


ORIGINAL ARTICLE

Place-Based Land Policy and Spatial Misallocation: Theory and Evidence From China

Min Fang^{1,2}  | Libin Han³ | Zibin Huang^{4,5} | Ming Lu⁶ | Li Zhang⁷

¹Department of Economics and Decision Sciences, China Europe International Business School, Shanghai, China | ²Department of Economics, University of Florida, Gainesville, Florida, USA | ³Institute for Northeast Full Revitalization, Dongbei University of Finance and Economics, Dalian, China | ⁴College of Business, Shanghai University of Finance and Economics, Shanghai, China | ⁵Shanghai Institute of International Finance and Economics, Shanghai, China | ⁶Antai College of Economics and Management, Shanghai Jiao Tong University, Shanghai, China | ⁷International School of Business and Finance, Sun Yat-Sen University, Guangzhou, China

Correspondence: Min Fang (minfang@ceibs.edu) | Libin Han (hanlibin@dufe.edu.cn)

Received: 31 March 2026 | **Accepted:** 31 March 2026

Keywords: China | labor mobility | land policy | migration | place-based policy | regional inequality | spatial misallocation

ABSTRACT

We investigate a land policy in China that allocated more urban land quotas to underdeveloped regions to reduce regional gaps. Empirically, the policy decreased productivity in eastern areas relative to the inland. A spatial equilibrium model with migration, land quota constraints, and agglomeration shows the policy distorts labor and production across regions, causing substantial output losses. Though regional gaps narrowed, workers from underdeveloped areas migrated less and earned less. Without the policy, national output would have been 1.8% higher, and workers in underdeveloped areas would have earned 1.6% more in 2010. Regional transfers offer a less distortionary alternative for reducing inequality.

JEL Classification: O18, R58, E24, J61, R52

1 | Introduction

Many countries regulate urban land allocation using place-based policies. These regulations commonly target underdeveloped regions to promote balanced national development (Neumark and Simpson 2015). However, promoting balanced development may come at the cost of generating spatial misallocation, especially in the presence of spatial frictions. In this paper, we empirically and quantitatively examine the effects of a major place-based land allocation policy on spatial misallocation and regional development in China. Specifically, we investigate a sudden shift in China's land supply policy in 2003, which transitioned from a demand-driven approach to a development-promoting approach, commonly referred to as the inland-favoring land policy.

Unlike most countries, China's state owns all urban land. The central government sets a strict quota on the amount

of land that can be used for construction in each prefecture each year. Since the 1978 reforms, the Chinese government has distributed quotas based on each prefecture's demand, which favored rapidly growing eastern coastal regions. However, as the 2000s approached, the continuing divergence in economic development across regions became a primary concern, as eastern regions substantially outpaced the rest of the country. As a result, in 2003, the demand-driven approach was dramatically shifted to a development-promoting approach by reallocating land supply quotas from eastern to inland regions, thereby establishing an "inland-favoring" land supply policy. This policy has remained in place since then.

This place-based policy distorted both urban floor space supply and labor markets, generating severe spatial misallocation of labor and production. Urban space constraints in more productive regions increased prices for residential and production

floor space. Such changes in floor space prices led to spatial misallocation and reduced output via three channels. First, more expensive production floor space directly constrained production in more productive regions. Second, labor demand and supply in the most productive areas were further constrained by more expensive production and residential floor space, hindering migration inflows. Finally, the decline in migration inflows into more productive areas further reduced agglomeration effects in these regions. All three channels shifted the spatial allocation of production and labor toward less productive areas and caused national labor productivity to stay relatively low.¹

But has China successfully promoted balanced development despite such spatial misallocation costs? The answer depends on the measure. The policy narrowed productivity and output gaps between developed eastern and underdeveloped inland regions, at the expense of lowering the incomes of workers from the underdeveloped areas, as they became less likely to migrate to developed regions that offered higher wages. This finding is consistent with recent literature (Tombe and Zhu 2019; Lagakos et al. 2020; 2023; Lagakos 2020; Wu and You 2025; Huynh 2023), which suggests that reducing internal migration costs is particularly beneficial to workers in underdeveloped regions, especially rural areas where returns to migration opportunities are high. Overall, national welfare was decreased, while the effects on workers from poorer and rural areas are *mixed*. Thus, this policy successfully promoted geographically balanced development. However, it did not necessarily benefit workers from underdeveloped regions. We find that by replacing the policy with regional transfers, China could increase both national output and the incomes and welfare of workers from the underdeveloped areas.

We analyze the effects of this place-based land policy in three steps. First, we show empirically how the policy changes measured productivity across regions. Second, we develop a spatial equilibrium model to explain the mechanism and quantify the policy's impact. Third, we conduct several counterfactual exercises to compare the current policy to other alternatives.

In the first step, we investigate the effect of the inland-favoring policy on the average firm productivity gap between eastern and inland regions at the prefecture level. Employing prefecture-level difference-in-differences regression, we find that the inland-favoring policy reduced the prefecture average firm productivity gap between the eastern and inland prefectures by 5%–7%. The results remain consistent across various robustness exercises. Moreover, we do not observe significant productivity improvements among inland firms. We further present empirical analyses that show the policy increased relative land and housing prices, while reducing relative wages, migration inflows, and employment in eastern regions. Our empirical analysis demonstrates that the inland-favoring policy narrowed the productivity gap between the east and inland regions by potentially increasing the spatial misallocation of labor and production.

In the second step, we construct a spatial general equilibrium model to illustrate the mechanism of policy distortion and quantify the aggregate effects. The model features several degrees of heterogeneity (multiprefecture, multiskill, and multiarea), migration with costs, urban production with agglomeration, and floor space constraints in both residence and production. In the

model, place-based land policy may affect national productivity in three ways. First, reducing land supply in more developed prefectures directly reduces national productivity as productive firms in developed prefectures face tighter production floor space constraints. Second, it reduces migration to developed prefectures as workers face higher housing costs due to tighter residential floor space constraints and lower wages due to tighter production floor space constraints. Finally, it reduces agglomeration effects in more developed prefectures due to fewer migration inflows.

Using microdata from the Chinese Population Census, the City Statistical Yearbooks of 225 Chinese prefectures, the Urban Statistical Yearbook of China, and other supplementary databases in 2005 and 2010, we solve and quantify the model. We then estimate the agglomeration parameter by combining our empirical analysis and the structural model using indirect inference. Finally, we present quantitative equilibrium results showing that measured productivity is significantly higher, but the land constraint is much more severe in the more developed eastern prefectures.

In the final step, we implement three counterfactuals. In the first counterfactual, we examine what would happen if the pre-2003 land supply policy were maintained, but the total land supply remained unchanged, to show the misallocation effects. Naturally, this increases land supply in eastern prefectures and decreases floor space prices. More migrants are attracted to these prefectures, resulting in a 1.1% (1.8%) increase in national output in 2005 (2010). We also find that the productivity loss due to the inland-favoring policy was considerable. If we remove the policy, national productivity increases by 1.4% in 2005 and by 2% in 2010. The removal of the policy would reduce output and productivity in underdeveloped inland prefectures, causing a larger regional output gap. However, since workers from these underdeveloped inland prefectures have better access to developed prefectures, their incomes could be higher due to more migration. Thus, removing the inland-favoring policy increases incomes for most of the workers. The inland-favoring land supply policy did promote geographical convergence, but did not necessarily increase the incomes of workers from underdeveloped regions.

In the second counterfactual, we propose a direct regional transfer as an alternative to the place-based land policy for regional balancing, based on the first counterfactual, and introduce an additional regional transfer policy. Instead of distributing more land to less developed regions, the central government could directly tax the additional benefits from more land in developed regions and transfer the proceeds to the underdeveloped areas. Without loss of generality, we demonstrate that a direct regional monetary transfer can increase the incomes and welfare of workers from underdeveloped regions, resulting in minimal spatial misallocation.

Finally, in the third counterfactual, we examine the implications of completely removing the land quota system. In this scenario, both national and local land supplies are freely adjustable. We find that productivity in China would rise by 4.3% (8.3%) in 2005 (2010). Similarly, national total output would increase by 3.9% (7.9%) in 2005 (2010). Compared with the first counterfactual, these results suggest that the inland-favoring land policy accounts for a substantial share of the overall distortion induced by the quota system. Moreover, this policy would raise incomes and

welfare for workers across all regions—eastern and inland, as well as affluent and less developed.

Literature Review. Evaluating the effects of place-based policies or land-use regulations is particularly challenging, especially in emerging markets. First, a clean causal identification of the impact of large-scale land-use regulations is usually hard to find. Second, empirically identified causal effects are typically local and cannot be easily aggregated, whereas aggregated quantitative studies often overlook the distributional impact. Finally, limitations in data availability usually restrict the analyses to a few developed regions, specifically prefectures or metropolitan areas. In this paper, we attempt to address all three issues simultaneously.

First, we draw on direct causal evidence for the effects of place-based land-use regulations. Earlier literature has studied the impacts of land-use regulations on housing and welfare, both theoretically (Hamilton 1978; Wallace 1988; Brueckner 1995; Helsley and Strange 1995; Hilber and Robert-Nicoud 2013) and empirically (Glaeser et al. 2005; Glaeser and Ward 2009; Gyourko and Molloy 2015). The focus has primarily been on the housing market in a few developed US cities, mainly due to data availability. Meanwhile, addressing the endogeneity of the effects of land-use regulations remains a challenge (Quigley and Rosenthal 2005). To tackle this challenge, recent literature has adopted DID strategies (Cunningham 2007; Kahn et al. 2010; Yu *Forthcoming*) in response to policy shifts. We leverage the sudden policy change in 2003 and the DID approach to establish the causal impact of the policy in China.

Second, we develop a comprehensive quantitative spatial equilibrium model to capture the aggregate and distributional effects. Recent literature has investigated various frictions and place-based policies² that result in spatial misallocation or welfare losses, including (urban–rural) migration frictions (Tombe and Zhu 2019; Lagakos et al. 2020; 2023; Lagakos 2020; Wu and You 2025), housing constraints (Hsieh and Moretti 2019), urban land expansion frictions (Yu *Forthcoming*; Fu et al. 2021), political manipulation (Henderson et al. 2022), and combinations of several of the frictions above (Li et al. 2024; Deng et al. 2020; Chen et al. 2019). Among these, the most related study is Yu (*Forthcoming*), which investigates the effect of the “Farmland Red Line Policy” on economic development in China.³ We comprehensively build our quantitative model to capture the aggregate effects by including urban–rural-skill-specific migration and housing frictions on the household side, as well as production space frictions and agglomeration effects in density on the firm side. In addition, the rich prefecture-urban–rural-skill structure allows us to analyze distributional effects more carefully.

Third, we apply our model to comprehensive individual-level, firm-level, and prefecture-level data sets to address data limitations commonly found in emerging markets. A considerable amount of literature has examined migration and regional development in China and other developing countries. In the context of China, scholars have investigated the Hukou restriction and regional trade barriers (Tombe and Zhu 2019; Hao et al. 2020), international trade and labor mobility (Ma and Tang 2020; Tian 2024; Fan 2019; Zi 2025), housing constraints (Fang and Huang 2022), air quality (Khanna et al. 2025), and local public

services for migrants (Sieg et al. 2023; Huang and Zhang 2022). Studies of other developing countries include Malaysia (Bertaud and Malpezzi 2001), Indonesia (Bryan and Morten 2019; Civelli et al. 2023), Brazil (Pellegrina 2022), Colombia (Tsivanidis 2026), Mexico (Monras 2020), and India (Imbert and Papp 2020), among others. We take our model to the most granular level possible by combining the Chinese Population Census, various Statistical Yearbooks, the Land Parcel Trade Data set, and other supplements to ensure the credibility of our aggregate and distributional quantitative results.

In summary, our study contributes to the literature by empirically, theoretically, and quantitatively examining the effect of place-based land-use regulations on China’s aggregate and regional economies. We address several issues common to this literature, such as endogeneity and data limitations. By combining comprehensive individual-level, firm-level, and prefecture-level data sets, we provide a detailed analysis of the impact of place-based land policies on various aspects of the Chinese economy, including both economic development and welfare analysis.

Layout. This paper is organized as follows. Section 2 provides the institutional background and describes the data sets. Section 3 offers empirical evidence that the inland-favoring land policy decreased productivity in more developed eastern regions relative to inland areas. Sections 4 and 5 develop and estimate a spatial equilibrium model and solve it using microdata. Section 6 conducts the counterfactual analysis of eliminating the place-based land policy. Section 7 discusses the counterfactual when the land quota system is removed. Section 8 concludes. Finally, our extended online appendix (Fang et al. 2025) validates all the results in the empirical analysis and the model.

