hsieh, C.-T. and E. Moretti (2019). Housing constraints and spatial misallocation. *American economic journal: macroeconomics* 11(2), 1–39.
- Hsieh, C.-T. and R. Ossa (2016). A global view of productivity growth in china. *Journal of international Economics* 102, 209–224.
- Imbert, C. and J. Papp (2020). Short-term migration, rural public works, and urban labor markets: Evidence from india. *Journal of the European Economic Association* 18(2), 927–963.

- Jaef, R. N. F. (2018). Entry and exit, multiproduct firms, and allocative distortions. *American Economic Journal: Macroeconomics* 10(2), 86–112.
- Kline, P. and E. Moretti (2014). Local economic development, agglomeration economies, and the big push: 100 years of evidence from the tennessee valley authority. *The Quarterly journal of economics* 129(1), 275–331.
- Lagakos, D., A. M. Mobarak, and M. E. Waugh (2023). The welfare effects of encouraging rural–urban migration. *Econometrica* 91(3), 803–837.
- Levinsohn, J. and A. Petrin (2003). Estimating production functions using inputs to control for unobservables. *The review of economic studies* 70(2), 317–341.
- Li, M. (2019). Information and corruption: Evidence from china’s land auctions. *Unpublished paper*.
- Lichtenberg, E. and C. Ding (2009). Local officials as land developers: Urban spatial expansion in china. *Journal of Urban Economics* 66(1), 57–64.
- Lin, Q. and C. Zheng (2024). Bidding for firms or bidding for people? local urban land allocation competitions in china. *Local Urban Land Allocation Competitions in China (January 01, 2024)*.
- Lu, M., Y. Suzuki, X. Xi, L. Xu, and Y. Zhong (2024). Pro-manufacturing land policies of competing local governments: A quantitative analysis of china. *Available at SSRN: <https://ssrn.com/abstract=4967319> or <http://dx.doi.org/10.2139/ssrn.4967319>*.
- McMillen, D. P. and J. F. McDonald (2002). Land values in a newly zoned city. *Review of Economics and Statistics* 84(1), 62–72.
- Melitz, M. J. (2003). The impact of trade on intra-industry reallocations and aggregate industry productivity. *econometrica* 71(6), 1695–1725.
- Midrigan, V. and D. Y. Xu (2014). Finance and misallocation: Evidence from plant-level data. *American economic review* 104(2), 422–458.
- Monras, J. (2020). Immigration and wage dynamics: Evidence from the mexican peso crisis. *Journal of Political Economy* 128(8), 3017–3089.
- Munshi, K. and M. Rosenzweig (2016). Networks and misallocation: Insurance, migration, and the rural-urban wage gap. *American Economic Review* 106(01), 46–98.

- Nie, J. and H. Liu (2022). Dataset of national and provincial levels development zones in china (2006–2018). *Journal of Global Change Data & Discovery* 1, 12–18.
- Notowidigdo, M. J. (2020). The incidence of local labor demand shocks. *Journal of Labor Economics* 38(3), 687–725.
- Parkhomenko, A. (2023). Local causes and aggregate implications of land use regulation. *Journal of Urban Economics* 138, 103605.
- Redding, S. J. and E. Rossi-Hansberg (2017). Quantitative spatial economics. *Annual Review of Economics* 9(1), 21–58.
- Restuccia, D. and R. Rogerson (2008). Policy distortions and aggregate productivity with heterogeneous establishments. *Review of Economic dynamics* 11(4), 707–720.
- Rossi-Hansberg, E. (2004). Optimal urban land use and zoning. *Review of Economic Dynamics* 7(1), 69–106.
- Shertzer, A., T. Twinam, and R. P. Walsh (2016). Race, ethnicity, and discriminatory zoning. *American Economic Journal: Applied Economics* 8(3), 217–246.
- Song, J. (2025). The effects of residential zoning in us housing markets. *Journal of Urban Economics* 149, 103784.
- Stull, W. J. (1974). Land use and zoning in an urban economy. *The American Economic Review* 64(3), 337–347.
- Suárez Serrato, J. C. and O. Zidar (2016). Who benefits from state corporate tax cuts? a local labor markets approach with heterogeneous firms. *American Economic Review* 106(9), 2582–2624.
- Tao, R., F. Su, M. Liu, and G. Cao (2010). Land leasing and local public finance in china’s regional development: Evidence from prefecture-level cities. *Urban studies* 47(10), 2217–2236.
- Tian, W., Z. Wang, and Q. Zhang (2022). Transaction mechanism and industrial land allocation efficiency in china: Evidence from the 2007 auction reform. *Available at SSRN 4016228*.
- Tombe, T. and X. Zhu (2019). Trade, migration, and productivity: A quantitative analysis of china. *American Economic Review* 109(5), 1843–1872.
- Topel, R. H. (1986). Local labor markets. *Journal of Political economy* 94(3, Part 2), S111–S143.

- Turner, M. A., A. Haughwout, and W. Van Der Klaauw (2014). Land use regulation and welfare. *Econometrica* 82(4), 1341–1403.
- Yang, M.-J. (2021). Micro-level misallocation and selection. *American Economic Journal: Macroeconomics* 13(4), 341–368.
- Yu, Y. (2019). Land-use regulation and economic development: Evidence from the farmland red line policy in china. *Job Market Paper*.

A Additional Institutional Background and Data

A.1 Evolution of Land Allocation Methods

Stage 1: From Administrative Allocation to Transfer for Consideration During the planned economy era, urban construction land was allocated under a regime of state-owned land characterized by three principles: free of charge, indefinite duration, and prohibition of transfer. The first breach of the “free of charge” principle can be traced back to the establishment of Sino-foreign joint ventures. Article 5 of the *Law of the People’s Republic of China on Chinese-Foreign Equity Joint Ventures (1979)* states that “The investment contributed by the Chinese partner may include the right to use the site during the joint venture’s operation. If the site-use right is not part of the Chinese partner’s investment, the joint venture is required to pay a land-use fee to the Chinese government”. The *Interim Provisions of the State Council on the Use of Construction land by Chinese-Foreign Equity Joint Ventures (1980)* further specified that “For the land used by Chinese-foreign joint ventures, whether newly acquired or consisting of an existing enterprise’s site, a site-use fee shall be charged. The calculation of the site-use fee shall take into account factors such as compensation for land acquisition, demolition costs of existing buildings, resettlement expenses, and the apportioned investment in off-site infrastructure directly supporting the joint venture, including roads, pipelines, and other public facilities”.

It is important to note that the introduction of paid use at this stage was unrelated to either land ownership or land use rights. A significant turning point occurred in 1987, when *Shenzhen* pioneered China’s first land transfer by assigning a 5,300-square-meter parcel for approximately one million yuan. One year later, the 1988 constitutional amendment revised the original provision that “land may not be transferred” to “land use rights may be transferred in accordance with the provisions of laws”. Following the amendment, the separation of land ownership and land use rights was formally established in legislation through the *Provisional Regulations of the PRC on the Grant and Transfer of the Right to use State-owned Land in Urban Areas*.

Although the series of reforms initiated the paid transfer of land, the level of marketization remained low throughout the 1990s. Only a small proportion of land was allocated through paid transfer, with most transactions still conducted through *negotiation*.

Stage 2: From Negotiation to marketization To improve the allocation efficiency and

realize the market value of land, the central government began promoting market-oriented land conveyance mechanisms. The *Circular of the State Council on Strengthening of Administration of State-owned land Assets (2001)* explicitly states that “To embody the principles of a market economy and insure openness, fairness and impartiality in the transfer of land use rights, local governments are required to vigorously promote the use of bidding and auction for land use right transactions...For land designated for commercial real estate development and other parcels included in the land supply plan, if two or more parties express interest in the same parcel, the land use rights must be provided by the municipal or county land administration authority through bidding or auction in accordance with the law...Only in cases where bidding or auction is truly not feasible may land be supplied through negotiation”. The *Provisions on the Assignment of the Right to Use State-owned Land through Bidding, Auction, and Listing (2002)* went a step further by mandating that “various operational land, such as commercial, tourism, entertainment, and commodity residential land, must be transferred through public transactions by means of bidding, auction, or listing.” Subsequently, the 2006 *Provisions on the Assignment of State-owned Construction Land Use Rights by Means of Bidding, Auction, and Listing*, issued by the Ministry of Land and Resources, extended this requirement to industrial land. It further stipulated that industrial land must be transferred at a price not lower than the specified minimum standard.¹⁹

A.2 Local land bureau land zoning decisions

Step 1: Land Use Plan The central government sets limits on the maximum amount of newly developed urban land for each locality. Given the overall plan and relevant constraints, the local land use plan is prepared by an independent committee composed of representatives from several bureaus, including the local Bureau of Natural Resources, Development and Reform Commission, Housing and Urban-Rural Development Bureau, Industry and Information Technology Bureau, and Finance Bureau. This committee coordinates zoning decisions and formulates a formal annual plan at the beginning of each year, taking into account the economic and social development plan, industrial policies, urban planning, and land market conditions. Note that key zoning decisions, such as how much land should be allocated for residential, industrial or other uses, are determined at this stage. After obtaining approval from both the local and higher-level governments, the plan is publicly released.

¹⁹The central government classifies all land into 15 levels, with minimum prices decreasing as the level increases.

Step 2: Detailed Transfer Scheme Subsequently, the local land bureau drafts specific transfer schemes in accordance with the annual land transfer plan. In particular, these schemes specify, for each parcel, the spatial boundaries, designated land use, term of use, transfer method, and other relevant conditions. After obtaining approval from the local government, the bureau determines the reserve price based on a formula that incorporates appraised values provided, in principle, by independent appraisal companies.

Step 3: Prepare Land and Initiate Transfer Process The local land bureau then prepares the corresponding transaction documents. The subsequent transfer process is described in detail in section [A.3](#).

A.3 Price Formation Process

A.3.1 Land Transaction Methods

Except for auction, bidding, listing and negotiation, there are some other types of transaction methods which are uncommon in practice, which account for approximately 0.35% of the total sample. This section provides a detailed overview of how each transaction method works.

Auction (*Paimai*) This refers to a standard English auction. The process typically begins with a public announcement issued 20 working days in advance, providing basic information such as land use restrictions, reserve price, parcel size and location, etc. Any interested buyers must submit an application to gain access to more details with a cash deposit, usually about 5%-20% of the reserve price. The auction is fully public and is required to be videotaped. As in a standard ascending auction, bidders gather in a room and submit progressively higher bids; the bidder who offers the highest bid will win the land use rights with a specified term.

Listing (*Guapai*) Similar to a standard English auction, a listing process begins with a public announcement issued at least 20 weekdays in advance, including basic land information and the required deposit amount. What differs is that it is a two-stage auction. In the first stage, typically lasting about 10 weekdays, qualified participants submit ascending bids either in person or online. Bid prices are publicly updated in real time, though the identity of the bidders remains anonymous. If only one active bidder remains at the end of the first stage, the bidder automatically wins and acquires the land at their bid price. If multiple qualified bidders remain, then the process is converted to a standard English auction, using the highest first-stage bid as the new reservation price. In addition to the two-stage structure, another distinctive feature of listing is that only pre-qualified bidders are allowed to participate. These eligibility

requirements make the two-stage auction less market-oriented as some studies suggest that sometimes requirements are so strict that they are tailored to meet specific firms' qualifications that are closely tied to local governments, thereby reducing the degree of market competition. As a result, the listing occupied a middle ground between fully market-oriented and non-market allocation mechanisms.