2 | Background and Data

2.1 | Institutional Background

Land Ownership. In China, there is no private land ownership. A village collectively owns agricultural land, while urban land is state-owned. Agricultural land is transferred to the state through land expropriation before being used for urban construction. Construction companies must buy “use rights” from the local government to develop urban land. The central government strictly controls urban expansion to ensure enough agricultural land for domestic food supply security (Yu *Forthcoming*). Each prefecture is assigned a quota of new urban construction land each year. Before 2003, the quota was mainly based on each prefecture’s demand. **The Reform in 2003.** Allocation of construction land quotas has been used as a place-based policy since 2003. Before 2003, developed areas with higher land demand were typically assigned a larger land quota. However, after Jintao Hu and Jiabao Wen’s new administration took office in 2003, the central government started to focus on balancing economic development by allocating more land quota to underdeveloped inland provinces.⁴In 2004, the central committee of the Chinese Communist Party made it clear that it is necessary to strengthen the role of land supply policy in macroeconomic management.⁵In addition, the National Master Land Use Plan (2006–2020) issued in 2005 officially stated that construction land use in eastern areas would be strictly controlled, and land-use quotas in inland areas would be increased.⁶

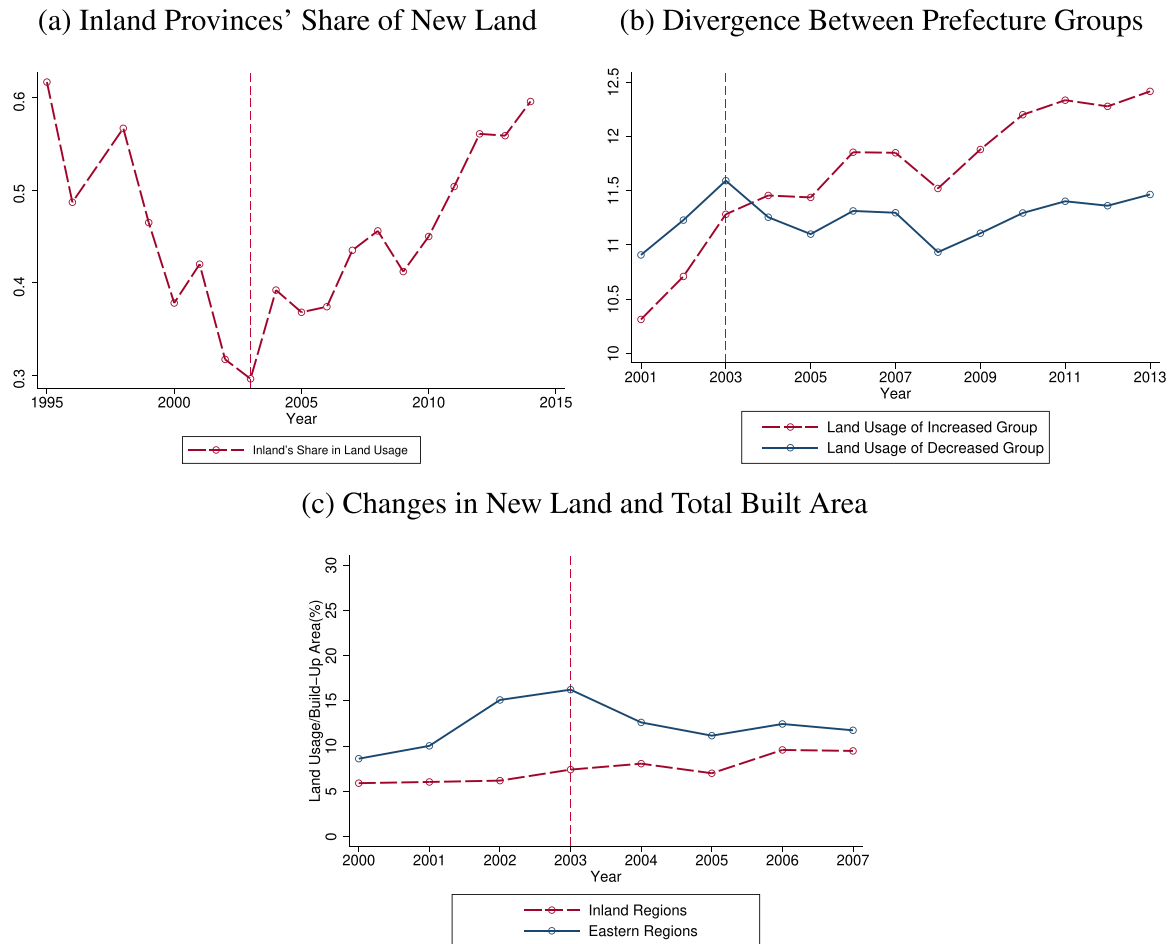


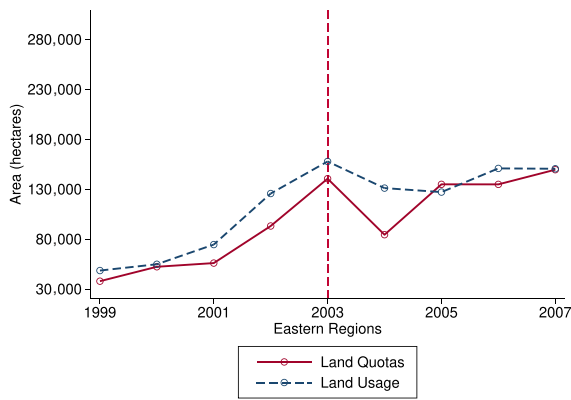
FIGURE 1 | New urban land usage before and after 2003. *Notes:* Panels (a) and (b) show changes in the usage of new urban land each year. Data sources include the National Bureau of Statistics of China, the Statistical Yearbook of China’s Land and Resources (2000–2016), and the Yearbook of China’s Land (1996–1999). The unit of Panel (a) is between 0 and 1, and the unit of Panel (b) is the log of hectares. Panel (c) shows time trends of the ratio between new urban land and total built area. The blue solid line is the annual new urban land in the developed eastern region, and the red dashed line is the annual new urban land in the inland region. The dashed vertical line indicates the implementation of the inland-favoring land policy.

Changes in Usage. We first measure actual new land usage across regions in each year. Figure 1a shows the inland provinces’ share of national new urban construction land from 1999 to 2007. This is distinct from land quota. A quota defines the amount of new land that may be converted to urban land each year. In contrast, new land usage refers to the actual amount of quota used to convert formerly agricultural land into new urban land each year. Relative inland urban land growth declined rapidly during the east’s rapid economic growth from 1995 to 2003 before reversing from less than 30% in 2003 to 60% in 2015. The turning point was clearly in 2003. The trend generated by this inland-favoring policy becomes even more apparent at the prefecture level. Figure 1b divides Chinese prefectures into two groups: prefectures whose new land usage shares increased after 2003 and prefectures whose new land usage shares shrank after 2003. Land usage in the first group was lower before 2003, but it jumped and surpassed that of the second group after 2003, with the gap widening over time. Han and Lu (2017) also show that a prefecture’s land usage share was more likely to shrink after 2003 if it had a larger share of land usage before 2003. Most of these were more developed eastern prefectures. Figure 1c shows the time trend of the proportion of new urban land usage each year

over the total built area (total used urban land). It illustrates that the proportion was at 10%–15% per year in eastern areas relative to 5%–10% in inland regions. We also observe a significant turning point in 2003, after which the proportion of new urban land decreased in the eastern areas.

Changes in Quotas. Another indicator is changes in new urban land quota—more specifically, changes in the amount of additional land designated for urban construction approved by the central government each year. This metric, while closely aligned with actual new land usage, may diverge due to local governments reserving land for future sale or development. Unfortunately, quota data at the prefecture level are confidential, restricting our analysis to province-level urban land quotas. Figure 2 depicts the variations in land quota and land usage within eastern regions in Panel (a) and inland areas in Panel (b).⁷We have two main observations. First, the land quota constraint is binding in the eastern regions, as indicated by the close movement between the quota and actual land usage lines. In certain early years, land usage was observed to be marginally higher, a phenomenon potentially attributable to the recycling of preexisting construction land.⁸Conversely, this constraint appears less stringent in

(a) Land Supply and Quota in Eastern Regions



(b) Land Supply and Quota in Inland Regions

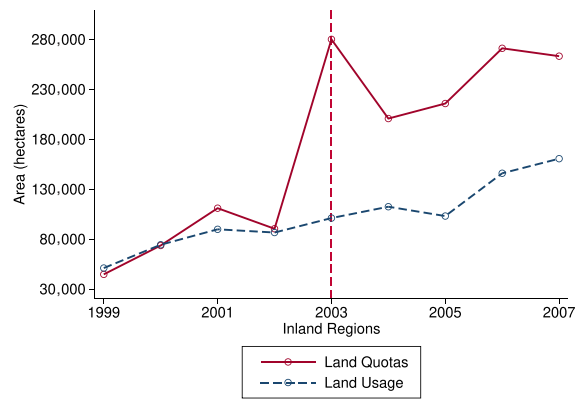


FIGURE 2 | Urban land usage and quota before and after 2003. *Notes:* This figure compares the allocated quota of urban land to land incorporated into cities each year. Data sources include the National Bureau of Statistics of China, the Statistical Yearbook of China’s Land and Resources (1999–2007), and the Yearbook of China’s Land (1999–2007).

inland regions. In particular, the growth rate of land usage in the inland areas was not as fast as that of land quotas after 2003. Land usage started to increase rapidly with a lag of about 2 years. Second, a pivotal shift in both land usage and quota post-2003 is evident. While eastern regions saw a reduction in quotas, inland quotas surged. Overall, this period marked a cessation of land usage and quota growth in eastern areas, in contrast to encouraging growth inland.

2.2 | Data Sets

Data for the Empirical Analysis. The primary data we use are the *National Industrial Enterprise Database (NIED)*, published by the National Bureau of Statistics. It covers all enterprises “above scale” (main business revenue greater than 5 million RMB). This data set accounts for over 90% of all industrial production in China.⁹ The data set contains rich enterprise-level information, such as firm name, industry category, incorporation year, number of employees, total salary, and total fixed assets.¹⁰ Table 1 shows the descriptive statistics of the enterprise data. Variables in Panel A are calculated at the firm level. Variables in Panel B are averaged at the prefecture level, weighted by firm employment. Our primary productivity calculation is based on the OP estimation method (Olley and Pakes 1996). We also calculate productivity using the LP (Levinsohn and Petrin 2003) and the ACF (Akerberg et al. 2015) methods, which yield similar results. Furthermore, we investigate other outcome variables, including prefecture-level wages, land prices, housing prices, migration, and employment, to validate the mechanism using additional data sets. Additional descriptions and results are in Online Appendix A.

Data for the Quantitative Analysis. The primary data set we use in the quantitative analysis is the Chinese Population Census. It is the most comprehensive household survey in China. Every 10 years, the National Bureau of Statistics conducts a thorough investigation of all households in the country. All families must complete a short survey, which requires the provision of basic demographic information such as name, education, and living address. Ten percent of all families must take a longer survey,

including additional information such as job and place of birth. Between each decennial Census, there is a mini-Census. For each mini-Census, the statistics bureau randomly chooses 10% of the population to complete a survey similar to the long survey in the decennial Census. For simplicity, we call both the decennial and mini-census “Census data.” In this study, we use Census data from 2005 and 2010. This gives us prefecture–area-level migration flows and housing rents for individuals with different education levels. In total, we have 2,585,481 (4,803,589) individuals in 2005 (2010), which covers 0.2% (0.36%) of the population.

Besides the Census, we utilize the Urban Statistical Yearbook and each prefecture’s (manually collected) City Statistical Yearbook. The Urban Statistical Yearbook provides an overview of the key characteristics of all Chinese prefectures. We derived prefecture-level GDP growth and built urban land area data from the Urban Statistical Yearbook. Since we do not directly observe land quotas at the prefecture level, we use built urban land areas and the province’s land quota increment to impute it in the quantitative analysis. We show the details in Online Appendix B.3. Local branches of the statistics bureau compile the City Statistical Yearbooks annually. We use the prefecture–industry-level wage information from these books to impute prefecture-skill-level wages, following an imputation method in the literature.¹¹ We also conduct sensitivity checks using another imputation method from individual-level wage data in the Census 2005. A complete list of prefectures, along with their corresponding GDP, measured productivity, and land tightness, is provided in Online Appendix B.1.

3 | Empirical Analysis

First, we empirically analyze how the inland-favoring policy affects productivity across regions. We show causal evidence that this policy shrank the productivity gap between eastern and inland prefectures. This reduction can be primarily attributed to the decreased productivity of eastern prefectures. Furthermore, we investigate other outcome variables, including prefecture-level wages, land prices, housing prices, migration, and employment, as supplementary evidence.

TABLE 1 | Summary statistics.

Variable	Description	Observations	Mean	Std. Dev.	Min	Median	Max
Panel A: Firm-level variables							
Ln(tfp_op)	Firm TFP (OP)	877,383	3.25	1.02	-0.04	3.27	5.63
Ln(tfp_lp)	Firm TFP (LP)	877,383	6.36	1.09	3.08	6.32	9.02
Ln(tfp_acf)	Firm TFP (ACF)	877,383	4.72	1.46	1.03	4.71	8.03
Ln(output)	Ln(1k yuan)	877,383	8.62	1.29	5.31	8.51	12.22
Ln(wage)	Ln(1k yuan yearly)	876,147	2.39	0.63	0.39	2.41	4.14
Employee	Person	877,383	192.37	293.80	12	97	1985
East	Dummy	877,383	0.80	0.40	0	1	1
Panel B: Prefecture-level variables							
Ln(tfp_op)	Prefecture TFP (OP)	1792	3.16	0.42	1.41	3.22	3.96
Ln(tfp_lp)	Prefecture TFP (LP)	1792	7.11	0.44	5.02	7.12	8.04
Ln(tfp_acf)	Prefecture TFP (ACF)	1792	4.70	0.65	2.39	4.74	6.15
East	Dummy	1792	0.32	0.47	0	0	1

Note: This table summarizes the main data we use—the *National Industrial Enterprise Database (NIED)*, published by the National Bureau of Statistics. It covers all enterprises “above scale” (main business revenue greater than 5 million RMB) from 2001 to 2007. Variables in Panel A are calculated at the firm level. Variables in Panel B are averaged at the prefecture level and weighted by firm employment. East is a dummy variable set to 1 if the firm/prefecture is in the eastern area.

3.1 | Empirical Specification

In the primary empirical analysis, we run a simple prefecture-level DID regression to identify the effect of the inland-favoring land supply policy on productivity. We use the region definitions published by the National Bureau of Statistics of China and consider northeastern provinces as inland. For prefecture j in year t , we have the following regression:

$$\ln(Prod_{jt}) = \alpha + \delta_1 Post2003_t \times East_j + \phi_j + \gamma_t + \epsilon_{jt}, \quad (1)$$

where $\ln(Prod_{jt})$ is prefecture average firm productivity. We first calculate firm-level productivity using our firm-level data and then take the average in different prefectures, weighted by firm employment. The coefficient δ_1 is the effect of the 2003 inland-favoring policy on the relative prefecture average productivity in the eastern region. $Post2003$ indicates whether the period is after 2003 (includes 2003). $East_j$ indicates whether the prefecture is in the eastern region. ϕ_j and γ_t are the sets of prefecture and year-fixed effects. ϵ_{jt} is the error term. It is important to clarify that the inland-favoring land policy can potentially affect the productivity of both regions. Therefore, the regression coefficient should be interpreted as the policy’s effect on the regional gap (relative level) rather than on the absolute level of productivity for either region.

3.2 | Regression Assumptions Validation

We validate our regression method by checking the key DID assumptions. First, we investigate the time trend of firm productivity in the eastern and inland regions. Our regression specification assumes that productivity in eastern and inland prefectures should have a similar time trend. Figure 3a shows the time trends of firm productivity. The black line is the average

productivity in the developed eastern region, and the gray line is the average productivity in the inland region. The dashed vertical line is located just after 2003, when the inland-favoring land policy was implemented. We find no evidence of divergent time trends in productivity before the policy. Despite the 2003 policy’s aim to boost inland development, we do not observe a corresponding increase in the growth rate of inland productivity. Instead, the policy seems to have stymied the growth of eastern productivity.¹²

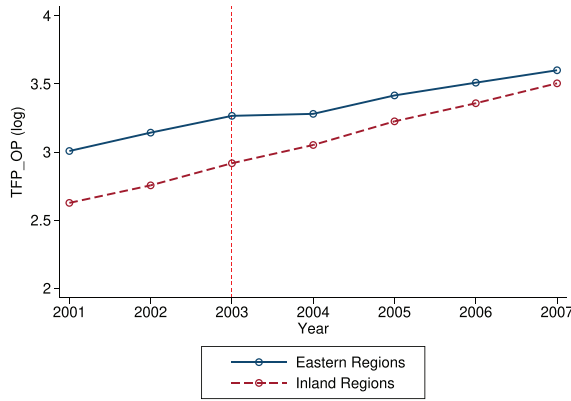
Second, we employ a traditional event-study regression to examine the evolution of the eastern region effect over time. We take 2003 as the baseline year and then run the following regression for the event study:

$$\ln(Prod_{jt}) = \alpha + \sum_{s \neq 2003} \delta_{1s} \mathbf{1}(s = t) \times East_j + \phi_j + \gamma_t + \epsilon_{jt}. \quad (2)$$

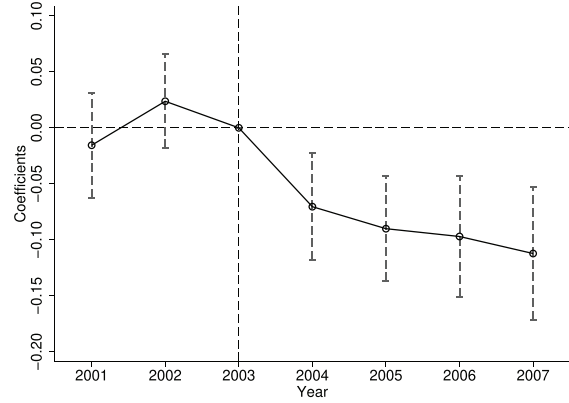
We plot the evolution of the coefficient δ_{1s} across time s in Figure 3b, illustrating the change in the eastern region effect across time, with 95% confidence intervals. We find that all coefficients are very close to zero before 2003. They become statistically and economically distinguishable from zero only after the policy implementation. The results from this event study confirm that there is no divergent pretrend in our data. These figures also give us a preview of the main results. Following the central government’s imposition of the inland-favoring land policy in 2003, there was a decrease in the productivity gap between eastern and inland prefectures.

3.3 | Empirical Results

Main Results on Productivity. Table 2 shows the regression results for productivity. We control for prefecture fixed



(a) Time Trends of Firm Productivity



(b) Event Study of Firm Productivity

FIGURE 3 | Regression assumptions validation. *Note:* Panel (a) shows the time trends of firm-level productivity calculated using the Olley and Pakes (1996) method. The blue solid line is the average productivity in the developed eastern region, and the red dashed line is the average inland productivity. The dashed vertical line indicates the implementation of the inland-favoring land policy. Panel (b) shows the event study. The dependent variable is the same average firm productivity in different prefectures. The corresponding confidence interval is 95%. We control for prefecture and year-fixed effects. We also control for linear time trends in different provinces and prefectures with varying initial characteristics in the year 2001, including GDP per capita and industry composition.

TABLE 2 | DID results on productivity.

	(1) LP	(2) OP
Post2003 × East	-0.0505*	-0.0705***
	(0.0298)	(0.0267)
GDP per capita × Time trend	Y	Y
Industry share × Time trend	Y	Y
Year FE	Y	Y
Prefecture FE	Y	Y
Observations	1792	1792
R ²	0.6350	0.7529

Note: The dependent variable is prefecture-level average firm productivity. We first measure firm productivity using the Levinsohn and Petrin (2003) and Olley and Pakes (1996) methods, then calculate the average for each prefecture, weighted by firm employment. The standard errors are clustered at the prefecture level. *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$.

effects, year-fixed effects, and linear time trends in prefectures with different initial characteristics in the year 2001, including GDP per capita and industry composition. In columns (1) and (2), we use the Levinsohn and Petrin (2003) and Olley and Pakes (1996) methods, respectively. We find that the reduction in land supply after 2003 reduced the measured productivity gap of eastern prefectures relative to inland prefectures by about 5%–7%. The qualitative results are consistent across regression settings.

Other Variables and Potential Mechanism. We further investigate the policy’s effect on additional outcome variables, including wages, land prices, land-use quantity, housing prices, migration, and employment in Online Appendix A.10. This investigation aims to briefly discuss the policy’s mechanism while assembling empirical evidence to support our quantitative model.

The results are summarized in Table 3. Our findings reveal that in eastern regions, the inland-favoring land policy directly led to relative increases in land and housing prices, as well as relative reductions in land-use quantity, wages, migration, and employment. The mechanism is as follows. On one hand, the surge in eastern land prices raised costs for firms, leading to a decrease in wages and a reduction in labor demand. On the other hand, the rise in housing prices drove up the cost of living, further diminishing the labor supply. These channels combined to noticeably reduce worker migration from inland to eastern regions. Consequently, the 2003 land policy impacted productivity not merely by distorting the land market but also by distorting the decision-making processes of firms and workers in the labor market. In the forthcoming sections, we intend to explore this mechanism more comprehensively through a quantitative model.

Robustness Checks. We further implement nine groups of robustness analyses to address an extensive set of potential empirical concerns. The results are available in Online Appendix A. Our main results are robust across all checks. First, in Online Appendix A.1, we address concerns with the robustness of our productivity estimates. We verify robustness by repeating the empirical analysis using productivity calculated with the method Akerberg et al. (2015). We also use the prefecture-level GDP per labor as an alternative measure of productivity. Second, in Online Appendix A.2, we drop Zhejiang Province from our sample, which had a special land system reform during the 2000s. Third, in Online Appendix A.3, we change the model specification using province-level quota changes and imputed city-level quota changes as the treatment variable. Similar to the main results, we find that prefectures with larger quota reductions experienced larger productivity drops. We do not use this as the primary specification, as we only have province-level quota data. Fourth, we run the regressions at the province level with province-level average productivity as the dependent

TABLE 3 | Summary of policy effects on other variables.

	Land price	Housing price	Average wage	Migration inflow	Employment
Post2003 × East	0.513** (0.220)	0.0721*** (0.0265)	-0.0341 (0.0044)	-7.04** (2.88)	-0.2025† (0.1243)

Note: This table summarizes the policy's effect on additional outcome variables, including prefecture-level land prices, housing prices, wages, migration, and employment. The standard errors are clustered at the prefecture level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$, and † $p < 0.15$.

variable in Online Appendix A.4. Fifth, the policy was enacted in 2003, and we categorize 2003 as part of the treatment group in the main context. In Online Appendix A.5, we change the definition and include 2003 in the control group. Sixth, in Online Appendix A.6, we restrict our analysis to prefectures located near the border between the eastern and noneastern regions to make them more comparable. We also address concerns about possible confounding policies around 2003. In Online Appendix A.7, we discuss the potential spatial effects of China joining the WTO in 2001. To address this issue, we run regressions that include only firms with zero exports and regressions that control for prefecture-level exports to eliminate any WTO effect. In Online Appendix A.8, we try to rule out the impact of other firm subsidies and tax policies implemented around 2003. In Online Appendix A.9, we investigate the potential confounding effects of two rural reform policies.

3.4 | Empirical Remarks

This empirical analysis demonstrates that the inland-favoring land policy has reduced the productivity gap between developed eastern regions and underdeveloped inland regions. Furthermore, in a related study (Fang et al. 2024), we also present the main results and all robustness checks at the firm level, combining difference-in-differences and regression discontinuity analyses at the border between eastern and inland regions. The same conclusions presented in this paper are maintained at the firm level, particularly within the border between the east and inland areas. As depicted in Figure 3, this change is primarily driven by a slowdown in eastern productivity growth rather than an acceleration in inland productivity growth. Our supplementary findings, which include land prices, wages, housing prices, migration, and employment, provide preliminary evidence in support of our proposed mechanism. These findings suggest that while the government's policy succeeded in reducing eastern-inland gaps, it may have created significant distortions in Chinese land and labor markets. This regional convergence is potentially achieved at the cost of spatial misallocation. To better understand the aggregate and spatial effects, as well as the underlying mechanism, we construct a spatial equilibrium model for further quantitative analysis in the following sections.

4 | The Model

The economy consists of discrete locations, precisely, **prefectures** (administrative cities in China), indexed by $i = 1, \dots, K$. Each prefecture j consists of two areas: urban u and rural r . The economy is populated by an exogenous measure of H workers, who are imperfectly mobile within the economy and subject to migration costs. Each worker is either low-skill $s = l$ or high-

skill $s = h$. They are endowed with a Hukou/hometown location, which cannot be changed. Each location i has an inelastic supply of urban floor space S_i^u , produced by a fixed amount of urban land supply L_i^u . In urban areas, floor space can be used for production or residence. We denote the endogenous fractions of floor space allocated to production and residential use by θ_i and $(1 - \theta_i)$, respectively. Rural housing markets are simplified such that their rents are proportional to the average urban rent in the same prefecture.¹³

After observing idiosyncratic utility shocks between each possible pair of destinations and their original location, workers decide whether and where to move, given their skills and Hukou locations. Firms produce a single final good, which is costlessly traded within the country and is chosen as the numeraire.¹⁴ Locations differ in terms of their final urban goods productivity (A_i^u), rural final goods productivity (A_i^r), and supply of urban floor space (S_i^u). Finally, agglomeration effects exist in urban production, where prefecture-level productivity in urban areas is positively related to the density of workers. We estimate the agglomeration parameters using our empirical findings above, which are jointly estimated with our structural model, employing an indirect inference method.

4.1 | Worker Preferences

The utility of worker o with skill s , originating from region i area n , migrating to region j area k , is a combination of final good consumption ($c_{in,jk}^o$), residential floor space consumption ($s_{in,jk}^o$), migration cost ($\tau_{in,jk}^s$), and an idiosyncratic shock ($z_{in,jk}^o$) in a Cobb–Douglas form:

$$U_{in,jk}^o = \frac{z_{in,jk}^o}{\tau_{in,jk}^s} \left(\frac{c_{in,jk}^o}{\beta} \right)^\beta \left(\frac{s_{in,jk}^o}{1 - \beta} \right)^{1 - \beta}. \quad (3)$$

We model the heterogeneity in the utility that workers derive from working in different parts of the economy following the migration literature (Tombe and Zhu 2019; Fan 2019). We also do not distinguish between urban and rural residence in the utility function, but allow rural workers to construct their own residential floor space by paying construction costs. For each worker o originating from region i area n , migrating to region j area k , the idiosyncratic component of utility ($z_{in,jk}^o$) is drawn from an independent Fréchet distribution:

$$F(z_{in,jk}^o) = e^{-z_{in,jk}^o{}^{-\epsilon}}, \quad \epsilon > 1,$$

where the shape parameter $\epsilon > 1$ controls the dispersion of idiosyncratic utility. We assume that migration costs can be

separated into two parts, $\tau_{in,jk}^s = \tau_{in}^s d_{in,jk}$, where $d_{in,jk}$ captures the physical distance and institutional costs due to the Hukou system and other frictions in migrating from prefecture i area n to prefecture j area k , and τ_{in}^s captures cost differences between individuals with different skills which may include skill-biased migration policies or differences in their preferences for specific amenities such as schools, entertainment, or transportation.¹⁵

After observing the realizations of idiosyncratic utility of potential employment locations jk given their origination in , workers choose their locations and areas of employment to maximize utility, taking as given residential housing prices, factor prices, and the decisions of other workers and firms. Residential housing prices serve as the first congestion effect in our model because when more and more people migrate to a city, the housing prices will increase, resisting further migration (Allen and Arkolakis 2014; Eckert and Peters 2022).

Each worker is endowed with one unit of labor that is supplied inelastically with zero disutility. Taking the final good as numeraire and combining the worker's first-order conditions, we obtain the following demands for the final good and residential floor space for worker o with skill s from location i area n who migrates to location j area k :

$$c_{in,jk}^o = \beta v_{in,jk}^s, \quad s_{in,jk}^o = (1 - \beta) \frac{v_{in,jk}^s}{Q_{jk}},$$

where $v_{in,jk}^s$ is total income for a worker with skill s who stays in area k , and Q_{jk} is the rental cost of residential floor space in area k in prefecture j .

Floor space is not tradeable across political boundaries and is owned in common by Hukou-registered workers from prefecture i area n . This assumption is broadly consistent with the institutional features of China and implies that migrant workers have no claim to this fixed factor income. Therefore, the income $v_{in,jk}^s$ is a combination of wage income which depends on skill s in prefecture j area k and equally divided residential floor space rental income among all Hukou registrants in prefecture i area n :

$$v_{in,jk}^s = w_{jk}^s + \frac{Q_{in} S_{in}^R}{H_{in}^R}, \quad (4)$$

where H_{in}^R denotes all Hukou registrants, including those who migrated to work elsewhere, and S_{in}^R denotes all the residential floor space owned by H_{in}^R Hukou registrants.¹⁶ Substituting equilibrium consumption of the final good and residential land use into utility, we obtain the following expression for the indirect utility function:

$$U_{in,jk}^o = \frac{z_{in,jk}^o v_{in,jk}^s Q_{jk}^{\beta-1}}{\tau_{in,jk}^s}. \quad (5)$$

4.2 | Distribution of Migration Flows

Using the monotonic relationship between utility and the idiosyncratic shock, the distribution of utility for a worker

migrating from prefecture i area n and moving to the prefecture j area k is also Fréchet distributed:

$$G_{in,jk}^s(u) = Pr[U \leq u] = F\left(\frac{u \tau_{in,jk}^s Q_{jk}^{1-\beta}}{v_{in,jk}^s}\right)$$

$$G_{in,jk}^s(u) = e^{-\Phi_{in,jk}^s u^{-\epsilon}}, \quad \Phi_{in,jk}^s = (\tau_{in,jk}^s Q_{jk}^{1-\beta})^{-\epsilon} (v_{in,jk}^s)^\epsilon.$$

Since the maximum of a sequence of Fréchet distributed random variables is itself Fréchet distributed, the distribution of utility across all possible destinations is

$$1 - G_{in}^s(u) = 1 - \prod_{jk=11}^{JK} e^{-\Phi_{in,jk}^s u^{-\epsilon}}.$$

Therefore, we have

$$G_{in}^s(u) = e^{-\Phi_{in}^s u^{-\epsilon}}, \quad \Phi_{in}^s = \sum_{jk=11}^{JK} \Phi_{in,jk}^s.$$

We derive the gravity equation for migration flow in spatial equilibrium models as follows. Let $\pi_{in,jk}^s$ denote the share of workers with skill s registered in in who migrated to jk . The law of large numbers implies that the proportion of workers who migrate to prefecture-region jk is

$$\pi_{in,jk}^s = \frac{(\tau_{in,jk}^s Q_{jk}^{1-\beta})^{-\epsilon} (v_{in,jk}^s)^\epsilon}{\sum_{j'k'=11}^{JK} ((\tau_{in,j'k'}^s Q_{j'k'}^{1-\beta})^{-\epsilon} (v_{in,j'k'}^s)^\epsilon)} = \frac{\Phi_{in,jk}^s}{\Phi_{in}^s}. \quad (6)$$