Negotiation (*Xieyi*) The process of negotiation typically involves the following procedures. After the land user submits an application to the local Bureau of Natural Resources, a qualified appraisal agency will conduct a land price valuation. Then, collectively with the local government, the land bureau determines the transfer price based on the valuation which, in principle, must not be lower than the minimum stipulated price. Then the agreed transfer result is publicly disclosed, and after the disclosure period, a formal land-use right transfer contract is signed.

Land Contributed as Capital or Equity Stake (*Zuojia Chuzi/Rugu*) In this arrangement, land use rights are injected into a company or project as a form of capital contribution or equity. This typically occurs when the government or a state-owned enterprise provides land to participate in the ownership or profits of a project, instead of transferring land through a direct sale.

Administrative Allocation (*Xingzheng Huabo*) This refers to the non-market allocation of land by the government, typically at no cost, for specific public interest purposes such as infrastructure, education, public utilities, or government facilities. The land remains publicly owned and is not traded through competitive bidding.

Authorized Operation (*Shouquan Jingying*): In this case, the government authorizes an enterprise to use and manage a piece of land for a certain period without transferring ownership. The enterprise may develop, lease, or operate on the land, but the underlying land rights remain with the state. This is commonly used in the context of industrial parks or public-private partnerships.

Land Leasing (*Tudi Zulin*) Instead of selling land use rights, the government leases them to enterprises for a fixed term, often 20, 30, or 50 years. During the lease period, the enterprise has the right to use the land for agreed-upon purposes. Leasing allows for more flexible and temporary arrangements, especially in cases where full transfer of land rights is not desirable.

A.4 Land Characteristics Measures

A.4.1 Land Quality Measure

Land is classified into fifteen levels, with higher levels generally indicating either lower relative land quality or location in economically less developed areas. In addition, some parcels are designated as “unassessed areas”, which typically refer to land located on the urban fringe, newly listed rural collective land, or plots in newly developed industrial parks. These areas have not yet been incorporated into the formal land evaluation system. The sample includes all land from level one to level fifteen, including the “unassessed land”.

A.4.2 Land Source

Newly Designated Construction Land: Refers to land newly converted from agricultural or other non-construction uses into construction land, through land use planning and official approval procedures. Typically, this type of land requires land acquisition, compensation to original users, and installation of basic infrastructure before development. Usually, the land is located in suburban or newly developed areas; therefore, the land price may be lowered due to its disadvantaged location or underdeveloped infrastructure. However, the price may involve higher land preparation and development costs.

New Construction Land from the Inventory Pool Refers to construction land that has been approved for development in previous years but has not yet been released to the market, and is stored in the “inventory pool” under the land quota management system. This type of land may be located in relatively more developed areas than newly designated land, and development conditions are often more mature.

Existing Construction Land: Refers to land that was previously developed and used and is now re-entering the market.

A.5 A Typical Transaction Record

The document attached shows what a typical land transaction record looks like.

供地结果信息													
location: province-prefecture-county													
行政区：		甘肃省庆阳市镇原县			电子监管号：		6210272010B00158						
项目名称：		拍卖出让镇原县金龙工业集中区国有土地使用权											
项目位置：		镇原县金龙工业集中区											
土地面积(m)：		28200.00		area(m^2)									
土地用途：		工业用地			designated use		供地方式：		拍卖出让		transaction method		
土地使用年限：		50		leasing term (year)			行业分类：		废弃资源和废旧材料回收加工业				
土地级别：		十四等级		land-quality tier			成交价格(万元)：		296.2		total price (10,000 yuan)		
分期支付约定：		支付期号			约定支付日期			约定支付金额			备注		
土地使用权人：		庆阳凯迪塑业有限公司											
约定容积率：		下限：		0.8		上限：				约定交地时间：		2010-10-15	
约定开工时间：		2010-10-16				约定竣工时间：		2011-06-01					
实际开工时间：		--				实际竣工时间：		--					
批准单位：		镇原县				合同签订日期：		2010-10-15					

*以上数据信息以原始国有建设用地使用权出让合同或国有建设用地划拨决定书等为准

A.6 Rural Migrants' Destination and Sectoral Share Estimation

I use the sampling weights to estimate the joint distribution of employed rural migrants across destination prefectures and sectors. In particular, each year the share of rural migrants working in prefecture j and sector k is calculated as

$$\omega_{k,j}^{\text{CMDS}} = \frac{\sum_i \text{weight}_i \mathbf{1}\{\text{dest}_i = j, \text{rural hukou}_i = 1, \text{migration}_i = 1, \text{sector}_i = k\}}{\sum_i \text{weight}_i \mathbf{1}\{\text{rural hukou}_i = 1, \text{migration}_i = 1, \text{sector}_i \in \{m, s\}\}}$$

In 2010, the number of out-migrating rural workers is reported to be approximately 153.35 million²⁰. I then estimate the number of rural migrants employed by prefecture and sector as

$$N_{m,j}^{R,\text{data}} = \omega_{m,j}^{\text{CMDS}} \times N_{\text{mig}}^{R,MS}, \quad N_{s,j}^{R,\text{data}} = \omega_{s,j}^{\text{CMDS}} \times N_{\text{mig}}^{R,MS}$$

where $N_{\text{mig}}^{R,MS}$ is the adjusted total number of rural migrants employed in non-agricultural sectors:

$$N_{\text{mig}}^{R,MS} = 153.35\text{million} \times \Pr(k \in \{m, s\} | \text{migrate} = 1)$$

²⁰According to the *Statistical Communiqué of the People's Republic of China on the 2010 National Economic and Social Development*, the rural labor force was approximately 393.62 million, of whom 153.35 million migrated to work in urban prefectures. I therefore target an aggregate rural-urban migration rate of $\frac{153.35}{393.62} = 0.39$.

Urban employment is then measured residually

$$N_{m,j}^{U,\text{data}} = N_{m,j}^{\text{data}} - N_{m,j}^{R,\text{data}}, \quad N_{s,j}^{U,\text{data}} = N_{s,j}^{\text{data}} - N_{s,j}^{R,\text{data}}$$

The urban manufacturing employment share used to discipline urban sectoral preferences is therefore

$$\pi_{m|j}^{\text{data}} = \frac{N_{m,j}^{U,\text{data}}}{N_{m,j}^{\text{data}}}$$

An analogous expression is used for rural migrants' sectoral employment.

B Additional Figures

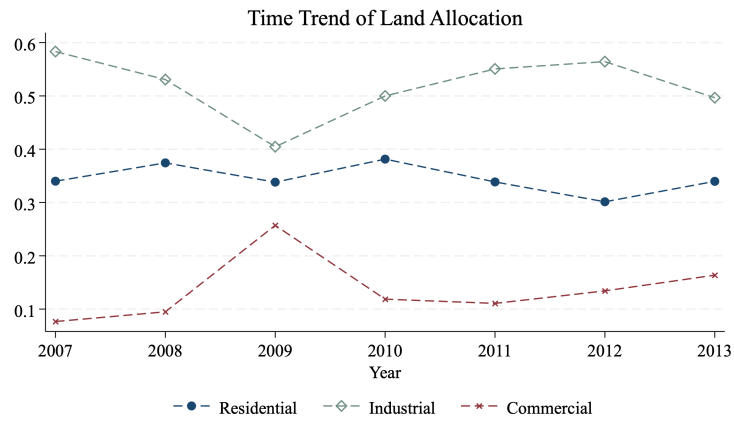


Figure B.1: Land Use Shares over Time

Notes: The figure reports annual shares of land transacted for residential, industrial, and commercial uses during 2007-2013. Each share is calculated as the area transacted nationwide for a given use divided by the combined nationwide area transacted for these three uses in the same year. With the exception of 2009, the shares remain relatively stable over time.

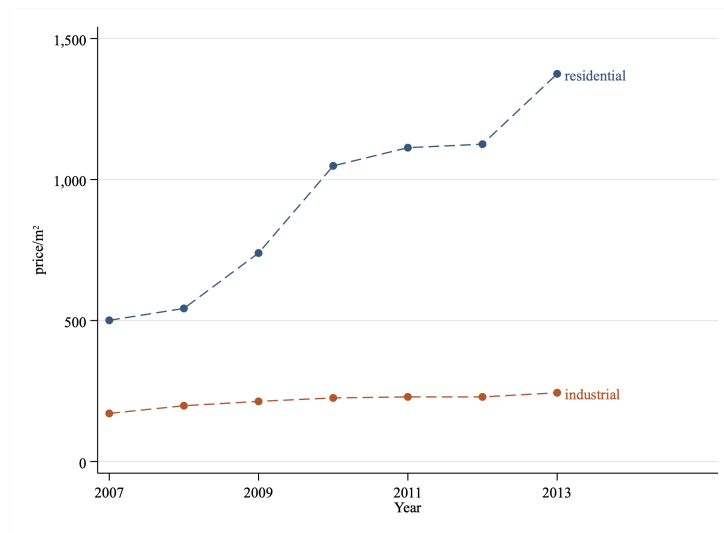
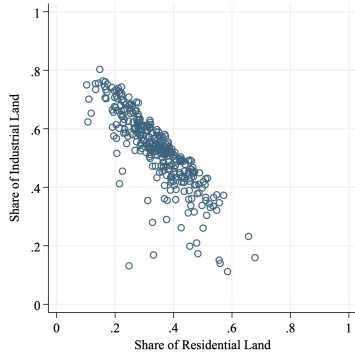
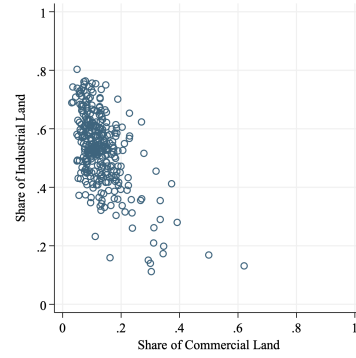


Figure B.2: Residential vs. Industrial Land Prices over Time

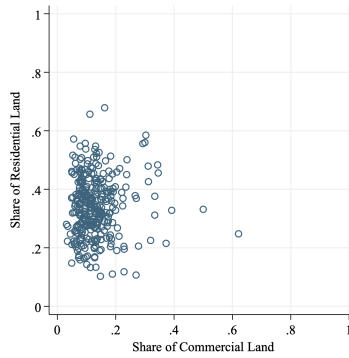
Notes: The figure reports annual mean transaction prices per square meter for residential and industrial land in 2007-2013. Prices are expressed in nominal yuan and are adjusted for lease length. Means are calculated using parcel area as the weight.