4.3 | Production

A single final good y is costlessly traded within the economy. In urban regions, it is produced with constant returns to scale following a Cobb–Douglas form, using some efficient combination of labor X_j and production floor space S_j^M :

$$Y_{ju} = (X_{ju})^\alpha (S_{ju}^M)^{1-\alpha}, \quad \text{where } X_{ju} = [(A_{ju}^h H_{ju}^h)^{\frac{\sigma-1}{\sigma}} + (A_{ju}^l H_{ju}^l)^{\frac{\sigma-1}{\sigma}}]^{\frac{\sigma}{\sigma-1}}, \quad (7)$$

where X_{ju} is a CES combination of high-skill labor H_{ju}^h and low-skill labor H_{ju}^l multiplied by their corresponding prefecture-level efficiencies A_{ju}^h and A_{ju}^l . In rural regions, production is simply $Y_{jr} = A_{jr} H_{jr}$. Since we are not focusing on trade or substitution between agricultural goods and other goods, we assume that Y_r and Y_u are perfect substitutes. In equilibrium, A_{jr} equals the agricultural wage w_{jr} in prefecture j rural area r .¹⁷

Firm Optimization. We assume that the goods market is perfectly competitive. Urban firms choose their inputs of workers and production floor space to maximize profits, taking as given final goods productivity ($\{A_{ju}^h, A_{ju}^l\}$), the distribution of idiosyncratic utility, factor prices, and decisions of other firms and workers. The production input factor prices serve as the second congestion effect in this model since when more and more people migrate to a city, production floor space prices will be increased and wages will be decreased, resisting further migration. From the first-order conditions, we obtain the following:

$$w_{ju}^l = \alpha X_{ju}^{\alpha-1} S_{ju}^{M 1-\alpha} A_{ju}^l \frac{\sigma-1}{\sigma} X_{ju}^{\frac{1}{\sigma}} H_{ju}^l \frac{-1}{\sigma} \quad (8)$$

$$w_{ju}^h = \alpha X_{ju}^{\alpha-1} S_{ju}^{M^{1-\alpha}} A_{ju}^h \frac{\sigma-1}{\sigma} X_{ju}^{\frac{1}{\sigma}} H_{ju}^h \frac{-1}{\sigma} \quad (9)$$

$$S_{ju}^M = \left(\frac{1-\alpha}{q_{ju}} \right)^{\frac{1}{\alpha}} X_{ju}. \quad (10)$$

The zero profit property from the constant returns to scale production function determines the equilibrium production floor price q_{ju} by

$$(X_{ju})^\alpha (S_{ju}^M)^{1-\alpha} - W_{ju} X_{ju} - q_{ju} S_{ju}^M = 0,$$

where $W_{ju} X_{ju} = w_{ju}^l H_{ju}^l + w_{ju}^h H_{ju}^h$. This, together with profit maximization (10), yields the following expression for the equilibrium production floor price:

$$q_{ju} = (1-\alpha) \left(\frac{\alpha}{W_{ju}} \right)^{\frac{\alpha}{1-\alpha}}. \quad (11)$$

Agglomeration. We now introduce endogenous agglomeration forces as in Ahlfeldt et al. (2015) with slight modifications at the prefecture level. We allow urban labor productivity for both skills to depend on production fundamentals (a_{ju}^h and a_{ju}^l) and production externalities (D_{ju}). Production externalities impose structure on how the productivity of a given region is affected by the density of workers within the urban area of the prefecture.

$$A_{ju}^s = a_{ju}^s \times (D_{ju})^\gamma, \quad (12)$$

where $D_{ju} = (H_{ju}^h + H_{ju}^l) / \bar{L}_{ju}$ is the urban density in thousands of workers per square kilometer of administrative prefecture urban districts (urban core and its surroundings) as in Chauvin et al. (2017), and γ controls density's relative importance in determining overall productivity.¹⁸

4.4 | Land Market Clearing

Urban Regulations and Urban Land Supply. Before moving to the urban floor space market clearing, we highlight the regulation of the supply of urban land. For urban land supply in each prefecture, it is subject to a quota restriction, which is determined by the central and local governments. There are two main parameters in our model to reflect this quota restriction. We have (1) a regulated density of development ϕ_j (the ratio of floor space to land) and (2) a geographic construction land quota \bar{L}_j^u . When the desired land supply in prefecture j reaches the quota, they cannot build anymore. As a result, the actual construction land supply $L_j^u \leq \bar{L}_j^u$ always holds. Therefore, the total floor space S_{ju} is supplied by a highly regulated construction sector that uses construction land L_j and a regulated density ϕ_j to produce $S_{ju} = \phi_j L_j^u \leq \phi_j \bar{L}_j^u$. The detailed measurement of land quotas is explained in Online Appendix B.3.

For prefectures that reach the quota, $S_{ju} = \phi_j \bar{L}_j^u$ holds. Otherwise, we assume an endogenous land supply as a function of total land reserve R_j , inverted construction density $1/\phi_j$, floor space price Q_{ju} , and local urban development conditions κ_j . Therefore,

$$L_j^u = \min \left\{ R_j - \kappa_j \left(\frac{Q_{ju}}{\phi_j} \right)^{-1/\zeta}, \bar{L}_j^u \right\}, \quad (13)$$

where ζ is the price elasticity of developed land as in Yu (Forthcoming). The endogenous land supply could be derived from a microfounded urban land converter's problem as in Yu (Forthcoming). We provide a detailed derivation for Equation (13) in Online Appendix B.2.

Finally, local governments exogenously determine the allocation between production and residence, which is heterogeneous across prefectures. We treat this preference heterogeneity as creating a wedge between prices of production (q_{ju}) and residential (Q_{ju}) floor space $q_{ju} = \eta_j Q_{ju}$, where η_j captures the prefecture-specific land-use regulations that restrict the price of production land relative to the price of residential land. To keep the model tractability, we assume that η_j is an exogenous parameter.

Urban Floor Space Clearing. Production land market clearing requires that the demand equals the supply of floor space allocated to production use in each location: $\theta_j S_{ju}$. Using the first-order conditions for profit maximization, this production land market clearing condition is

$$S_{ju}^M = \left(\frac{(1-\alpha)}{q_{ju}} \right)^{\frac{1}{\alpha}} X_{ju} = \theta_j S_{ju}, \quad (14)$$

where $\theta_j \in (0, 1)$ is the measured proportion of floor space allocated to production use.¹⁹

Residential land market clearing implies that the demand for residential floor space equals the supply of floor space allocated to residential use in each location: $(1-\theta_j)S_{ju}$. Using utility maximization for each worker and taking expectations over the distribution for idiosyncratic utility, this residential land market clearing condition can be expressed as

$$S_{ju}^R = E[s_{ju}]H_{ju} = (1-\beta) \frac{E[v_{ju}]H_j}{Q_{ju}} = (1-\theta_j)S_{ju}. \quad (15)$$

Rural Floor Space Clearing. Rural housing markets are more straightforward as there is no production land. We assume that rural housing costs are a fixed fraction of the urban cost $Q_{jr} = \tau Q_{ju}$. Therefore, the price Q_{jr} is the cost of building a unit of floor space on rural land. Given the cost, rural residents choose the optimal floor space to build.

4.5 | Definition of Spatial General Equilibrium

We now define and characterize the properties of a spatial general equilibrium given the model's fixed parameters $\{\beta, \epsilon, \alpha, \sigma, \gamma\}$.

Definition 1. A Spatial General Equilibrium for this economy is defined by a set of exogenous economic conditions $\{\tau_{in,jk}^s, a_j^s, \eta_j, \phi_j, R_j, \kappa_j, \bar{L}_j^u, H_{in}^s\}$, a list of endogenous prices $\{Q_{ju}, q_{ju}, w_{jk}^s\}$, quantities $\{v_{in,jk}^s, Y_{jk}^s, H_{jk}^s, L_j^u, S_{ju}\}$, and proportions $\{\pi_{in,jk}^s, \theta_j\}$ that solve the firms' problem, workers' problem, floor space producers' problem, and satisfy market clearing such that:

- i. **[Worker Optimization]** Taking the exogenous economic conditions $\{\tau_{in,jk}^s, A_{jk}^s\}$ and the aggregate prices $\{Q_{ju}, w_{jk}^s\}$ as given, workers' optimal migration choices pin down the equilibrium labor supply in each prefecture H_{jk}^s , the

TABLE 4 | Parameters.

Parameter	Description	Value	Source
<i>From our microdata</i>			
β	share of consumption in utility	0.77	Urban Household Survey
α	share of labor in production	0.88	Enterprise Surveys
η_j	relative cost of production to residential land	prefecture-specific	China Land Market Website
τ	relative cost of rural housing	0.34	Population Census
γ	agglomeration elasticity	0.09	Indirect Inference
<i>From literature</i>			
σ	elasticity of skill substitution	1.4	Katz and Murphy (1992)
ϵ	migration elasticity	1.9	Fang and Huang (2022)
ζ	price elasticity of land supply	3.2	Yu (Forthcoming)

Note: This table summarizes all calibrated parameters. We first match $(1 - \beta)$ to the cost share of residential floor space in consumer expenditure from the Urban Household Survey of China, $(1 - \alpha)$ to the cost share of production floor space in firm costs from the Enterprise Surveys of Chinese manufacturing firms conducted by the World Bank in 2005, and $(\eta - 1)$ to the ratio of production land price to residential land price in each prefecture from land transaction data via the China Land Market Website (<http://www.landchina.com/>). We then calibrate the prefecture pair migration elasticity (ϵ) to be 1.9, which is estimated in Fang and Huang (2022) using the same Census data and the relative cost of rural housing (τ) to be 0.34 using the average rent paid by rural workers over the average rent paid by urban workers in the Population Census. Unfortunately, we failed to generate a robust estimate for σ using our microdata and various empirical methods. As a result, we rely on Katz and Murphy (1992) to choose the elasticity of substitution between high and low skill (σ) to be 1.4. The elasticity of construction land supply to density-adjusted floor space prices (ζ) is calibrated to 3.2 as in Yu (Forthcoming). We have conducted various sensitivity checks concerning all of our parameters and ensured the robustness of the model mechanisms.

migration flow between each prefecture pair $\pi_{in,jk}^s$, and equilibrium residential floor space demand $(1 - \theta_j)S_{ju}$

- ii. **[Firm Optimization]** Taking the exogenous economic conditions $\{A_{jk}^s\}$ and the aggregate prices $\{q_{ju}, w_{jk}^s\}$ as given, firms' optimal production choices pin down the equilibrium labor demand H_j^s and equilibrium production floor space demand $\theta_j S_{ju}$ in each prefecture.
- iii. **[Market Clearing]** For all prefectures, labor supply equals labor demand, floor space supply equals floor space demand, and final good supply equals final goods demand. This pins down the equilibrium aggregate prices $\{Q_{ju}, q_{ju}, w_{jk}^s\}$, equilibrium land supply L_j^u , equilibrium floor space S_{ju} , and equilibrium urban output Y_{ju} .

5 | Taking the Model to the Data

In this section, we first solve the model for the unobserved fundamentals of the economy using the census data from 2005 and 2010. We then estimate the agglomeration parameters using indirect inference (Gourieroux et al. 1993), which combines our prefecture-level regression from the empirical analysis and the solved unobserved fundamentals of the economy in 2005. Finally, we quantitatively analyze the spatial distributions of measured productivity and land tightness across regions with different levels of development. We conduct a thorough sensitivity check in Section 6.5 to ensure the robustness of our quantitative results.

5.1 | Calibrating the Parameters

We fix a set of parameters to match data moments. Table 4 summarizes our calibrated parameters, which rely on various data sources, including our own and the literature.

In the first group, we match $(1 - \beta)$ to the cost share of residential floor space in consumer expenditure, $(1 - \alpha)$ to the cost share of production floor space in firm costs, and $(\eta - 1)$ to the ratio of production land price to residential land price. To match $(1 - \beta)$, we use the average accommodation expenditure share of total consumption from the Urban Household Survey of China (UHS). The National Bureau of Statistics of China conducted the survey and partially redesigned it in 2012. We believe the post-2012 measurement standard is more realistic, which gives us an average share of roughly 23% from 2013 to 2017.²⁰ Hence, we choose β to be 0.77. Second, to match $(1 - \alpha)$, we use the average production floor space cost per output unit. Unfortunately, there is no direct measure of floor space costs available. We rely on the Enterprise Surveys of Chinese Manufacturing Firms conducted by the World Bank in 2005. Firms reported tax payments based on land usage, through which we can infer the costs of production land. The mean across all firms and prefectures is 12% of output. Therefore, the labor share of production (α) is 0.88.

Furthermore, to match $(\eta - 1)$, we need to compare the prices of production and residential land. Prefecture governments may have different incentives to promote residential or production construction through tax or development motivations. Therefore, we use land price differences to match η_j for each prefecture j . The land price differences in each prefecture come from land transaction data via the China Land Market Website (http://www.landchina.com). We define land used for both industrial and service firms as production land. Finally, the relative cost of rural housing (τ) is calculated using the average rent paid by rural area workers over the average rent paid by urban area workers in each prefecture in both Censuses. This gives us a value of 0.34.

In the second group, we calibrate from the literature. The elasticity of substitution between skills (σ) is calibrated to be 1.4

as in Katz and Murphy (1992), which has been widely used in previous literature.²¹ The prefecture pair migration elasticity (ϵ) is calibrated to be 1.9 following Fang and Huang (2022), which is estimated using the same data as this paper.²² We choose the latter value since it is estimated in an almost identical model context to this study. Finally, the elasticity of construction land supply to density-adjusted floor space prices (ξ) is calibrated to 3.2 as in Yu (Forthcoming), which is estimated from microfounded urban land development data.

5.2 | Solving for Equilibrium Allocations and Prices

Based on the data we have on the observed equilibrium allocations and prices $\{H_{jk}^s, \pi_{in,jk}^s, w_{jk}^s, Q_{jk}, q_{jk}\}$, we can calculate all unobserved variables except the agglomeration parameter and local urban development: productivities $\{A_{jk}^l$ and $A_{jk}^h\}$; migration costs ($\tau_{in,jk}^s$), floor spaces $\{S_{ju}^M, S_{ju}^R, S_{jr}^R\}$, and construction density (ϕ_j) in both 2005 and 2010 as follows. We then estimate the agglomeration parameters γ and local urban development conditions κ_j by eliminating place-based policies.