(a) Industrial vs. Residential



(b) Industrial vs. commercial



(c) Residential vs. Commercial

Figure B.3: Land Use Tradeoff

Notes: Each point represents a prefecture. Panels plot the shares of transacted land designated for industrial, residential, and commercial uses against one another. Each share is calculated as the area transacted within a prefecture for a given use divided by the combined prefecture area transacted for those three uses and is averaged over 2007-2013. Panel (a) shows a clear tradeoff between industrial and residential land use, while panel (b) and panel (c) indicate that the tradeoff is much weaker with commercial land.

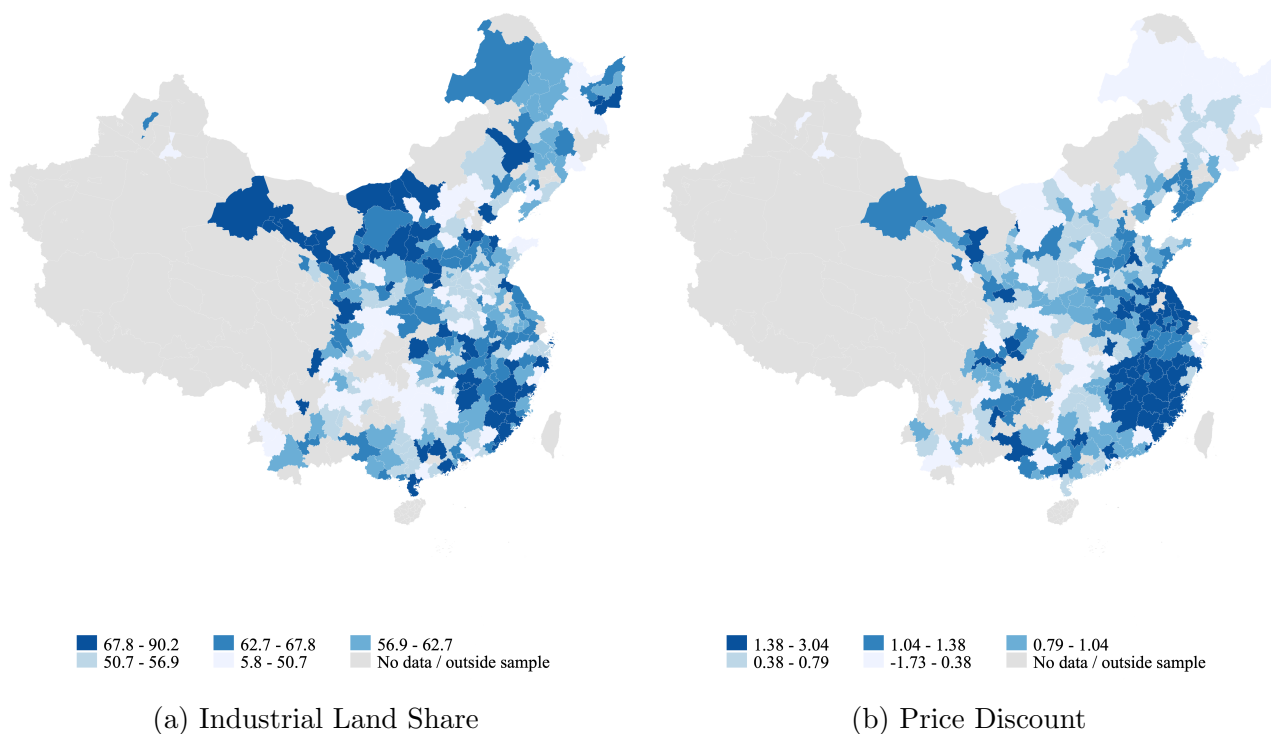


Figure B.4: Geographic Distribution of Industrial Land Shares and Price Discounts

Notes: Panel (a) maps industrial land's share of the combined area transacted for industrial and residential uses, averaged over 2007-2013. Panel (b) maps the estimated industrial land price discount. Prefectures are divided into quintiles separately for each measure; darker shades indicate higher values. Land shares in the legend are expressed as percentages, and discounts are expressed in log points. Gray areas indicate prefectures outside the sample or without data.

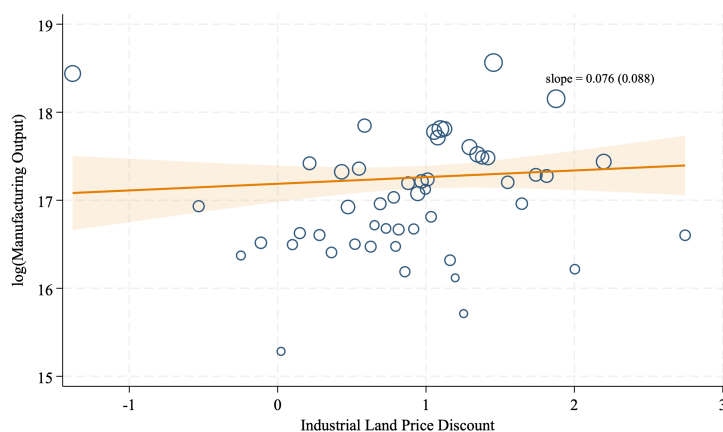


Figure B.5: Manufacturing Output and Industrial Land Price Discount

Notes: Prefectures are sorted by the estimated industrial land price discount, and divided into 50 approximately equal-sized bins. Each point reports the bin means of the discount and log manufacturing output. Output is measured in 2010 yuan and averaged over 2007-2013. The line and reported slope are estimated by OLS using the underlying prefecture-level observations. Shading denotes a 95% confidence band. Each prefecture receives equal weight.

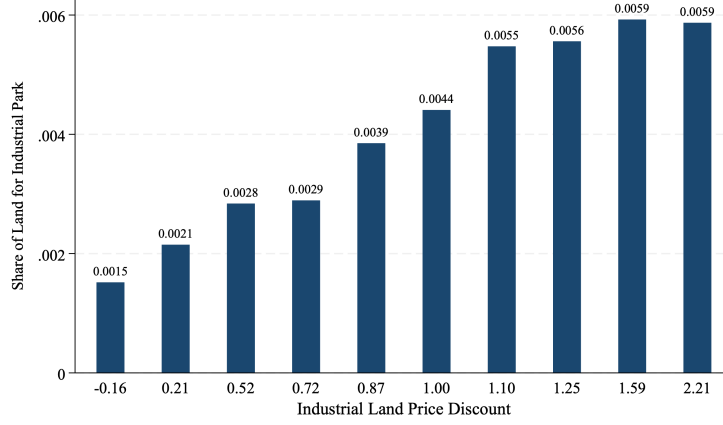


Figure B.6: Industrial Park Area across Industrial Land Price Discount Deciles

Notes: Prefectures are sorted by the estimated industrial land price discount, and divided into ten approximately equal-sized groups. Each bar reports the mean industrial park area divided by urban construction land area in its group. Groups are ordered from the smallest to largest discount. Industrial-park zone area is calculated by summing the approved areas of national- and provincial-level industrial parks within each prefecture. The data are from [Nie and Liu \(2022\)](#), who compile information from the 2006 and 2018 editions of the *China Development Zone Audit Announcement Catalogue*, jointly issued by the National Development and Reform Commission and other central government agencies. Zones below the provincial level are excluded. The reported share divides total approved development-zone area by the prefecture's total urban construction land area. Each bar is an unweighted mean within each group.

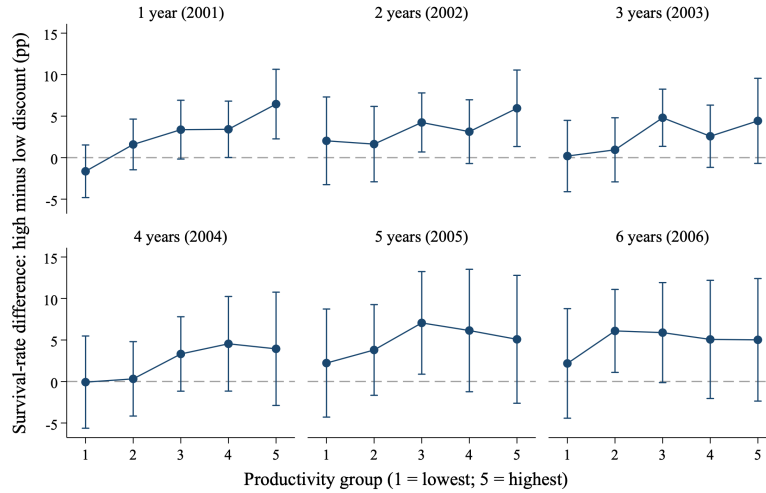


Figure B.7: Incumbent Survival Differences by Initial Productivity: 2000 Cohort

Notes: The sample consists of manufacturing firms operating in 2000. Firms are assigned to quintiles of their 2000 TFP using pooled rankings. Group 1 contains the least productive firms while group 5 contains the most productive firms. Prefectures are classified as high- or low-discount according to whether their estimated 2007-2013 industrial land price discount is above or below the median across prefecture samples. Each point reports the high-minus-low difference in survival rates for the corresponding productivity quintile, in percentage points. Panels report horizons of one to six years after 2000, covering 2001-2006. A firm is classified as surviving in year t if it is observed in the sample in a subsequent year. The sample is restricted to firms with annual sales revenue above RMB 20 million, so this measure captures continued sample presence above the sales threshold. Vertical bars denote 95% confidence intervals based on standard errors clustered at the prefecture level.

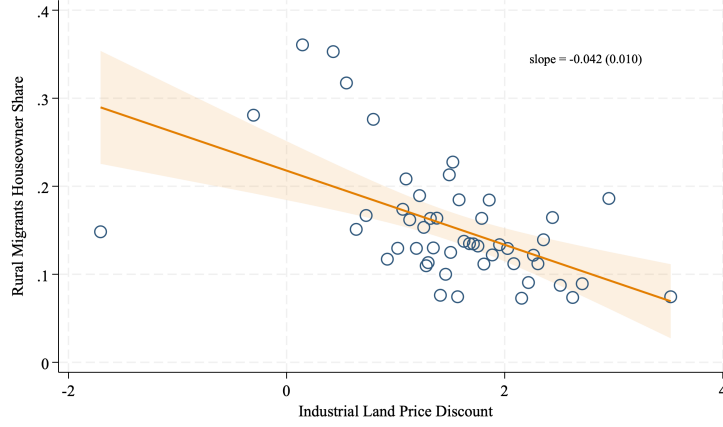


Figure B.8: Rural Migrants' Houseowner Share and Industrial Land Price Discount

Notes: Prefectures are sorted by the estimated industrial land price discount, and divided into 50 approximately equal-sized bins. Each point reports the bin means of the discount and share of rural migrants who own a house in their destination urban prefectures. Houseowner data come from the 2010 Population Census. The line and reported slope are estimated by OLS using the underlying prefecture-level observations. Shading denotes a 95% confidence band. Each prefecture receives equal weight.