Productivities. First, from profit maximization and zero profits, we can infer productivity from the data on employment and wages. First, we solve for productivity A_j^h as a function of A_j^l using the first-order conditions $A_{ju}^h = A_{ju}^l \left(\frac{H_{ju}^h}{H_{ju}^l} \right)^{\frac{1}{\sigma-1}} \left(\frac{w_{ju}^h}{w_{ju}^l} \right)^{\frac{\sigma}{\sigma-1}}$. Plugging A_{ju}^h into the definition of X_{ju} , then:

$$X_{ju} = A_{ju}^l H_{ju}^l \left[\frac{w_{ju}^h H_{ju}^h + w_{ju}^l H_{ju}^l}{w_{ju}^l H_{ju}^l} \right]^{\frac{\sigma}{\sigma-1}} \equiv A_{ju}^l H_{ju}^l (\Xi_{ju}^l)^{-\frac{\sigma}{\sigma-1}},$$

where $\Xi_{ju}^l = w_{ju}^l H_{ju}^l / (w_{ju}^h H_{ju}^h + w_{ju}^l H_{ju}^l)$ is the share of labor income distributed to low-skill workers. We also assume that agricultural productivity equals agricultural wages $A_{jr}^s = w_{jr}$, for both $s \in \{h, l\}$. Combining the previous equation with the definition of W_{ju} , we have $W_{ju} = (w_{ju}^h H_{ju}^h + w_{ju}^l H_{ju}^l) / X_{ju} = w_{ju}^l / A_{ju}^l \cdot (\Xi_{ju}^l)^{1/(\sigma-1)}$. Plugging W_j into the price function of q_j , we can solve

$$A_{ju}^l = \frac{q_{ju}^{\frac{1-\alpha}{\alpha}} w_{ju}^l (\Xi_{ju}^l)^{\frac{1}{\sigma-1}}}{\alpha(1-\alpha)^{\frac{1-\alpha}{\alpha}}}, \quad A_{ju}^h = \frac{q_{ju}^{\frac{1-\alpha}{\alpha}} w_{ju}^h (\Xi_{ju}^h)^{\frac{1}{\sigma-1}}}{\alpha(1-\alpha)^{\frac{1-\alpha}{\alpha}}}, \quad (16)$$

where $\Xi_{ju}^h = 1 - \Xi_{ju}^l$. Intuitively, higher production floor prices, wages, or skill shares s require higher skill s productivity at equilibrium.

Land Market Clearing. Second, from workers' first-order conditions for residential floor space, the summation of all workers residing in each prefecture j (residential demand), and firms' first-order conditions for production floor space, we can calculate both urban and rural floor space:

$$S_{ju}^R = \frac{1-\beta}{\beta Q_{ju}} \left[w_{ju}^l H_{ju}^l + w_{ju}^h H_{ju}^h \right], \quad S_{ju}^M = \left(\frac{1-\alpha}{q_{ju}} \right)^{\frac{1}{\alpha}} X_{ju},$$

$$S_{jr}^R = \frac{1-\beta}{\beta Q_{jr}} [w_{jr} H_{jr}].$$

We are then able to calculate the total amount of urban floor space $S_{ju} = S_{ju}^R + S_{ju}^M$ and finally back out the implied construction intensity $\phi_j = S_{ju} / L_j^u$.

Migration Costs. To compute migration costs, we need first to compute the prefecture-level equally divided rent income for residents $Q_i S_i^R / H_i$ from the residential floor space S_i^R calculated above, to which we can add observed wages to determine incomes of workers of skill s moving from in to jk : $u_{in,jk}^s = w_{jk}^s + Q_{jn} S_{jn}^R / H_{in}^R$. Then, we can calculate all migration costs between all prefecture pairs from the gravity equations. We assume the iceberg migration cost for staying in one's original prefecture is $\tau_{in,in}^s = 1$. With Q_{in} , $u_{in,jk}^s$ and $\pi_{in,jk}^s$ in hand, along with the gravity equation, we have

$$\Phi_{in}^s = \sum_{jk=1}^{JK} (\tau_{in,jk}^s Q_{jk}^{1-\beta})^{-\epsilon} (u_{in,jk}^s)^{\epsilon} = \frac{(Q_{jk}^{1-\beta})^{-\epsilon} (u_{in,in}^s)^{\epsilon}}{\pi_{in,in}^s}$$

by inserting Φ_{in}^s into the original gravity equation, we have

$$\tau_{in,jk}^s = \frac{u_{in,jk}^s}{Q_{jk}^{1-\beta} (\pi_{in,jk}^s \Phi_{in}^s)^{1/\epsilon}}, \quad \text{for } i \neq j. \quad (17)$$

And for prefecture-area pairs with zero migration flow, we assign a migration probability $\pi_{in,jk}^s \sim 0$, resulting in a prohibitive migration cost approaching infinity.

5.3 | Solving Agglomeration and Land Development Parameters

Finally, we estimate and solve for the remaining parameters: agglomeration elasticity γ , urban production fundamentals a_{ju}^h and a_{ju}^l , and local urban land development condition κ_j .

Estimating Agglomeration Parameters. Now we describe the process to estimate the agglomeration parameters using the indirect inference method. To begin with, we calculate the counterfactual urban land allocation in 2005 and 2010 if there is no inland-favoring land policy. To do so, we assume that the prefecture-level new land allocation increments from 2003 to 2005 or 2010 follow the corresponding prefecture-level new land allocation based on the land supply growth rate from 2000 to 2003. More details are in Online Appendix B.5.

Below, we summarize the three steps of indirect inference. The first step is our prior regression (1), which yields a range of estimates for the coefficient δ_1 . This gives us the treatment effect of the inland-favoring policy from real data. The second step is to simulate productivity in different prefectures using our model. We simulate productivity in two cases. The first case is the original equilibrium in 2005 and 2010, following the inland-favoring policy, as observed in the real world. The second case is a counterfactual equilibrium in 2005 and 2010, assuming no inland-favoring land supply policy, as described above. Given different guessed agglomeration parameters γ , we calculate different simulated productivities in each scenario. The

third step is to run the same regression (1) using the simulated data from both the original and the counterfactual equilibria. We repeat this progress until the model-simulated regression coefficient $\hat{\delta}_1^*$ converges to our empirical estimation $\hat{\delta}_1$. From step one, we find that the 2003 inland-favoring policy led to a decrease of between 5% and 7% in the average productivity of eastern prefectures relative to the inland (results in Table 2). From step three, we find a monotonic negative relationship: the stronger the agglomeration effects are, the larger the loss generated by the inland-favoring land policy in the model. Matching the model-simulated coefficient $\hat{\delta}_1^* \in [-0.07, -0.05]$ gives us a range of estimates for $\gamma \in [0.09, 0.16]$.

This estimated range is slightly larger than the common point estimate of 0.07 in developed countries (Combes and Gobillon 2015). As documented in the literature, the estimates in developing countries tend to be larger than in developed countries. Chauvin et al. (2017) estimated a density elasticity for wages as high as 0.19 for China, while Combes et al. (2013) estimate between 0.10 and 0.12. In a more recent paper, Wu and You (2025) use microdata on individual wages and an appropriate definition of cities to estimate the agglomeration elasticity in China. They obtain an estimate of agglomeration elasticity of 0.10. Since the agglomeration parameter plays a crucial role in determining the magnitude of misallocation, we conservatively choose this parameter as our estimated lower bound, $\gamma = 0.09$, which falls within the range reported in the literature, such as Wu and You (2025). We check the sensitivity of our results across a wide range of values for γ , and our results hold qualitatively. Finally, we recover production fundamentals a_{ju}^h and a_{ju}^l given agglomeration elasticity $\gamma = 0.09$.

Estimating Land Development Parameters. After recovering the agglomeration parameters, we again use the counterfactual equilibrium with no inland-favoring policy, as described above, to recover the land development condition parameters κ_j . We assume that in this counterfactual, land quota is no longer binding in eastern prefectures. For prefectures with nonbinding land quota constraints, land supply equals land demand. Given the solved equilibrium floor space prices Q_{ju} , construction intensity ϕ_j , and data on the natural limit R_j , we can directly recover κ_j using the endogenous supply $R_j - \kappa_j (Q_{ju}/\phi_j)^{-1/\zeta}$. For prefectures with binding land quota constraints, land supply falls short of demand. In this case, we employ the counterfactual equilibrium without inland-favoring land policy, as described above, to recover the land development condition parameters κ_j . The underlying assumption is that, in the counterfactual equilibrium, the binding land quota constraints are relaxed, resulting in an unconstrained equilibrium. Consequently, the equilibrium endogenous land supply is equal to local land demand.

5.4 | Characterizing Equilibrium Spatial Distribution

Our model quantifies the equilibrium spatial distribution of productivity and land tightness. The complete list of prefectures, along with their measured productivity and land tightness, is provided in Online Appendix B.1. Here, we present only the key findings on the model-implied spatial correlation of productivity

and land tightness in equilibrium. We define measured productivity as the ratio of local output to the local labor force $ln(\widehat{Prod}_{ju}) = ln(Y_{ju}/(H_{ju}^h + H_{ju}^l)^\alpha)$, mirroring the productivity calculated in the empirical analysis. We then define land tightness as kil-square meters per thousand workers. Figure 4 shows the static spatial equilibrium distribution of measured productivity and land tightness across regions.

Figure 4a shows the correlation by prefecture region groups. Region groups are classified by the location of the prefecture (east or inland) and the level of development (GDP per capita) in 2005, as in the data. For the level of development, we divide all prefectures into three categories {high, mid, and low} to capture {10, 45, 45}% of the distribution of GDP per capita. Each region had the same prefectures in 2005 and 2010 for consistent comparisons. Plot (b) shows the correlation by individual prefectures, from which the prefecture group plot is created. We have two observations. First, there is a strong negative correlation between productivity and land tightness. More developed eastern prefectures are much more productive but much more land-constrained. Second, the negative relation is increasingly severe over time, even though productivity is generally improving. Both patterns demonstrate the existence of potential spatial misallocation of land and labor in the presence of place-based land policies.

We also provide additional results that examine the spatial distribution of economic development and income in depth, containing three key observations consistent with our findings in Online Appendix B.7. First, more developed eastern prefectures have much higher output, especially urban output. Second, these prefectures are much more densely populated with higher floor space prices. Third, workers in these prefectures earn higher incomes, reflected in higher wages for all workers and higher nonwage incomes for Hukou workers. These findings complement our previous empirical results on the spatial misallocation caused by the place-based land policy. These patterns suggest potential losses in productivity and equality due to the place-based land policy, which reallocates construction land supply from eastern and more developed prefectures to inland and less developed prefectures.

6 | Removing the Inland-Favoring Distortions

This section simulates what would happen if the inland-favoring land policy were not implemented, while maintaining the national land supply. That is, in the counterfactual world, we assume that the inland-favoring land supply policy was not implemented, and the pre-2003 land allocation rule remained in place. However, to best illustrate the effects of the inland-favoring policy on spatial misallocation, **we maintain the national total land supply at a constant level as in the real world.** Then, we investigate the impact in two scenarios. First, we remove the inland-favoring policy without any other changes. Second, we remove the inland-favoring policy and replace it with regional transfers. Since the model features nonlinear interactions between skills and contains multiple floor space markets, classical hat algebra is not feasible. Therefore, we develop a multilayer global solution iteration algorithm to compute the counterfactuals. The algorithm clears all markets, including

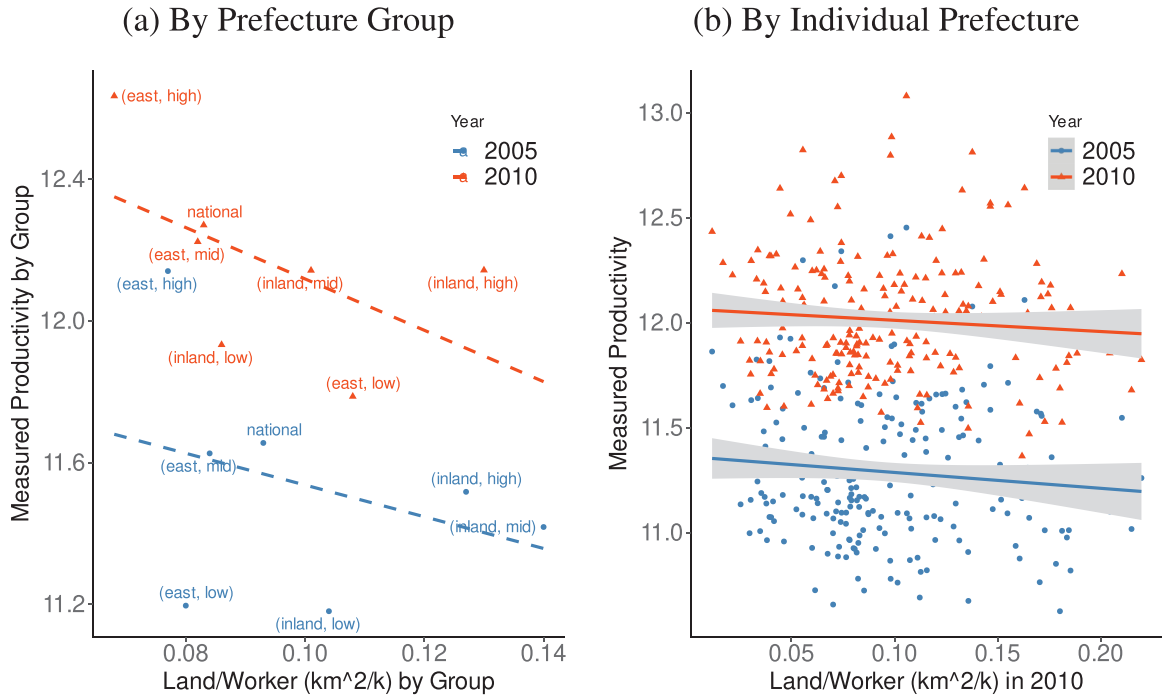


FIGURE 4 | Correlation between productivity and land tightness. *Notes:* This figure plots the correlation between productivity and land tightness in the model. Plot (a) shows the correlation by prefecture group as in the tables above. Plot (b) shows the correlation between individual prefectures. Plot (b) excludes six extreme values for visual clarity; for the plot with the whole sample, please refer to Figure B2 in Online Appendix B.6. The correlation is stronger when we include the extreme values. Regions are classified by the location of the prefecture (east or inland) and the level of development (GDP per capita) in 2005, as in the data. For the level of development, we divide all prefectures into three categories {high, mid, and low} to capture {10, 45, 45}% of the distribution of GDP per capita. Each region had the same prefectures in 2005 and 2010 for consistent comparisons.

labor, production floor space, and residential floor space markets across prefectures and areas. The details are described in Online Appendix B.4.

6.1 | Constructing the Counterfactual Land Policy

We investigate what would have happened if the 2003 inland-favoring land supply policy had not been implemented. To do so, we preserve the total new land supply increments from 2003 to 2005 and 2010 but redistribute the total new land supply based on the land supply growth rate from 2000 to 2003. We chose the 2000–2003 growth rate because pre-1999 land supply data at the prefecture level are unavailable. The following equation shows the details of the new supply rule:

$$\widehat{L}_j(t) = L_j(2003) + \underbrace{\sum_j [L_j(t) - L_j(2003)]}_{\text{actual total increment of land}} \times \frac{L_j(2003)(1 + g_{L_j})^{t-2003}}{\sum_j L_j(2003)(1 + g_{L_j})^{t-2003}}, \quad (18)$$

prefecture j 's share if no inland-favoring

where the first component $L_j(2003)$ is prefecture j 's urban land stock in 2003, just before the structural change happened. The second component multiplies the actual national total increment of land $\sum_j [L_j(t) - L_j(2003)]$ and prefecture j 's share of land supply if the total land supply followed the pre-2003 growth rate.

TABLE 5 | Counterfactual land allocation (km²).

Regions (loc., dev.)	No. of prefectures	Reality		Counterfactual	
		2005	2010	2005	2010
National	225	22,268	28,336	22,268	28,336
(east, high)	21	5838	7272	6597	10,958
(east, mid)	51	5875	7832	5734	6551
(east, low)	25	1418	1681	1472	1596
(inland, high)	2	169	206	169	169
(inland, mid)	50	5131	6578	4537	4819
(inland, low)	76	3837	4767	3760	4244

Note: This table displays a summary of total urban land supply data by prefecture group (summations within the group) in 2005 and 2010, as well as the counterfactual land supply in 2010 (unit: km²). Regions are classified by prefecture location (east or inland) and the level of development (GDP per capita) in 2005.

We consider this counterfactual land policy since it still fulfills the central government's strict goal of controlling the national total urban land usage.

This counterfactual land policy is summarized in Table 5. Columns 1–2 present the actual land supply under the policy, while Columns 3–4 display the counterfactual land supply based on the allocation rule in Equation (18). Without the inland-

favoring policy in 2003, more developed prefectures would have received a greater share of land. For example, the land quota for highly developed eastern prefectures would have been 10,958 km² in 2010 without the inland-favoring policy instead of the observed 7,272 km². Conversely, the land quota for low-development inland prefectures would have been 4,244 km² in 2010 without the policy, compared to the observed 4,767 km². Further details of the changes are in Online Appendix C.1.

6.2 | Regional Transfer Policy and Welfare Calculation

Constructing the Regional Transfer Policy. We aim to demonstrate that a regional transfer results in less spatial misallocation and genuinely benefits people from disadvantaged regions. Rather than implementing the place-based land policy, we consider that the central government opts to redistribute the additional land income generated by the counterfactual land allocations from developed to underdeveloped prefectures. The sole difference between removing the inland-favoring policy with regional transfers and removing the inland-favoring policy without transfers counterfactuals is that the former incorporates a feasible regional transfer on top of the latter.

We select a specific yet sophisticated transfer rule, as our goal is to demonstrate that such a regional transfer can reduce regional income gaps and spatial misallocation. The detailed construction of the policy is in Online Appendix C.2. We only provide the key idea here. The essence of the transfer is: (1) preserve urban land income by transferring funds from land-gaining prefectures to land-losing prefectures, (2) adjust for housing prices by transferring from price-decreasing prefectures to price-increasing prefectures, and (3) transfer additional production land income from urban to rural regions. We also provide a simpler transfer rule in Online Appendix C.3 that is equally effective. Notice that the sophisticated transfer rule redistributes additional production land income to rural workers, as aggregate income would be much higher.

Calculating the Welfare Changes. We can calculate the ex ante expected utility of workers based on the properties of the Fréchet distribution. The cumulative distribution function of the utility of workers originating from region i area n with skill s is $G_{in}^s(u) = e^{-\Phi_{in}^s u^{-\epsilon}}$ where $\Phi_{in}^s = \sum_{j'k'=11}^{JK} (\tau_{in,j'k'}^s Q_{j'k'}^{1-\beta})^{-\epsilon} (v_{in,j'k'}^s)^{\epsilon}$. Therefore, their expected utility is $E_{in}^s[u] = \Gamma(1 - 1/\epsilon) \times (\Phi_{in}^s)^{1/\epsilon}$ where the Gamma function $\Gamma(1 - 1/\epsilon)$ is a constant and Φ_{in}^s reflects the expected utility from access to all alternative regions and areas. Φ_{in}^s is positively correlated with potential income $v_{in,j'k'}^s$ and is negatively correlated with migration and housing costs. We can then calculate the changes in ex ante welfare of people from origin in with skill s as follows:

$$\Delta E_{in}^s[u] = \frac{E_{in}^s[u]}{E_{in}^s[u]} - 1 = \left(\frac{\sum_{j'k'=11}^{JK} (\tau_{in,j'k'}^s Q_{j'k'}^{1-\beta})^{-\epsilon} (v_{in,j'k'}^s)^{\epsilon}}{\sum_{j'k'=11}^{JK} (\tau_{in,j'k'}^s Q_{j'k'}^{1-\beta})^{-\epsilon} (v_{in,j'k'}^s)^{\epsilon}} \right)^{1/\epsilon} - 1$$

$$= \left(\underbrace{\frac{(\widehat{Q}_{in}^{1-\beta})^{-\epsilon} (\widehat{v}_{in,in}^s)^{\epsilon}}{\Phi_{in}^s}}_{\text{Changes in Hometown Conditions}} + \underbrace{\frac{\sum_{j'k' \neq in}^{JK} (\tau_{in,j'k'}^s Q_{j'k'}^{1-\beta})^{-\epsilon} (v_{in,j'k'}^s)^{\epsilon}}{\Phi_{in}^s}}_{\text{Changes in Migration Destination Conditions}} \right)^{1/\epsilon} - 1,$$

where changes in the welfare of the specific group of workers of origin in with skill s consist of changes from two parts. First, changes in hometown local conditions are reflected in floor space prices, local wages, and local housing asset returns. Second, changes in migration destination conditions are reflected in a nonlinear combination of migration costs, destination floor space price, destination wage, and housing asset return. Overall, welfare changes are nonlinear combinations of various components in this model. As a result, for workers from less developed regions who have a probability of moving to work in more developed regions, both hometown local conditions and destination conditions matter significantly for welfare changes. On the contrary, for workers from more developed regions who are likely to stay at home, hometown local conditions matter more. Finally, we assign equal weights to each worker and sum across all individuals of the country or a specific region when calculating national or regional aggregated welfare.

6.3 | Aggregate Effects and Decomposition

Aggregate Effects. We first present the aggregate effects of the counterfactual, which involves removing the inland-favoring land policy while maintaining the constrained total land supply, both with and without regional transfers, on measured national productivity, urban output, rural output, urban population, house prices, national average income, and welfare.

The results are illustrated in Figure 5. Eliminating the place-based land policy significantly increased productivity, urban output, average income, and welfare in both 2005 and 2010, with or without regional transfers. First, aggregate economic development is significantly boosted by removing the inland-favoring land policy. Without the regional transfer, the national gain in productivity is 1.6% in 2005 and 2.0% in 2010, while total output rises by 1.1% and 1.8%, respectively. With the regional transfer, the national gain in productivity is 1.4% in 2005 and 1.6% in 2010, while total output rises by about 1.2% in both years. The removal of the policy also boosts the urban population by lowering the price of residential floor space in the urban areas of developed prefectures. In contrast, rural output declines due to the emigration of workers. With the regional transfer, the gains from economic development are weaker but qualitatively in the same direction. The results for the simple regional transfer are in Online Appendix C.4.

Second, aggregate income and welfare increase, but magnitudes vary significantly depending on the regional transfer. Incomes with the regional transfer are considerably higher than without, because the additional return from more productive land in more productive prefectures is redistributed to rural workers. Aggregate welfare, however, is sensitive to whether and how the regional transfer is applied, as welfare is more heavily influenced by rich urban workers, who have significantly higher initial welfare levels. As a result, the aggregate welfare changes are more sensitive to changes in housing prices in these more developed regions. For instance, the 4.7% welfare gain in 2010 is primarily driven by gains in more developed regions, which will be explained further in the section on spatial effects below.



FIGURE 5 | Aggregate effects of removing the inland-favoring distortions. *Notes:* This figure shows the aggregate effects of removing the inland-favoring land allocation distortions on the Chinese economy in 2005 and 2010. Gray columns represent changes in 2005. Black columns represent changes in 2010. In both years, we find substantial national changes in productivity, total output, urban and rural output, urban population, house prices, income, and welfare. Plot (a) shows the results without the regional transfer, and Plot (b) shows the results with the regional transfer.

Aggregate Effects Decomposition. We now decompose the aggregate effects into three channels: (1) the direct effect arising only from changes in production floor space, (2) the indirect effect through induced changes in labor demand and supply, and (3) the agglomeration effect through induced changes in population density. The first channel reflects the direct distortion of land and housing markets, while the second captures the indirect distortion of the labor market. Together with the third channel, all three mechanisms of the inland-favoring land policy contribute to the spatial misallocation of production and labor toward less productive regions, thereby lowering national productivity. To conduct this decomposition, we construct two hypothetical equilibria. The first hypothetical equilibrium has only the changes in production floor space without changes in migration. The second hypothetical equilibrium has no agglomeration effects. We could then take (1) the gap between the original equilibrium and the first hypothetical equilibrium as the direct effect, (2) the gap between the first hypothetical equilibrium and the second hypothetical equilibrium as the indirect effect, and (3) the gap between the second hypothetical equilibrium and the original counterfactual equilibrium as the agglomeration effect. Details of this construction are provided in the Online Appendix C.5.

Table 6 reports the decomposition of production and allocation variables. Our primary focus is on changes in measured productivity and total output. There are three main observations.

First, the direct effect is quantitatively the least important and may even operate in the opposite direction, since the national total land input remains unchanged. Second, the indirect impact of worker reallocation plays a central role, contributing the most to the gains in measured productivity and output in both years. Finally, agglomeration effects are also significant: although smaller than the indirect effect, they are of sizable magnitudes for both measured productivity and total output. Other variables, such as income and welfare, follow similar patterns. Taken together, these decomposition results underscore that migration and agglomeration are central considerations for place-based policies (Morten 2019; Duranton and Puga 2023).

6.4 | Spatial Effects on Development, Income, and Welfare

Spatial Effects on Development. We further show the spatial effects of removing the inland-favoring policy on economic development. Table 7 shows the changes in productivity, urban output, rural output, urban population, and housing prices across different regions without transfers. For additional results with the regional transfer, see Online Appendix C.7. Three main conclusions can be drawn. First, after eliminating the inland-favoring land policy, housing prices decreased significantly in developed eastern prefectures but increased in other prefectures. Second, more workers migrated to developed eastern prefectures,

TABLE 6 | Aggregate effects decomposition.

Decomp.	Δ Productivity		Δ Total Output		Δ Urban Pop.		Δ House Price		Δ Income		Δ Welfare	
	2005	2010	2005	2010	2005	2010	2005	2010	2005	2010	2005	2010
Total	1.6%	2.0%	1.1%	1.8%	0.4%	1.5%	-3.9%	-6.5%	1.3%	1.5%	3.9%	4.7%
Direct	0.1%	-1.3%	0.2%	-0.6%	0.0%	0.0%	0.0%	0.0%	0.2%	-0.4%	0.2%	-0.4%
Indirect	1.0%	2.6%	0.9%	1.2%	1.3%	1.2%	-3.8%	-7.3%	0.8%	1.3%	3.2%	3.9%
Agglom.	0.4%	0.6%	0.0%	1.2%	-0.8%	0.3%	-0.1%	0.8%	0.4%	0.6%	0.5%	1.2%
(a) Without transfer												
Total	1.4%	1.6%	1.1%	1.2%	0.4%	0.3%	-3.9%	-7.5%	2.8%	2.7%	4.5%	3.7%
Direct	0.1%	-1.3%	0.2%	-0.6%	0.0%	0.0%	0.0%	0.0%	0.2%	-0.3%	0.2%	-0.3%
Indirect	1.0%	2.5%	0.6%	1.2%	0.4%	0.3%	-4.3%	-8.0%	1.9%	1.7%	4.0%	2.2%
Agglom.	0.4%	0.5%	0.3%	0.6%	0.0%	0.0%	0.4%	0.5%	0.7%	1.3%	0.4%	1.9%
(b) Regional transfer												

Note: This table summarizes the decomposition of the aggregate effects into three components in 2005 and 2010 for the production and allocation variables. All numbers are relative changes from the observed data to the counterfactual results without the inland-favoring policy. The three channels are (1) the direct effect from production floor space changes, (2) the indirect effect from induced labor demand and supply changes, and (3) the agglomeration effect from induced population density changes. All three channels of the inland-favoring land policy lead to the spatial misallocation of production and labor toward less productive regions, resulting in national productivity remaining relatively low. Please refer to Online Appendix C.5 for details of constructing the decomposition.

TABLE 7 | Spatial effects on economic development.

Regions (loc., dev.)	No. of cities	Δ Productivity		Δ Urban Output		Δ Rural Output		Δ Urban Pop.		Δ House Price	
		2005	2010	2005	2010	2005	2010	2005	2010	2005	2010
National	225	1.6%	2.0%	2.6%	3.1%	-1.4%	-1.9%	1.3%	1.5%	-3.2%	-6.5%
(east, high)	21	1.6%	4.8%	7.7%	16.4%	0.0%	3.7%	6.8%	13.0%	-17.8%	-33.1%
(east, mid)	51	-0.2%	-1.8%	-0.7%	-4.1%	-0.4%	-0.9%	-0.6%	-2.8%	1.4%	12.0%
(east, low)	25	0.2%	-1.4%	-0.8%	-4.6%	-1.4%	-3.5%	-0.6%	-2.6%	-3.2%	3.0%
(inland, high)	2	-0.2%	-2.4%	0.0%	-3.2%	0.0%	1.7%	0.1%	-1.0%	1.7%	18.6%
(inland, mid)	50	-0.8%	-4.7%	-2.4%	-11.3%	-1.5%	-3.1%	-1.9%	-7.2%	1.7%	10.2%
(inland, low)	76	-0.2%	-2.6%	-1.7%	-6.7%	-1.8%	-3.2%	-1.6%	-4.7%	-3.7%	-1.4%

Note: This table displays a summary of changes in core economic development variables by prefecture group (weighted by population) in 2005 and 2010 without transfer. All numbers are relative changes from the observed data to the counterfactual results without the inland-favoring policy. For each variable, we display the changes from 2005 to 2010. Regions are classified by prefecture location (east or inland) and the level of development (GDP per capita) in 2005, as in Table 5.