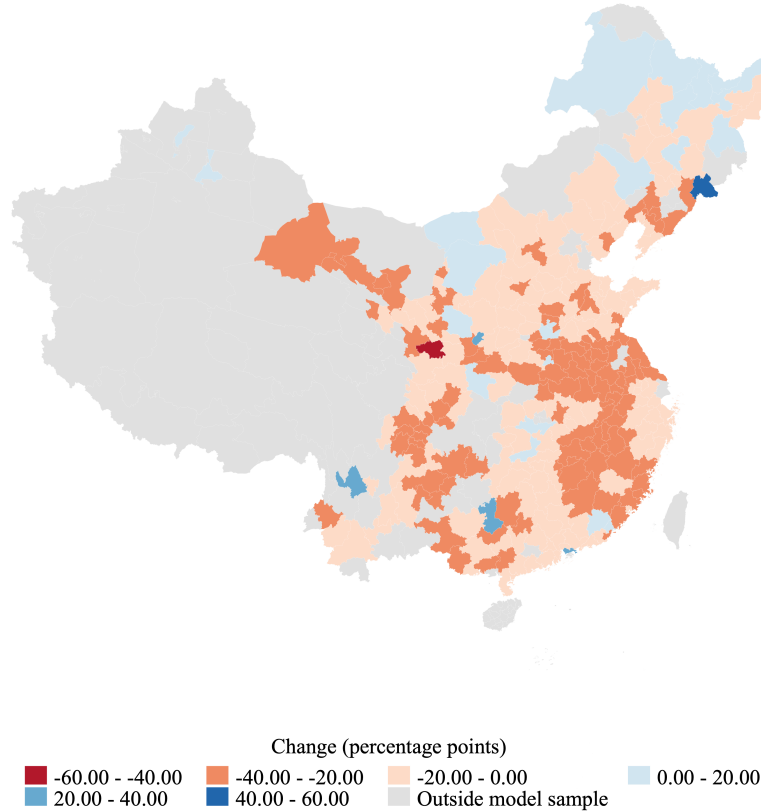


Figure B.9: Industrial Land Share Change: Competitive Local Land Market vs. Baseline

Notes: The map reports the change in each prefecture's industrial land share between the calibrated baseline and equal-price equilibrium, calculated as $100 [(L_{m,j}^{CF}/\bar{L}_j) - (L_{m,j}^B/\bar{L}_j)]$. Red shades indicate decreases and blue shades indicate increases; darker shades indicate larger absolute changes. Gray areas indicate locations without a mapped model value.

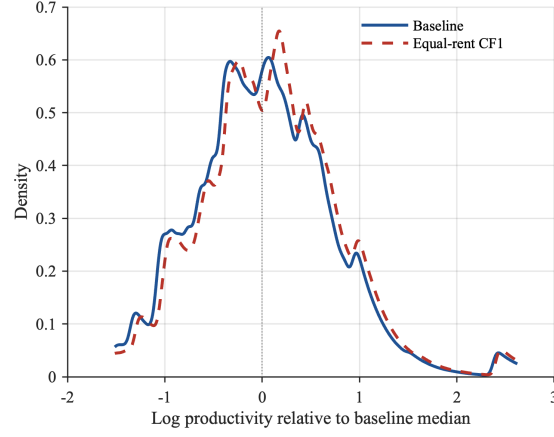
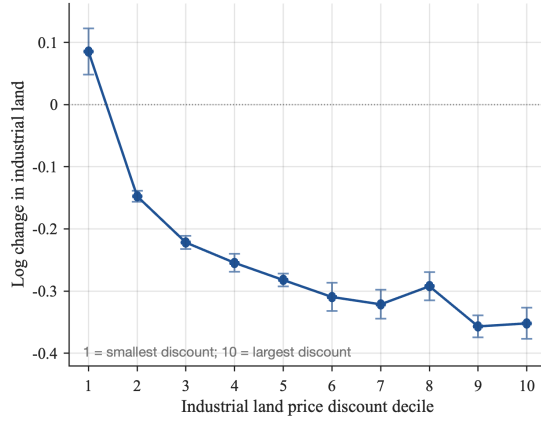
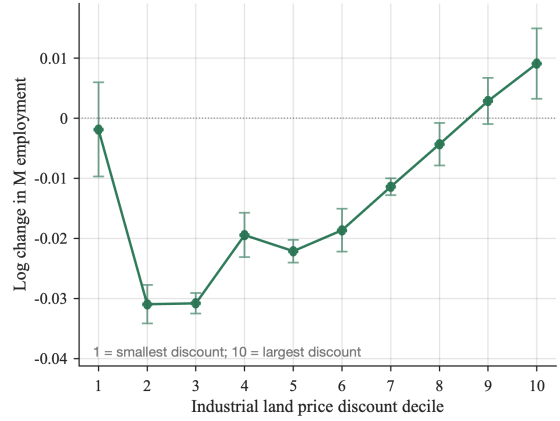


Figure B.10: Shifts in Productivity Distribution

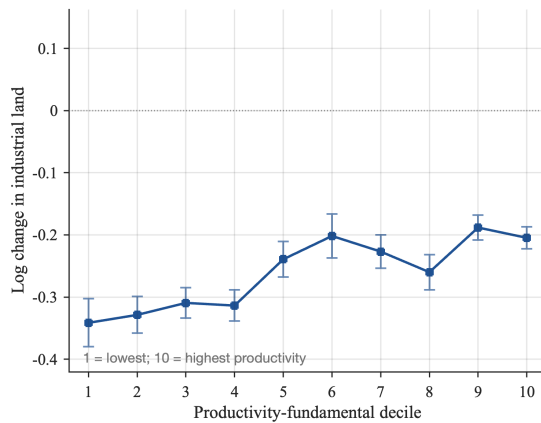
Notes: The figure compares firm productivity distributions in the calibrated baseline and equal-price equilibria. Productivity is expressed in logs relative to the baseline median. Solid and dashed lines denote the baseline and equal-price equilibria, respectively.



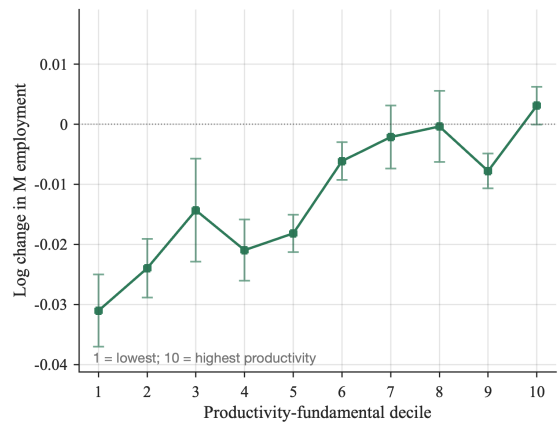
(a) Industrial Land vs. PD



(b) Manufacturing Employment vs. PD



(c) Industrial Land vs. $z_{\min}$



(d) Manufacturing Employment vs. $z_{\min}$

Figure B.11: Mechanism Distribution

Notes: Panels (a) and (b) group prefectures into deciles of the baseline industrial land price discount, from smallest to largest. Panels (c) and (d) instead use deciles of the calibrated productivity fundamental $z_{\min,j}$ from lowest to highest. Panels (a) and (c) report changes in log industrial land; panels (b) and (d) report changes in log manufacturing employment. All changes compare the equal-price equilibrium with the calibrated baseline. Horizontal zero lines indicate no change.

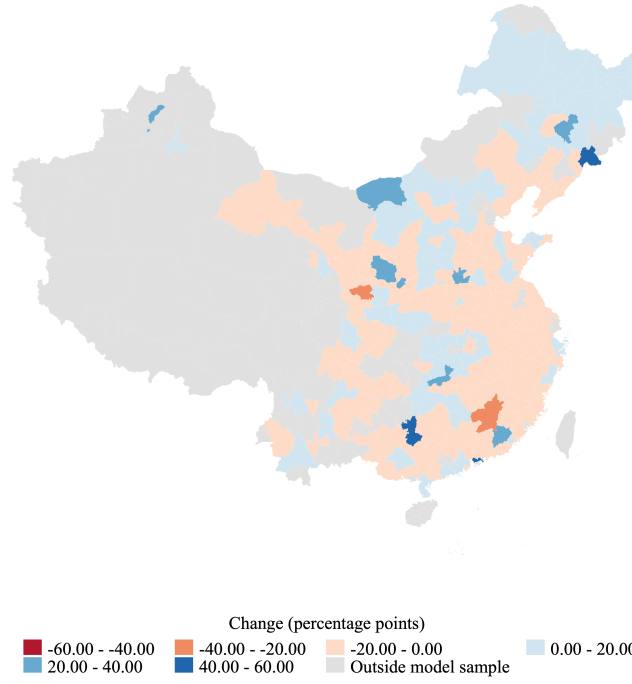


Figure B.12: Industrial Land Share Change: Output-Target vs. Baseline

Notes: The map reports the change in each prefecture's industrial land share between the calibrated baseline and output-target welfare-maximizing equilibrium, calculated as $100 [(L_{m,j}^{CF}/\bar{L}_j) - (L_{m,j}^B/\bar{L}_j)]$. Red shades indicate decreases and blue shades indicate increases; darker shades indicate larger absolute changes. Gray areas indicate locations without a mapped model value.

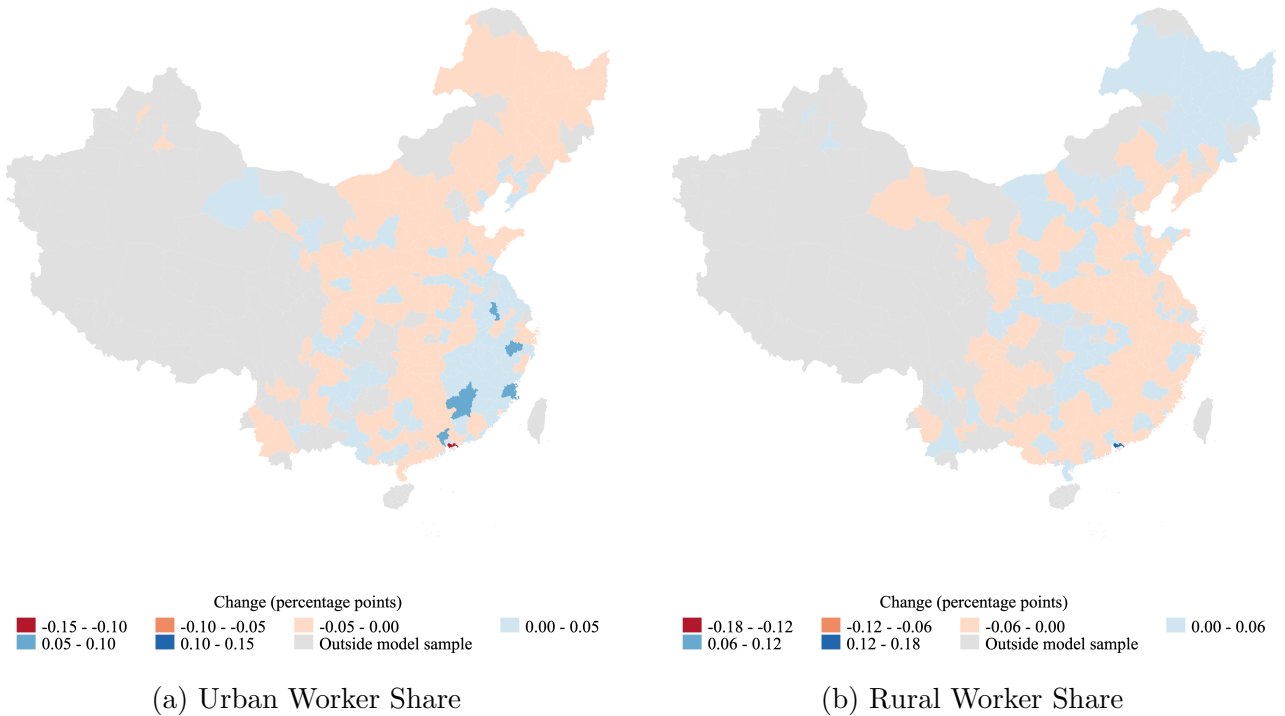


Figure B.13: Worker Reallocation: Output-Target vs. Baseline

Notes: The map reports the change in each prefecture's urban and rural workers' reallocation between the calibrated baseline and output-target welfare-maximizing equilibrium. Red shades indicate decreases and blue shades indicate increases; darker shades indicate larger absolute changes. Gray areas indicate locations without a mapped model value.