TABLE 8 | Spatial effects on income and welfare.

Regions (loc., dev.)	No. of cities	Without transfer				Regional transfer			
		Δ Income		Δ Welfare		Δ Income		Δ Welfare	
		2005	2010	2005	2010	2005	2010	2005	2010
National	225	1.3%	1.5%	3.9%	4.7%	2.8%	2.7%	4.5%	3.7%
(east, high)	21	2.5%	6.8%	10.4%	8.8%	-10.1%	-11.1%	7.5%	4.2%
(east, mid)	51	0.3%	-0.2%	-0.2%	-4.0%	0.5%	4.5%	1.0%	1.7%
(east, low)	25	1.0%	1.6%	-1.7%	1.1%	0.6%	5.7%	1.8%	5.6%
(inland, high)	2	0.0%	-1.6%	-0.3%	-5.2%	2.1%	4.9%	1.9%	2.0%
(inland, mid)	50	0.8%	-1.0%	-0.2%	-5.2%	18.5%	6.2%	5.2%	3.1%
(inland, low)	76	2.0%	1.6%	2.5%	-3.5%	6.0%	6.3%	4.7%	3.2%

Note: This table summarizes income and welfare changes in our main counterfactuals in 2005 and 2010. Regions are classified by prefecture location (east or inland) and the level of development (GDP per capita) in 2005, as in Table 5. Each row represents all workers whose hometowns are in the relevant prefectures. Columns 1–4 show the changes when we remove the inland-favoring land policy. Columns 5–8 show the changes when we replace the inland-favoring land policy with a direct regional transfer.

resulting in a 13% rise in the urban population in 2010 in the most developed regions. Third, productivity and output increased in developed eastern prefectures, while decreasing in other prefectures. Specifically, measured productivity increased by 4.8% and urban output rose by 16.4% in these prefectures in 2010 under our counterfactual. The declines in productivity and production in other prefectures are smaller in magnitude. In addition, we provide a decomposition of spatial effects on productivity in the Online Appendix C.9, which shows that the spatial effects decomposition is consistent with the aggregate decomposition, such that the indirect and agglomeration effects in more developed regions dominate the productivity gains of removing the inland-favoring policy.

Overall, our findings indicate that removing the inland-favoring policy can increase national productivity and output. However, it exacerbates the regional development gap and attracts more migrants to developed areas. Most productivity and output gains are concentrated in the most developed regions. Consequently, the inland-favoring land policy seems to have achieved its original objective of balancing development between eastern and inland regions. However, does this mean workers from the underdeveloped areas benefited from this policy? Not necessarily.

Spatial Effects on Income and Welfare. We continue to show the spatial effects on income and welfare changes in Table 8. The first four columns in Table 8 display income and welfare changes for workers from different regions when we remove the inland-favoring policy. Additional results are provided in Online Appendix C.8. Incomes of workers from all areas increased in 2005. Incomes of workers from prefectures with low development levels increased in both years from both the east and the inland regions. This highlights a paradox: the inland-favoring land policy narrows the regional output gap but reduces the incomes of workers from impoverished regions because it diminishes the land supply in developed areas, leading to higher housing costs and decreased labor demand. Consequently, many workers from underdeveloped areas who would have migrated remain in their hometowns due to lower wages.

How about welfare changes? Are workers from less developed regions better off because they earn higher incomes in their hometowns thanks to the inland-favoring policy? The answer is mixed. Consider workers from prefectures other than the ones in group (east, high). On the one hand, we observe that most of them suffer from welfare losses because of the reductions in land quotas. However, this does not seem to be a necessary case for workers from prefectures with the lowest levels of development. When eliminating the inland-favoring policy, the average utility increased by 1.1% for workers from eastern low-development prefectures in 2010, and by 2.5% for workers from inland low-development prefectures in 2005. Overall, we find mixed evidence of whether the inland-favoring land supply policy enhanced the welfare of workers from poorer regions. This inland-favoring policy significantly reduces national welfare without clearly helping workers from the most impoverished areas.

Could regional transfers change the results? Columns 5–8 in Table 8 display the income and welfare changes experienced by workers from different regions when we replace the inland-favoring land policy with a regional transfer. There are two main findings. First, the regional transfer effectively reduces the income disparities between workers from developed and underdeveloped regions. Without regional transfers, the benefits of removing inland-favoring land policies mainly go to the most developed eastern regions. With regional transfers, incomes of workers from inland prefectures with low (middle) development levels increased by 6% (18.5%) in 2005 and 6.3% (6.2%) in 2010. The incomes of workers from the most developed eastern regions have decreased. Second, national welfare continues to rise following the regional transfer. Workers from all regions benefit in terms of welfare from replacing the inland-favoring land policy with a regional transfer policy. Workers from the underdeveloped areas benefit from better opportunities to migrate to developed regions with higher wages, while workers from developed regions benefit from significantly lower housing costs. Generally, compared with the inland-favoring land policy, a regional transfer policy can unambiguously promote the welfare and incomes of workers from poor regions without creating significant aggregate efficiency losses.

TABLE 9 | Unconstrained counterfactual land allocation (km²).

Regions (loc., dev.)	No. of cities	Reality		Counterfactual		% Change	
		2005	2010	$\widehat{2005}$	$\widehat{2010}$	$\widehat{2005}$	$\widehat{2010}$
National	225	22,268	28,336	27,701	46,257	24%	63%
(east, high)	21	5838	7272	8847	15,310	52%	111%
(east, mid)	51	5875	7832	7409	15,205	26%	94%
(east, low)	25	1418	1681	1593	2387	12%	42%
(inland, high)	2	169	206	170	209	0%	1%
(inland, mid)	50	5131	6578	5350	7358	4%	12%
(inland, low)	76	3837	4767	4334	5787	13%	21%

Note: This table displays a summary of total urban land supply data by prefecture group (summations within the group) in 2005 and 2010, as well as the counterfactual land supply in 2010 (unit: km²). Regions are classified by prefecture location (east or inland) and the level of development (GDP per capita) in 2005.

TABLE 10 | Spatial effects on development, income, and welfare.

Regions (loc., dev.)	No. of cities	Removing the land quota system					
		Δ Productivity	Δ Total Output	Δ Urban Pop.	Δ House Price	Δ Income	Δ Welfare
Year 2005							
National	225	4.3%	3.9%	2.1%	-13.2%	3.5%	9.2%
(east, high)	21	5.6%	11.8%	7.5%	-25.5%	6.4%	12.9%
(east, mid)	51	2.8%	2.1%	1.4%	-15.3%	2.7%	8.3%
(east, low)	25	0.0%	-3.0%	-2.8%	-5.6%	2.9%	4.7%
(inland, high)	2	-0.1%	-0.5%	-1.0%	-1.2%	0.1%	0.4%
(inland, mid)	50	0.2%	-1.8%	-2.2%	-4.1%	2.2%	6.4%
(inland, low)	76	1.3%	-1.5%	-1.1%	-11.4%	3.1%	8.3%
Year 2010							
National	225	8.3%	7.9%	4.1%	-34.4%	7.4%	15.1%
(east, high)	21	9.9%	20.9%	12.0%	-43.0%	13.3%	16.5%
(east, mid)	51	9.1%	10.4%	7.0%	-43.5%	8.0%	20.5%
(east, low)	25	4.4%	-2.2%	-3.2%	-30.0%	6.4%	13.3%
(inland, high)	2	-0.8%	-4.5%	-5.5%	-6.6%	0.6%	2.1%
(inland, mid)	50	0.5%	-4.7%	-5.5%	-12.3%	3.6%	5.8%
(inland, low)	76	1.4%	-5.2%	-4.7%	-19.2%	6.0%	8.8%

Note: This table displays a summary of changes in core economic development, income, and welfare variables by prefecture group (weighted by population) in 2005 and 2010. Regions are classified by prefecture location (east or inland) and the level of development (GDP per capita) in 2005, as in Table 5.

6.5 | Sensitivity Checks on Removing the Inland-Favoring Distortions

To address concerns regarding model robustness, we perform several sensitivity checks for our quantitative model, focusing on critical parameter values, model data inputs, and counterfactual policy specifications. These model sensitivity checks include the following four groups: (1) Parameter values regarding agglomeration effects ($\gamma \in [0.0, 0.21]$), migration elasticity ($\epsilon \in [1.0, 2.0]$), elasticity of substitution between H/L-skills ($\sigma \in [1.0, 4.0]$),²³ share of consumption in utility ($\beta \in [0.60, 0.90]$), share of labor

in production ($\alpha \in [0.75, 0.95]$), and relative cost of rural housing ($\tau \in [0.20, 0.40]$). (2) Model data inputs regarding the purge of our observed wage measures using the method of Fajgelbaum and Gaubert (2020). (3) Alternative counterfactual allocations using the pre-2003 prefecture-level GDP growth rates, and the second method uses pre-2003 prefecture-level migration inflow growth rates. (4) Additional congestion effects besides floor space constraints in workers' migration costs as an increasing function of urban density (Allen and Arkolakis 2014; Eckert and Peters 2022). Some of the sensitivity aggregate results are in the Online Appendix C.10. Many others are largely redundant and closely

related to what is presented in the paper, and are omitted for brevity. In Online Appendix D, we further explore a constrained optimal land allocation policy by eliminating across-prefectures and within-prefectures land distributional distortions, while keeping the national total land supply unchanged.

6.6 | Remarks on Removing the Inland-Favoring Distortions

We demonstrate that the inland-favoring land supply distortions led to a severe misallocation of both production and labor. It increased the price of residential and production floor space and discouraged workers in underdeveloped prefectures from migrating to developed prefectures. This resulted in lower national output and productivity. The observed regional convergence is geographical. The government achieved its goal of reducing regional output and productivity gaps; however, workers from developed and underdeveloped regions did not necessarily benefit from this. The income gap narrowed not because the incomes of people from impoverished areas increased but because everyone's income decreased, and those from affluent areas were impacted more severely. Furthermore, this policy reduced national welfare but had a mixed impact on welfare for less developed regions. In essence, these place-based land distortions aid underdeveloped areas, but they do not necessarily benefit the people from those regions. Finally, we demonstrate that a direct regional monetary transfer policy could reduce regional inequality without intensifying spatial misallocation. It effectively reduces inequality by directly assisting workers from poorer regions rather than causing a substantial spatial misallocation.

7 | Removing the Land Quota System

Finally, we relax the land supply restrictions by removing the land quota system. Specifically, we remove the upper bounds \bar{L}_j^u in Equation (13) and simulate the unconstrained counterfactual land allocation policies. Different from removing the inland-favoring distortion above, in this unconstrained counterfactual world, **the national total land supply endogenously adjusts**.

7.1 | Land Allocation and Aggregate Effects

Unconstrained Counterfactual Land Allocation. The equilibrium unconstrained counterfactual land allocation after removing the land quota system is summarized in Table 9. Columns 1–2 present the actual land supply under the policy, while Columns 3–4 display the counterfactual land supply based on removing the upper bounds \bar{L}_j^u in Equation (13). Without the land quota system, more developed prefectures would have received more construction land. For example, the land quota for highly developed eastern prefectures would have been 15,310 km² in 2010 without the land quota system, instead of the observed 7,272 km². Conversely, the land quota for low-development inland prefectures would only increase moderately. Some inland prefectures are not constrained, for instance, the two inland prefectures with high development level.

Aggregate Effects of Quota System Removal. The aggregate effects are illustrated in Figure 6. Eliminating the land quota system significantly increased productivity, urban output, average income, and welfare in both 2005 and 2010. Aggregate economic development is boosted substantially by the land quota system. The national gain in productivity is 4.3% in 2005 and 8.3% in 2010, while total output rises by 3.9% and 7.9%, respectively. Compared with the first counterfactual, these results suggest that the inland-favoring land policy accounts for a substantial share of the overall distortion induced by the quota system. The removal of the land quota system also boosts the urban population by significantly lowering the price of residential floor space in the urban areas of developed prefectures. In contrast, rural output declines due to the emigration of workers. Aggregate income and welfare also increase. Welfare gains are substantially higher than income gains because workers also benefit from reduced house prices.²⁴ For all additional results on spatial effects, please refer to Online Appendix E.

7.2 | Spatial Effects on Development, Income, and Welfare

Spatial Effects on Development. We further show the spatial effects of removing the land quota system on economic development. Columns 1–4 in Table 10 show the changes in productivity, total output, urban population, and housing prices across different regions. For additional results, see Online Appendix E. Three main conclusions can be drawn as well. First, after removing the land quota system, housing prices decrease significantly nationally. Second, even more workers migrate to developed eastern prefectures, resulting in a 12.0% rise in the urban population in 2010 in the most developed regions. Third, productivity and output continue to increase in developed eastern prefectures, while production declines in other prefectures due to a reduced urban population. Specifically, measured productivity increases by 9.9% and urban output rises by 20.9% in the most developed prefectures in 2010. Overall, our findings indicate that removing the land quota system can further increase national productivity and output.

Spatial Effects on Income and Welfare. We then show the spatial effects on income and welfare changes in Columns 5 and 6 in Table 10. Incomes and welfare of workers from all areas increase in both years due to the nationwide relaxation in land supply. Since we do not implement any redistribution policy, workers from most developed regions still gain the most. However, among inland regions, workers from the least developed regions also gain the most due to much improved migration opportunities to the most developed regions.

8 | Conclusion

This paper examines how place-based land allocation policies lead to spatial misallocation of production and labor. We focus on a significant land policy in China that favors less-developed inland regions, intending to balance regional growth and reduce spatial inequality. Causal evidence demonstrates that this policy lowered productivity in developed eastern regions relative to underdeveloped inland regions. A spatial equilibrium model

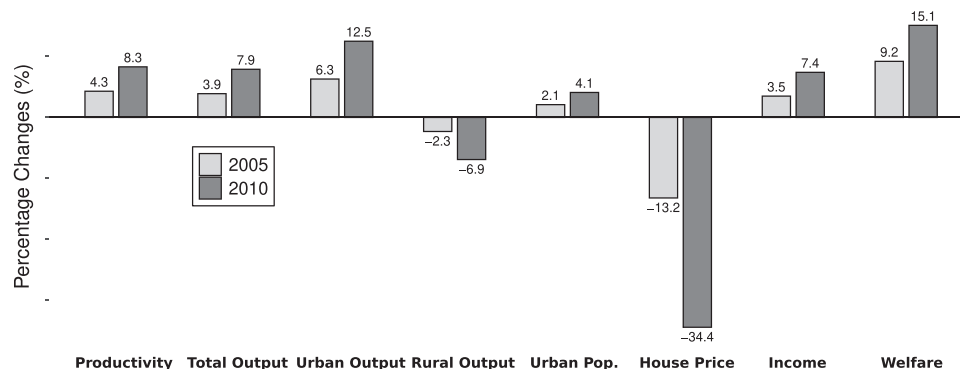


FIGURE 6 | Aggregate effects of removing the land quota system. *Notes:* This figure shows the aggregate effects of removing the land quota system on the Chinese economy in 2005 and 2010. Gray columns represent changes in 2005. Black columns represent changes in 2010. In both years, we find substantial changes in national productivity, total output, urban and rural output, urban population, house prices, incomes, and welfare.

shows that this policy directly distorted the land market and indirectly distorted the labor market, resulting in spatial misallocation. A simulated counterfactual removing this inland-favoring policy suggests that resolving this spatial misallocation would increase national productivity and output.