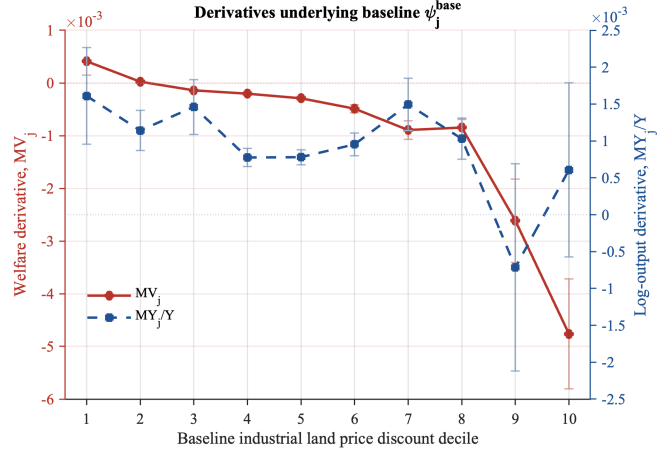


Figure B.14: Derivatives Underlying the Baseline Welfare Cost

Notes: Prefectures are grouped into deciles of the baseline industrial land price discount, from smallest to largest. The solid red series reports the welfare derivative $\partial W/\partial L_{m,j}$ on the left axis. The dashed blue series reports the output derivative $\partial Y/\partial L_{m,j}$ on the right axis. Here W is population-weighted log welfare and Y is national manufacturing output. Both derivatives incorporate general equilibrium adjustments.

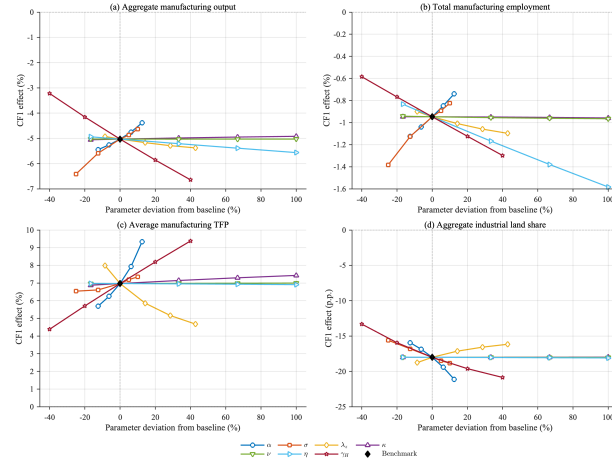


Figure B.15: Parameter Sensitivity: Production and Land Allocation

Notes: Each series varies one parameter over a five-point grid. At each value, the model is recalibrated to the same baseline data targets and the equal-price counterfactual is recomputed. The horizontal axis reports the parameter's percentage deviation from its baseline value. Panels (a)-(c) report percentage changes in manufacturing output, manufacturing employment, and average manufacturing TFP. Panel (d) reports the percentage point change in the national industrial land share. Changes are relative to the corresponding recalibrated baseline; diamonds mark the baseline parameter specification.

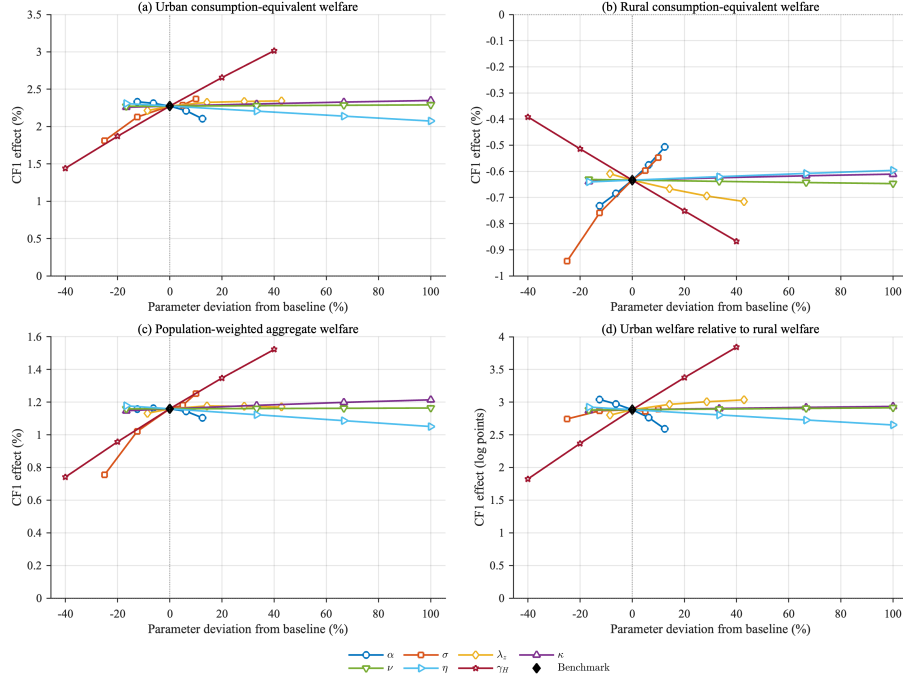


Figure B.16: Parameter Sensitivity: Welfare

Notes: Each series varies one parameter over a five-point grid. At each value, the model is recalibrated to the same baseline data targets and the equal-price counterfactual is recomputed. The horizontal axis reports the parameter's percentage deviation from its baseline value. Panels (a)-(c) report consumption-equivalent percentage changes in urban, rural, and population-weighted aggregate welfare. Panel (d) reports the percentage change in the urban-to-rural welfare ratio. Changes are relative to the corresponding recalibrated baseline; diamonds mark the baseline parameter specification.

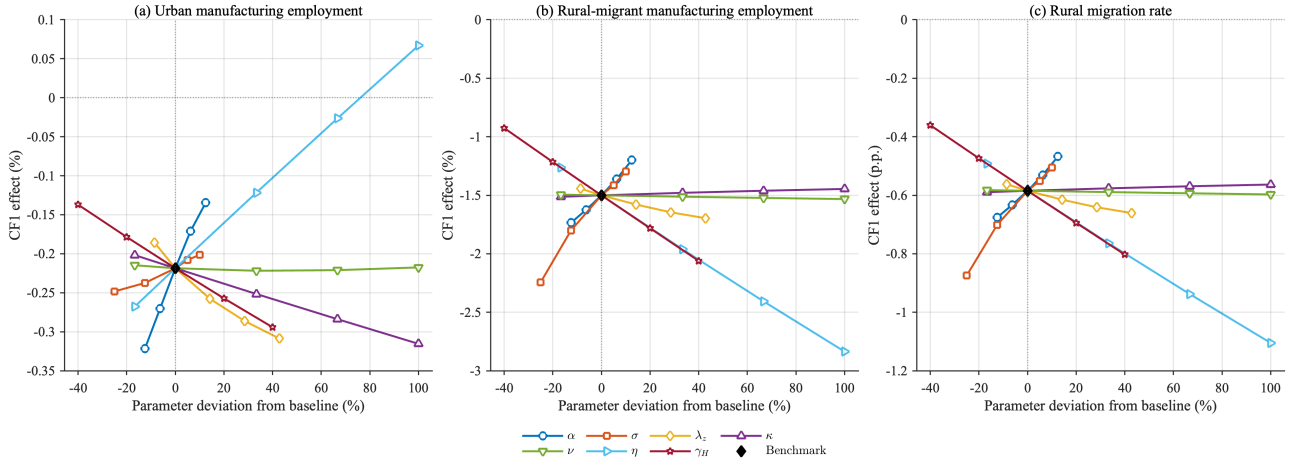


Figure B.17: Parameter Sensitivity: Employment and Migration

Notes: Each series varies one parameter over a five-point grid. At each value, the model is recalibrated to the same baseline data targets and the equal-price counterfactual is recomputed. The horizontal axis reports the parameter's percentage deviation from its baseline value. Panels (a) and (b) report percentage changes in urban and rural migrant manufacturing employment. Panel (c) reports the percentage point change in the rural migration rate. Changes are relative to the corresponding recalibrated baseline; diamonds mark the baseline parameter specification.

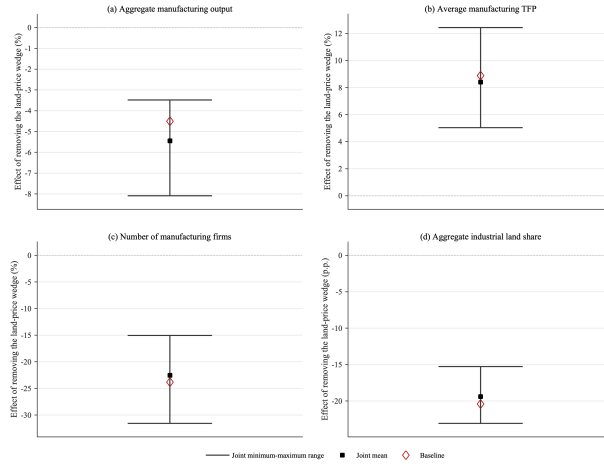


Figure B.18: Joint Parameter Sensitivity: Production and Land Allocation

Notes: The figure summarizes the equal-price counterfactual across the 16 joint parameter specifications. The model is recalibrated to the same baseline targets for each specification, and its equal-price counterfactual is recomputed. Vertical ranges show minima and maxima across specifications, squares their means, and diamonds the baseline specification. Panels (a)-(c) report percentage changes in manufacturing output, average TFP, and number of active firms. Panel (d) reports the percentage point change in the national industrial land share. Ranges describe parameter sensitivity.

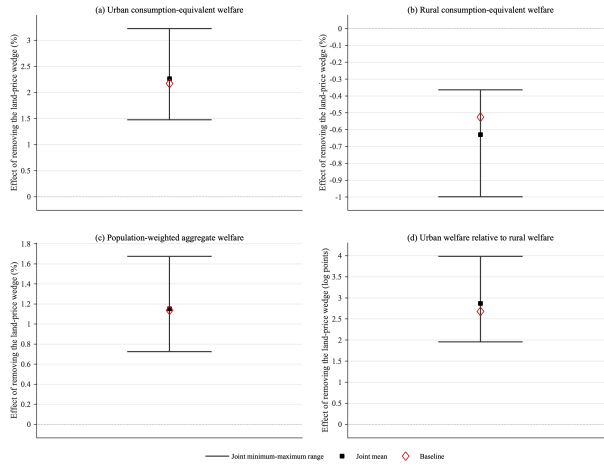


Figure B.19: Joint Parameter Sensitivity: Welfare

Notes: The figure summarizes the equal-price counterfactual across the 16 joint parameter specifications. The model is recalibrated to the same baseline targets for each specification, and its equal-price counterfactual is recomputed. Vertical ranges show minima and maxima across specifications, squares their means, and diamonds the baseline specification. Panels (a)-(c) report consumption-equivalent percentage changes in urban, rural and population-weighted aggregate welfare. Panel (d) reports the percentage change in the urban-to-rural welfare ratio. Ranges describe parameter sensitivity.

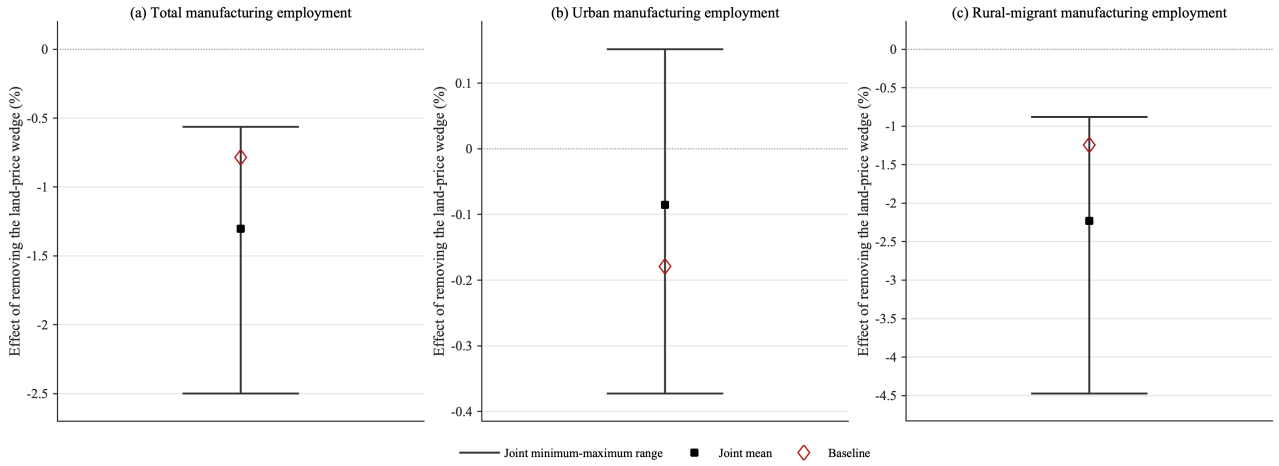


Figure B.20: Joint Parameter Sensitivity: Manufacturing Employment

Notes: The figure summarizes the equal-price counterfactual across the 16 joint parameter specifications. The model is recalibrated to the same baseline targets for each specification, and its equal-price counterfactual is recomputed. Vertical ranges show minima and maxima across specifications, squares their means, and diamonds the baseline specification. Panels report percentage changes in total manufacturing employment, urban manufacturing employment, and rural migrant manufacturing employment, relative to the corresponding recalibrated baseline. Ranges describe parameter sensitivity.

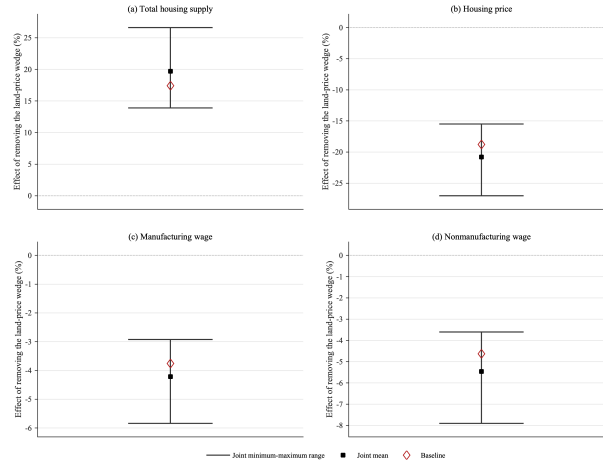


Figure B.21: Joint Parameter Sensitivity: Housing and Wage

Notes: The figure summarizes the equal-price counterfactual across the 16 joint parameter specifications. The model is recalibrated to the same baseline targets for each specification, and its equal-price counterfactual is recomputed. Vertical ranges show minima and maxima across specifications, squares their means, and diamonds the baseline specification. Panels report percentage changes in total housing supply, housing-service prices, manufacturing wages, and local service wages, relative to the corresponding recalibrated baseline. Ranges describe parameter sensitivity.

C Additional Tables

Table C.1: Selected Measures of Industrial Land Share

Country	Share (%)	Measure and coverage	Source
<i>Panel A. Land-use stock measures</i>			
United States (2019)	19.5	Satellite-mapped industrial built-up area divided by mapped industrial plus nonindustrial built-up area; national coverage.	Calculated from Yoo et al. (2024) , Fig. 2 and accompanying text.
Singapore	≈ 16	Combined industrial and commercial land divided by built-up land; national coverage, using the MND (2013) source compiled in the report.	World Bank (2015) , pp. 23–24, Table 2-1 and Fig. 2-13.
Malaysia (2008–2010)	10–13	Industrial land divided by built-up land in four selected conurbations; range across cities, not a national average.	World Bank (2015) , p. 24, Fig. 2-13 and discussion.
<i>Panel B. Statutory zoning measures</i>			
Japan (2025)	24.9	Industrial, exclusively industrial, and quasi-industrial zones divided by all designated use-zone land; national coverage.	Calculated from MLIT (2025) , Overview, p. 3.
South Korea (2017)	23.6	Industrial zoning divided by urban zoning excluding green zones; undesignated urban zones remain in the denominator; national coverage.	Calculated from OECD (2019) , Table 1.2.
<i>Panel C. Indicative planning guidelines</i>			
India (2014 guidelines)	7–10	Recommended industrial allocation as a share of developed area in ordinary urban centres; range varies by city-size category.	Ministry of Urban Development (2014) , Table 5.2, p. 141.
India (2014 guidelines)	30–35	Recommended industrial allocation as a share of developable area in specialized industrial towns.	Ministry of Urban Development (2014) , Table 5.6, p. 167.

Notes: The table reports industrial land indicators with their definitions, dates, geographic coverage, and sources for selected countries. Panel A reports land-use stocks, Panel B statutory zoning, and Panel C planning guidelines. These measures have different denominators and should be interpreted using the definitions in each row. The satellite-based shares for the US are calculated as $100 \times IND/(IND + NIND)$, using the reported areas: $IND = 22,366$ and $NIND = 92,506$ km². Singapore’s category combines industrial and commercial land. The Malaysian range covers Greater Kuala Lumpur, Johor Bahru, George Town, and Kota Kinabalu. Excluding quasi-industrial zones gives a Japanese share of 13.9%; including green zones in the denominator gives a Korean share of 6.7%. India’s figures are recommended allocations rather than observed shares.

Table C.2: Characteristics of Residential and Industrial Land Transactions

Characteristic	Residential Mean	Industrial Mean	Within-prefecture Ind. minus res.
Panel A. Physical characteristics and location			
Distance to city center (km)	14.99	19.26	2.25
Distance percentile within prefecture-year	47.3	54.3	10.7
Elevation (m)	341.30	193.97	-0.74
Slope	5.55	4.28	0.15
Panel B. Land-quality tiers			
Unassessed (%)	7.2	13.7	6.4
Tier 1 (%)	23.5	11.5	-8.5
Tier 2 (%)	16.6	7.0	-8.4
Tier 3 (%)	18.0	13.4	-1.9
Tier 4 (%)	9.4	12.5	2.8
Tier 5 (%)	4.1	7.4	3.4
Tiers 6–10 (%)	7.8	17.0	3.2
Tiers 11–15 (%)	13.4	17.4	3.1
Panel C. Transaction methods			
Apportion (%)	2.4	0.6	-2.7
Negotiation (%)	54.9	16.9	-6.6
Auction (%)	10.8	4.2	-12.4
Bidding (%)	0.9	0.9	-0.5
Listing (%)	30.9	77.2	22.1
Panel D. Land sources			
Newly developed land (%)	30.2	74.6	28.3
Existing construction land (%)	69.8	25.4	-28.3
Number of Parcels	396,764	242,937	–

Notes: The sample contains 396,764 residential and 242,937 industrial parcel transactions in 2007-2013. The first two columns report pooled parcel means or category shares for each land use. The third column reports the mean of industrial-minus-residential differences within prefecture-year cells. Differences in category shares and distance percentiles are expressed in percentage points; differences in other continuous characteristics retain the units shown in the row labels. The unit of slope is degrees.

Table C.3: Correlation among Firm Productivity Measures

	Labor prod.	Solow resid.	ACF	LP
Labor prod.	1.000	0.763	0.711	0.708
Solow resid.	0.772	1.000	0.691	0.755
ACF	0.731	0.700	1.000	0.697
LP	0.712	0.759	0.712	1.000
Lower triangle: Pearson correlation; upper triangle: Spearman rank correlation. N = 916,732.				

Notes: The table reports pairwise correlations among log output per worker and three TFP measures: the Solow residual and the measures of [Levinsohn and Petrin \(2003\)](#) and [Akerberg et al. \(2015\)](#). The lower triangle reports Pearson correlations and the upper triangle Spearman rank correlations. Correlations are calculated using the common sample of 916,732 observations in 2007-2013, subject to the restrictions in Section 3.2.

Table C.4: Correlation among Prefecture Productivity Measures

	Solow resid.	ACF	LP
Solow resid.	1.000	0.958	0.941
ACF	0.962	1.000	0.948
LP	0.953	0.957	1.000
Lower triangle: Pearson correlation; upper triangle: Spearman rank correlation.			

Notes: The table reports correlations among prefecture-level averages of the Solow residual and the measures of [Levinsohn and Petrin \(2003\)](#) and [Akerberg et al. \(2015\)](#). Prefecture averages are constructed using employment-weighted firm-level measures over 2007-2013. The lower triangle reports Pearson correlations and the upper triangle Spearman rank correlations across 276 prefectures.

Table C.5: Distribution of Estimated Industrial Land Price Discount

Statistic	Value
Panel A. Distribution across prefectures	
Number of prefectures	276
Mean	0.886
Standard deviation	0.695
10th percentile	0.043
25th percentile	0.516
Median	0.931
75th percentile	1.295
90th percentile	1.765
Panel B. Shares of prefectures (%)	
Positive estimated discount	91.3
Estimated discount above pooled national estimate (0.99)	45.3
Individual 95% confidence interval entirely above zero	76.4

Notes: This table summarizes industrial land price discounts estimated from 2007-2013 transactions using equation (2) for the 276 prefectures in the main sample. Each prefecture receives equal weight. Panel A reports the distribution in log points. Panel B reports the percentages of prefectures with a positive discount, a discount above the pooled estimate from Table 3, column (3), and a 95 percent confidence interval entirely above zero. Confidence intervals are based on standard errors clustered at the county level.

Table C.6: Income and Expenditure of Rural Migrant Manufacturing Workers

Year	Family Income	Local Expenditure	Rent	Share Paying Rent	Implied ρ	Implied β_h^R
2011	3916.13	1642.85	296.72	0.71	0.420	0.127
2012	4718.10	1942.93	318.03	0.71	0.412	0.116
2013	5133.04	2124.38	334.62	0.76	0.414	0.120
Mean					0.415	0.121

Notes: The sample consists of rural migrants employed in urban manufacturing in the 2011-2013 CMDS using survey weights. Income and local expenditure are monthly household amounts. Rent is the mean monthly payment conditional on paying positive rent. “Share paying rent” reports the fraction with positive rent payments. The implied destination expenditure share is calculated as $\rho = \frac{\text{Local Expenditure}}{\text{Family Income}}$; the implied housing share is calculated as $\beta_h^R = \frac{\text{Rent}}{\text{Local Expenditure}} \times \text{Share Paying Rent}$. The final row reports the equally weighted average of the three annual parameter estimates.

Table C.7: Output and Aggregate Land Target Welfare-maximizing Allocation

<i>Panel A. Manufacturing output and its components</i>						
	Agg mfg output	Manufacturing employment			Output per worker	avg TFP
		Total	No. firms	Avg firm size		
Effect (%)	0	+0.25	−1.95	+2.26	−0.25	+0.47
<i>Panel B. Employment, land allocation, and migration</i>						
	Urban mfg emp	Rural-migrant mfg emp	Agg ind land share	Rural migration rate		
Effect	+0.24%	+0.26%	0 by construction	0.10 p.p.		
<i>Panel C. Welfare</i>						
	Aggregate welfare	Urban welfare			Rural welfare	
Effect	+0.82%	+1.26%			+0.11%	

Notes: The table reports changes from the calibrated baseline to the planner allocation that maximizes population-weighted welfare such that both aggregate manufacturing output and national industrial land equal their observed data baselines. The land allocation is assumed to be the only policy instrument. Production outcomes in Panel A and the employment outcomes in Panel B are ordinary percentage changes. Changes in industrial land share and rural migration rate are reported in percentage points. Panel C reports consumption-equivalent welfare changes. Average manufacturing TFP is constructed using the model-consistent CES aggregator. Average firm size is manufacturing employment per active firm.

D Model Derivations

D.1 Selection, Stationary Firm Moments, and Aggregation

With operating profit $\pi_j(z) = \mathcal{R}_j(z)/\sigma - r_{m,j}l_{m,j}^0$, the zero-profit condition implies

$$z_j^* = \frac{\sigma}{\sigma-1} c_{I,j} \left(\frac{\sigma r_{m,j} l_{m,j}^0}{E_m} \right)^{1/(\sigma-1)}. \quad (18)$$

Define $\underline{z}_j = \max\{z_j^*, z_{\min,j}\}$ as the lowest productivity of active firms in prefecture j . For $b \in \{0, \sigma-1\}$, define

$$I_{b,j} = \int_{\underline{z}_j}^{\infty} z^b \frac{g_j(z)}{\delta_j(z)} dz. \quad (19)$$

A stationary distribution implies inflows exactly balance exits: $M_j \mu_j(z) \delta_j(z) = M_{e,j} g_j(z)$.

Therefore,

$$\frac{M_{e,j}}{M_j} = \frac{1}{I_{0,j}}, \quad \mu_j(z) = \frac{g_j(z)/\delta_j(z)}{I_{0,j}}. \quad (20)$$

Thus, active firms are weighted by expected operating duration. The mean revenue of active firms is

$$\overline{\mathcal{R}}_j = E_m \left(\frac{\sigma}{\sigma-1} c_{I,j} \right)^{1-\sigma} \frac{I_{\sigma-1,j}}{I_{0,j}}. \quad (21)$$

Combining the standard variable-factor shares with the fixed operating land and entry labor requirements yields

$$M_j = \frac{L_{m,j}}{l_{m,j}^0 + (1-\alpha) \frac{\sigma-1}{\sigma} \frac{\overline{\mathcal{R}}_j}{r_{m,j}}}, \quad (22)$$

$$N_{m,j}^U + N_{m,j}^R = M_j \left[\alpha \frac{\sigma-1}{\sigma} \frac{\overline{\mathcal{R}}_j}{w_{m,j}} + \frac{c_{e,j}}{I_{0,j}} \right]. \quad (23)$$

The second term in brackets counts manufacturing labor used for entry. The CES mean productivity within prefecture j is $\tilde{z}_j = (I_{\sigma-1,j}/I_{0,j})^{1/(\sigma-1)}$; its national counterpart is $\tilde{z} = [\sum_j M_j \tilde{z}_j^{\sigma-1} / \sum_j M_j]^{1/(\sigma-1)}$.

The mean exit rate is $\bar{\delta}_j = [1 - G_j(\underline{z}_j)]/I_{0,j}$, equal to successful entry relative to the active mass. Substituting the stationary density into aggregate profits and the free entry condition gives

$$M_j \int_{\underline{z}_j}^{\infty} \pi_j(z) \mu_j(z) dz = M_{e,j} \int_{\underline{z}_j}^{\infty} \frac{\pi_j(z)}{\delta_j(z)} g_j(z) dz = w_{m,j} c_{e,j} M_{e,j}. \quad (24)$$

Successful entry equals exit in stationarity, while aggregate operating profits after paying for

the fixed land requirement finance entry labor. For a stationary incumbent cohort, survival after t periods is $S_j(t) = \int_{\underline{z}_j}^{\infty} [1 - \delta_j(z)]^t \mu_j(z) dz$.

D.2 Local Markets and the Land-Revenue Transfer

Local Service Sector Recall that urban labor income and expenditure are $I_j^U = w_{m,j}N_{m,j}^U + w_{s,j}N_{s,j}^U + TN_j^U$, and rural migrants' destination expenditure is $E_j^R = \rho w_{m,j}N_{m,j}^R$. Substituting these budgets into local service market clearing gives the service sector wage rate

$$w_{s,j} = \frac{\beta_s(w_{m,j}N_{m,j}^U + TN_j^U) + \beta_s^R E_j^R}{(1 - \beta_s)N_{s,j}^U}. \quad (25)$$

Local Housing Market Housing expenditure is $E_{h,j} = \beta_h I_j^U + \beta_h^R E_j^R$. The standard cost-share conditions imply $K_{h,j} = (1 - \gamma_h)E_{h,j}/R_K$ and $r_{h,j} = \gamma_h E_{h,j}/L_{h,j}$. Substitution into housing production then gives the housing price

$$p_{h,j} = \frac{R_K^{1-\gamma_h}}{z_{h,j}(1 - \gamma_h)^{1-\gamma_h}} \left(\frac{E_{h,j}}{L_{h,j}} \right)^{\gamma_h}. \quad (26)$$

Land Revenue Transfer The transfer must account for different expenditure shares across worker groups and for the part of housing revenue paid to residential land. Define

$$A_U = \sum_j w_{m,j}N_{m,j}^U, \quad A_R = \sum_j w_{m,j}N_{m,j}^R, \quad R_M = \sum_j r_{m,j}L_{m,j}.$$

Using (25), aggregate housing expenditure becomes

$$\sum_j E_{h,j} = \frac{\beta_h}{1 - \beta_s} (A_U + T\bar{N}^U) + \left(\beta_h^R + \frac{\beta_h \beta_s^R}{1 - \beta_s} \right) \rho A_R. \quad (27)$$

Substituting this expression into $T\bar{N}^U = R_M + \gamma_h \sum_j E_{h,j}$ yields

$$T = \frac{R_M + a_h A_U + b_h \rho A_R}{(1 - a_h)\bar{N}^U}, \quad \text{where } a_h = \frac{\gamma_h \beta_h}{1 - \beta_s}, \quad b_h = \gamma_h \left(\beta_h^R + \frac{\beta_h \beta_s^R}{1 - \beta_s} \right). \quad (28)$$

D.3 Finiteness of Firm-Side Aggregates

At finite positive prices, revenue and variable input demands are proportional to $z^{\sigma-1}$. Since $0 < \delta_{\min} \leq \delta_j(z) \leq \delta_{\max} < 1$,

$$\frac{1}{\delta_{\max}} \int_{\underline{z}_j}^{\infty} z^{\sigma-1} g_j(z) dz \leq I_{\sigma-1,j} \leq \frac{1}{\delta_{\min}} \int_{\underline{z}_j}^{\infty} z^{\sigma-1} g_j(z) dz. \quad (29)$$

For Pareto productivity, the integrand is proportional to $z^{\sigma-\lambda_z-2}$, so these moments are finite if and only if $\lambda_z > \sigma - 1$. Moreover, $M_j l_{m,j}^0 \leq L_{m,j} \leq \bar{L}_j$ bounds the mass of active firms, and (20) bounds the entry flow. Thus the same restriction guarantees finite firm-side revenue and labor-demand aggregates in a feasible equilibrium with positive production.

D.4 Nested Choice Formulation and Joint-Choice Equivalence

The general nested formulation permits two distinct margins of adjustment: the sectoral reallocation governed by ν , and a spatial reallocation governed by κ with different elasticities. Baseline employment shares identify the sector and location scale parameters conditional on ν and κ , but do not separately identify both shape parameters. The baseline quantitative implementation therefore imposes the parsimonious restriction $\nu = \kappa$; then the joint probability of choosing pair (k, j) simplifies to

$$\pi_{k,j}^U = \pi_j^U \pi_{k|j}^U = \frac{B_j A_{k,j}^U (V_{k,j}^U)^\kappa}{\sum_{j=1}^J \sum_{r \in \{m,s\}} B_j A_{r,j}^U (V_{r,j}^U)^\kappa} \quad (30)$$

which is equivalent to a single Fréchet choice over all prefecture–sector pairs, with a pair-specific scale parameter $B_j A_{k,j}^U$. Keeping the nested formulation remains useful because it separates a prefecture’s general attractiveness B_j from its sector-specific employment shifters, $A_{k,j}^U$, and permits robustness exercises with $\nu \neq \kappa$.

E Computational Details and Solution Algorithms

E.1 Productivity Integration

The firm block requires integrals over an unbounded productivity distribution. Let $s_j^e = 1 - G_j(\underline{z}_j) = (z_{\min,j}/\underline{z}_j)^{\lambda_z}$ be the probability of successful entry. The change of variable $z = \underline{z}_j/(1 - u)$, with $0 \leq u < 1$, gives $g_j(z) dz = s_j^e \lambda_z (1 - u)^{\lambda_z - 1} du$. Consequently,

$$I_{b,j} = s_j^e \lambda_z \underline{z}_j^b \int_0^1 \frac{(1 - u)^{\lambda_z - b - 1}}{\delta_j(\underline{z}_j/(1 - u))} du. \quad (31)$$

For numerical evaluation, use m equally spaced nodes u_n from zero to $1 - \varepsilon_q$, where $\varepsilon_q > 0$ controls the upper-tail truncation. Let t_n be the trapezoidal weights: half the grid spacing at the two endpoints and the full spacing at interior nodes. Define

$$z_{nj} = \frac{\underline{z}_j}{1 - u_n}, \quad \omega_{nj}^q = s_j^e \lambda_z t_n (1 - u_n)^{\lambda_z - 1}. \quad (32)$$

The required moments and free-entry value are then approximated by

$$I_{b,j} \simeq \sum_n \omega_{nj}^q \frac{z_{nj}^b}{\delta_j(z_{nj})}, \quad \int_{\underline{z}_j}^{\infty} v_j(z) g_j(z) dz \simeq \sum_n \omega_{nj}^q \frac{\pi_j(z_{nj})}{\delta_j(z_{nj})}. \quad (33)$$

Free entry equates the second expression to $w_{m,j} c_{e,j}$. Define normalized duration-adjusted weights as

$$\omega_{nj}^a = \frac{\omega_{nj}^q / \delta_j(z_{nj})}{\sum_r \omega_{rj}^q / \delta_j(z_{rj})}. \quad (34)$$

Average firm productivity in prefecture j is

$$\tilde{z}_j \simeq [\sum_n \omega_{nj}^a z_{nj}^{\sigma - 1}]^{1/(\sigma - 1)}$$

and revenue of firms with average productivity $\tilde{z}_j$ in prefecture j is

$$\overline{\mathcal{R}}_j \simeq \sum_n \omega_{nj}^a \mathcal{R}_j(z_{nj})$$

The unbounded upper tail is controlled by ε_q . Denote by $I_{b,j}^{\varepsilon_q}$ the integral truncated at $u = 1 - \varepsilon_q$; then

$$0 \leq I_{b,j} - I_{b,j}^{\varepsilon_q} \leq \frac{s_j^e \lambda_z \underline{z}_j^b}{\delta_{\min}(\lambda_z - b)} \varepsilon_q^{\lambda_z - b}. \quad (35)$$

The revenue moment converges more slowly when λ_z is close to $\sigma - 1$. Integration accuracy is assessed by refining the grid and reducing ε_q .

E.2 Marginal Welfare and Output from Industrial Land

This section derives the marginal welfare and marginal aggregate output utilized for solving the planner's problem. For these derivatives, industrial land quantities are policy instruments and the price discounts are equilibrium outcomes. A marginal increase in $L_{m,j}$ reduces $L_{h,j}$ by the same amount because $\bar{L}_j$ is fixed.

Let $L_m = (L_{m,1}, \dots, L_{m,J})'$ and let x collect the independent endogenous variables in the normalized equilibrium system, including prices, the transfer, and worker allocations, as well as firm objects. Denote the independent equilibrium system as $F(x, L_m) = 0$. The conditions include free entry, factor-market clearing, worker choice, local non-manufacturing and housing clearing, the transfer budget, and the manufacturing numeraire.

Differentiating these conditions with respect to industrial land L_m gives a linear system for the equilibrium responses:

$$F_x \frac{dx}{dL_m} = -F_{L_m} \quad (36)$$

Column j of $\frac{dx}{dL_m}$ contains the changes in all endogenous variables per additional unit of industrial land in prefecture j .

The Jacobians are partial derivatives evaluated at the converged equilibrium

$$(F_{L_m})_{\cdot j} \simeq \frac{F(x, L_m + h_j e_j) - F(x, L_m - h_j e_j)}{2h_j}, \quad (37)$$

where x is held fixed and e_j selects prefecture j . Each evaluation changes residential land consistently with $L_{h,j} = \bar{L}_j - L_{m,j}$ and recomputes derived quantities entering the residuals without updating the independent state variables. Columns of F_x are calculated analogously by perturbing one component of x while holding land fixed. The same state parameterization is used for all Jacobians and outcome derivatives.

The planner maximizes the population-weighted welfare subject to a manufacturing output target

$$\max W = \omega^U \log W^U + \omega^R \log W^R \quad \text{s.t. } Y \geq Y^{\text{data}} \quad (38)$$

where the weights are $\omega^g = \bar{N}^g / (\bar{N}^U + \bar{N}^R)$, $\bar{N}^U$ is the number of urban workers, and $\bar{N}^R$ is the

number of rural workers including those who stay in the rural sector. Define marginal welfare and marginal output in land-quantity units as

$$\text{MV}_j = \frac{dW}{dL_{m,j}} = W_{L_{m,j}} + W_x \left(\frac{dx}{dL_m} \right)_{\cdot j}, \quad \text{MY}_j = \frac{dY}{dL_{m,j}} = Y_{L_{m,j}} + Y_x \left(\frac{dx}{dL_m} \right)_{\cdot j}. \quad (39)$$

The direct terms hold x fixed at equilibrium levels; the terms involving $\frac{dx}{dL_m}$ capture induced responses in every prefecture. With $P_m = 1$, aggregate manufacturing output changes through both firm masses and mean revenues:

$$\text{MY}_j = \sum_i [\bar{\mathcal{R}}_i dM_i/dL_{m,j} + M_i d\bar{\mathcal{R}}_i/dL_{m,j}]$$

The log-output derivative is $d \log Y / dL_{m,j} = \text{MY}_j / Y$.

Totally differentiating equations (12) and (15) gives

$$d \log W^U = \sum_i \pi_i^U d \log V_i^U, \quad d \log W^R = \sum_i \pi_i^R d \log V_i^R, \quad (40)$$

where the rural outside option is fixed. With fundamentals and P_m fixed, the local utility changes are

$$d \log V_i^U = \sum_{k \in \{m,s\}} \pi_{k|i}^U \frac{dw_{k,i} + dT}{w_{k,i} + T} - \beta_s d \log p_{s,i} - \beta_h d \log p_{h,i} \quad (41)$$

$$d \log V_i^R = d \log w_{m,i} - \rho \beta_s^R d \log p_{s,i} - \rho \beta_h^R d \log p_{h,i}. \quad (42)$$

Substituting the responses from column j of $\frac{dx}{dL_m}$ into these expressions provides the group-specific welfare derivatives and hence MV_j . Therefore, the partial derivatives of W and Y can be evaluated numerically and combined with $\frac{dx}{dL_m}$ in (39).

An independent check perturbs land and fully re-solves the equilibrium:

$$\frac{df}{dL_{m,j}} \simeq \frac{f(x^+, L_m + h_j e_j) - f(x^-, L_m - h_j e_j)}{2h_j}, \quad f \in \{W, Y\}, \quad (43)$$

where $F(x^\pm, L_m \pm h_j e_j) = 0$. Unlike the partial derivative in (37), this comparison allows the equilibrium state to change. The IFT calculation applies locally where F_x is nonsingular and the cutoff regime is unchanged; one-sided perturbations are used at changes in the binding support constraint.

E.3 Using the Marginals in the Planner Problem

The planner's Lagrangian is $\mathcal{L} = W + \psi(\log Y - \log Y^{\text{data}})$. The interior first-order conditions and the prefecture-specific welfare-output measure are

$$MV_j + \psi \frac{MY_j}{Y} = 0, \quad \psi_j = -\frac{MV_j}{MY_j/Y} = \psi \quad \text{if } MY_j \neq 0. \quad (44)$$

$\psi_j > 0$ represents a welfare cost when additional industrial land raises output.

The numerical optimization uses the land share $s_j = L_{m,j}/\bar{L}_j$ and its logit $\ell_j = \log[s_j/(1 - s_j)]$.

The chain rule gives

$$\frac{\partial \mathcal{L}}{\partial \ell_j} = \bar{L}_j s_j (1 - s_j) \left(MV_j + \psi \frac{MY_j}{Y} \right). \quad (45)$$

E.4 Solution Algorithms

The procedures below summarize the solution algorithms. Productivity integration, equilibrium derivatives, and the planner gradient are described in Appendix E.

E.4.1 Stationary Equilibrium

Hold fundamentals and population endowments fixed. Price discounts are denoted as χ_j . Write $s_j = L_{m,j}/\bar{L}_j$ and set $L_{h,j} = \bar{L}_j - L_{m,j}$.

1. *Initialize.* Guess wages $w_{m,j}, w_{s,j}$, industrial land prices $r_{m,j}$, housing prices $p_{h,j}$, the transfer T , and worker allocations $(N_j^U, N_{m,j}^U, N_{m,j}^R)$, and the industrial land share s_j . For the local competitive land market counterfactual, use the baseline equilibrium as the initial guess.
2. *Solve manufacturing.* Given manufacturing employment $N_{m,j}^U + N_{m,j}^R$ and land $L_{m,j}$, solve free entry and factor-market clearing for $w_{m,j}, r_{m,j}$, and the firm mass M_j , using (22)–(23) and the entry integral in (33). Recover entry $M_{e,j}$ and the active-firm density $\mu_j(z)$ from (20).
3. *Solve local markets.* Jointly obtain $w_{s,j}, p_{h,j}$, and T from (25), (26), and (28). Recover residential land prices $r_{h,j} = \gamma_h E_{h,j}/L_{h,j}$ and housing quantities.
4. *Update allocations.* Calculate implied worker allocations and update $N_j^U, N_{m,j}^U$, and $N_{m,j}^R$ with damping. Update land allocation s_j to match prefecture-specific industrial land discounts $r_{m,j}/r_{h,j} = e^{-\chi_j}$.

5. *Iterate to convergence.* Repeat Steps 2–4 until prices, per capita land transfer T , worker allocations, and industrial land price discounts converge. Recompute the final objects and verify market clearing and $P_m = 1$.

E.4.2 Output-Target Land Allocation

Keep fundamentals fixed and set Y^{data} to the baseline aggregate manufacturing output level.

1. *Initialize.* Start from baseline land shares s_j , form their logits $\ell_j = \log[s_j/(1 - s_j)]$, and set the output multiplier $\psi = 0$.
2. *Evaluate the allocation.* For $L_{m,j} = \bar{L}_j s_j$, solve the fixed-land equilibrium using the procedure in E.4.1. Calculate welfare W and output Y from (38), and their marginal responses MV_j and MY_j from (39).
3. *Improve the allocation.* Holding ψ fixed, update ℓ_j using the planner gradient $\partial \mathcal{L} / \partial \ell_j$ in (45) and a backtracking step. Re-solve the equilibrium at each trial allocation and repeat until the fixed-multiplier optimality conditions are satisfied.
4. *Update the multiplier.* Raise ψ if $Y < Y^{\text{data}}$ and lower it if $Y > Y^{\text{data}}$. Bracket the target and bisect the multiplier interval, repeating Steps 2–3 at each trial value.
5. *Check the solution.* Stop when $Y = Y^{\text{data}}$ within tolerance and the land-allocation optimality conditions hold: use (44) for interior choices and the corresponding inequalities at numerical land bounds. Re-solve the final equilibrium and verify the target, land bounds, and equilibrium residuals.