Despite sacrificing national productivity and output, the inland-favoring policy did not necessarily benefit workers from underdeveloped regions. Eliminating this policy would increase the incomes of workers from underdeveloped regions through increased migration to developed areas. Although the inland-favoring policy reduced regional output gaps, it adversely affected workers from the underdeveloped areas by restricting their migration opportunities to higher-wage developed regions. The welfare effect on workers from the underdeveloped areas is mixed and undetermined. Instead of the inland-favoring land supply policy, we propose a direct regional transfer that promotes regional convergence by enhancing income and welfare for workers from underdeveloped regions with fewer efficiency losses due to spatial misallocation. Finally, we demonstrate that eliminating the place-based land quota system yields substantial benefits.

Acknowledgments

We thank the editor Dirk Krueger, the associate editor Mike Waugh, four anonymous referees, George Alessandria, Yan Bai, Mark Bils, Nathaniel Baum-Snow, Gaston Chaumont, Ying Chen, Andrew Davis, Jianpeng Deng, Rui Du, Wei Duan, John Friedman, Shihe Fu, Elena Gentili, Yizhen Gu, Juncong Guo, Narayana Kocherlakota, James Liang, Lin Ma, Ronni Pavan, Alexander Rothenberg, Yao Wang, Zhi Wang, Junichi Yamasaki, Wei You, Roman David Zarate, Junfu Zhang, Qinghua Zhang, Xiaodong Zhu, and Ben Zou for their comments and suggestions. We thank Guangshun Zhu for his excellent research assistance. We also thank all participants attending seminars and conferences for their valuable comments. Zibin Huang acknowledges funding from the Youth Program of the National Natural Science Foundation of China (Grant No. 72403152). Ming Lu acknowledges funding from the National Science Foundation of China (Grant No. 72342035). Li Zhang acknowledges funding from the National Social Foundation of China (22&ZD062). Earlier versions of this paper were titled “Regional Convergence or Just an Illusion? Place-Based Land Policy and Spatial Misallocation.” All errors are ours. All authors contributed equally to this work.

Data Availability Statement

The microdata that support the findings of this study are available from the National Bureau of Statistics of China. Restrictions apply to the availability of these data, which were used under license for this study. Researchers interested in the data can follow the official procedure to obtain authorized access from NBS (<http://www.stats.gov.cn/english/>) with the permission of the National Bureau of Statistics of China. The files for replication of the empirical and quantitative results are available at the OpenICPSR Project (<https://www.openicpsr.org/openicpsr/project/247027/version/V1/view>). There you will also find all the figures and tables.

Endnotes

- ¹All the spatial (mis)allocation of production and labor discussed here is relative to the national Chinese growth trend. With underlying structural transmission, productivity growth, population growth, total construction land, and total urban workers are still growing despite the potential spatial (mis)allocation.
- ²These papers include enterprise zones (Neumark and Kolko 2010; Freedman 2013; Ham et al. 2011; Busso et al. 2013), discretionary grants (Crozet et al. 2004; Devereux et al. 2007), infrastructure investment (Kline and Moretti 2014; Glaeser and Gottlieb 2008; Becker et al. 2010), special economic zones (Wang 2013; Lu et al. 2019), and community development (Eriksen and Rosenthal 2010; Accetturo and De Blasio 2012; Romero 2009), among others.
- ³Yu (Forthcoming) finds that this restriction on converting rural farmland to urban construction land leads to severe spatial misallocation in land and labor, lowers GDP, and reduces welfare, consistent with our findings.
- ⁴Some studies have documented this significant change (see, e.g., Lu and Xiang 2016; Han and Lu 2017; Liang et al. 2016; or Fu et al. 2021). Another part of the policy was that 70% of development zones, also known as special economic zones, that subsidize land usage, were closed in 2003–2004. The planned urban construction land supply for these closed development zones was also cut. Most of these closed development zones were located in eastern regions, and many newly opened development zones have since been established inland to support local economic development (Lu and Xiang 2016; Chen et al. 2019).
- ⁵Decision of the State Council on deepening the reform of strict land management, issued on December 21, 2004 in Chinese (http://www.gov.cn/ztl/2006-06/30/content_323794.htm).

- ⁶The National Master Land Use Plan (2006–2020) is published by Xinhua Press in Chinese (http://www.gov.cn/guoqing/2008-10/24/content_2875234.htm).
- ⁷We further show the land quota and land usage by provinces in Online Appendix Table A2. There are several provinces with new land usage exceeding the land quota. This can be attributed to historical land quota stock and measurement error.
- ⁸For instance, when an old manufacturing facility is demolished, and the land is repurposed for new commercial development, such usage is included in the annual new land usage statistics, but not in the land quota for that year.
- ⁹Since there is a major missing data issue after 2007, we only use data from 2001 to 2007.
- ¹⁰For unknown reasons, some companies provide missing or erroneous information. Some data cleaning and a 1% censoring process were applied to avoid abnormal observations.
- ¹¹The basic idea is that we know each individual's industry and skill from the Census data. We also have average wages for each sector from the City Statistical Yearbooks. We assign this average wage to each individual in the census data based on their prefecture and industry information, which is imputed individual wages. We then calculate average wages in each prefecture for each skill using these imputed wages. The detailed imputation method is identical to the one used in Fang and Huang (2022).
- ¹²We only show the event study figure for productivity calculated by Olley and Pakes (1996) method. For other methods, please refer to Online Appendix A.1.
- ¹³This model reflects rural China's unique land distribution system. All land in rural China is owned collectively by the village, but not by individuals. There is no housing market in rural areas. The village council first distributes land to farmers (housing land, or in Chinese, *Zhaijidi*), and then the farmers build their own houses. Farmers effectively cannot sell or buy houses. Thus, their housing cost is the building cost.
- ¹⁴We do not specifically model prefecture-to-prefecture trade flows mainly due to data limitations. The most disaggregated intra-China trade flow data are the trade flows between Chinese provinces, constructed from China's 2002 inter-regional input–output table, which are insufficient to support our analysis of prefecture-to-prefecture flows. Literature on trade and migration (Tombe and Zhu 2019; Fan 2019; Zi 2025) suggests that reducing internal and external trade costs would accelerate labor reallocation toward more developed regions. In our model, which does not include trade, such an effect would be mapped into the productivity of urban final goods.
- ¹⁵The Hukou system is a household registration system in China that restricts worker mobility. A household's social welfare programs, including educational, medical, and other public services, are tied to its Hukou registration. Households that attempt to use such services in non-Hukou-registered prefectures pay a substantially higher cost in terms of both money and time. For more details, please refer to Song (2014).
- ¹⁶This assumption is different than Tombe and Zhu (2019), which assumes that migrant workers have no claim to any fixed factor income from the land of either their current working prefecture or their Hukou prefecture. In their model, whenever a worker migrates, she loses all fixed factor income from her previously owned local property in her Hukou prefecture. Our mechanism in this paper would be even stronger with their assumption.
- ¹⁷We make a simplification such that $w_{jr}^h = w_{jr}^l = w_{jr}$.
- ¹⁸We choose to use administrative prefecture urban districts rather than construction land area as our main measure of \bar{L}_{ju} for two main reasons: (1) most importantly, to be consistent with existing literature so our results are comparable, and (2) many loosely constructed

amenities including some parks and all scenic tourism areas are not included in construction land areas. We use the other measure for sensitivity checks.

- ¹⁹Because production requires both production land and labor, and there is no commuting to work across prefectures, a prefecture cannot have 100% production or 100% residential land, $\theta_j \in (0, 1)$ always hold.
- ²⁰According to the old statistical standard, the average housing expenditure share ranged from 11.7% in 2012 to 14.3% in 2002, which is very low because imputed rent costs of self-owned houses and apartments were not included. They were added in 2013, resulting in a range from 22.7% in 2017 to 23.3% in 2013. The average expenditure share is stable across time within each of these measurement regimes.
- ²¹Unfortunately, we failed to generate a robust estimate for σ using our microdata and other individual-level data sets across various empirical methods, including several IVs and the 1999 college expansion quasi-natural experiment, among others. We test for the sensitivity of this parameter in the following section.
- ²²Tombe and Zhu (2019) estimate this elasticity at the province–area pair level and finds a value of 1.5. Fang and Huang (2022) show that the migration elasticity is around 1.9 at the prefecture–area pair level. In a different but related setup, Bryan and Morten (2019) and Fan (2019) have a relatively higher elasticity.
- ²³In a recent paper, Bils et al. (2024) argue that this elasticity should be as large as 4. Our results hold qualitatively and are robust even under this upper bound in the literature.
- ²⁴Another interesting pattern is that the impact of this counterfactual on national output and productivity is not as strong as the counterfactual of constrained optimal land allocation. This is because in this counterfactual, we only remove the land quota system without erasing the within-prefecture distortion between production and residential housing sectors. Therefore, this result implies that the within-prefecture distortion is important.

References

- Accetturo, A., and G. De Blasio. 2012. “Policies for Local Development: An Evaluation of Italy's ‘Patti Territoriali’.” *Regional Science and Urban Economics* 42, no. 1-2: 15–26.
- Akerberg, D. A., K. Caves, and G. Frazer. 2015. “Identification Properties of Recent Production Function Estimators.” *Econometrica* 83, no. 6: 2411–2451.
- Ahlfeldt, G. M., S. J. Redding, D. M. Sturm, and N. Wolf. 2015. “The Economics of Density: Evidence From the Berlin Wall.” *Econometrica* 83, no. 6: 2127–2189.
- Allen, T., and C. Arkolakis. 2014. “Trade and the Topography of the Spatial Economy.” *Quarterly Journal of Economics* 129, no. 3: 1085–1140.
- Becker, S. O., P. H. Egger, and M. von Ehrlich. 2010. “Going NUTS: The Effect of EU Structural Funds on Regional Performance.” *Journal of Public Economics* 94, no. 9-10: 578–590.
- Bertaud, A., and S. Malpezzi. 2001. “Measuring the Costs and Benefits of Urban Land Use Regulation: A Simple Model With an Application to Malaysia.” *Journal of Housing Economics* 10, no. 3: 393–418.
- Bils, M., B. Kaymak, and K.-J. Wu. 2024. “Labor Substitutability Among Schooling Groups.” *American Economic Journal: Macroeconomics* 16, no. 4: 1–34.
- Brueckner, J. K. 1995. “Strategic Control of Growth in a System of Cities.” *Journal of Public Economics* 57, no. 3: 393–416.
- Bryan, G., and M. Morten. 2019. “The Aggregate Productivity Effects of Internal Migration: Evidence From Indonesia.” *Journal of Political Economy* 127, no. 5: 2229–2268.
- Busso, M., J. Gregory, and P. Kline. 2013. “Assessing the Incidence and Efficiency of a Prominent Place Based Policy.” *American Economic Review* 103, no. 2: 897–947.

- Chauvin, J. P., E. Glaeser, Y. Ma, and K. Tobio. 2017. "What is Different About Urbanization in Rich and Poor Countries? Cities in Brazil, China, India and the United States." *Journal of Urban Economics* 98: 17–49.
- Chen, B., M. Lu, C. Timmins, and K. Xiang. 2019. "Spatial Misallocation: Evaluating Place-Based Policies Using a Natural Experiment in China." Working Paper No. 26148. National Bureau of Economic Research.
- Civelli, A., A. Gaduh, A. D. Rothenberg, and Y. Wang. 2023. "Urban Sprawl and Social Capital: Evidence From Indonesian Cities." *Economic Journal* 133, no. 654: 2110–2146.
- Combes, P.-P., S. Démurger, and S. Li. 2013. "Urbanisation and Migration Externalities in China." CEPR Discussion Paper No. DP9352.
- Combes, P.-P., and L. Gobillon. 2015. "The Empirics of Agglomeration Economies." In *Handbook of Regional and Urban Economics*, Vol. 5, 247–348. Elsevier.
- Crozet, M., T. Mayer, and J.-L. Mucchielli. 2004. "How Do Firms Agglomerate? A Study of FDI in France." *Regional Science and Urban Economics* 34, no. 1: 27–54.
- Cunningham, C. R. 2007. "Growth Controls, Real Options, and Land Development." *Review of Economics and Statistics* 89, no. 2: 343–358.
- Deng, Y., Y. Tang, P. Wang, and J. Wu. 2020. "Spatial Misallocation in Chinese Housing and Land Markets." Working Paper No. 27230. National Bureau of Economic Research.
- Devereux, M. P., R. Griffith, and H. Simpson. 2007. "Firm Location Decisions, Regional Grants and Agglomeration Externalities." *Journal of Public Economics* 91, no. 3-4: 413–435.
- Duranton, G., and D. Puga. 2023. "Urban Growth and Its Aggregate Implications." *Econometrica* 91, no. 6: 2219–2259.
- Eckert, F., and M. Peters. 2022. "Spatial Structural Change." Working Paper No. 30489. National Bureau of Economic Research.
- Eriksen, M. D., and S. S. Rosenthal. 2010. "Crowd Out Effects of Place-Based Subsidized Rental Housing: New Evidence From the LIHTC Program." *Journal of Public Economics* 94, no. 11-12: 953–966.
- Fajgelbaum, P. D., and C. Gaubert. 2020. "Optimal Spatial Policies, Geography, and Sorting." *Quarterly Journal of Economics* 135, no. 2: 959–1036.
- Fan, J. 2019. "Internal Geography, Labor Mobility, and the Distributional Impacts of Trade." *American Economic Journal: Macroeconomics* 11, no. 3: 252–288.
- Fang, M., L. Han, Z. Huang, M. Lu, and L. Zhang. 2024. "Place-Based Land Policy and Firm Productivity: Evidence From China's Coastal-Inland Regional Border." SSRN Working Paper 4695879.
- Fang, M., L. Han, Z. Huang, M. Lu, and L. Zhang. 2025. "Online Appendix to 'Place-Based Land Policy and Spatial Misallocation: Theory and Evidence From China.'" Online Appendix.
- Fang, M., and Z. Huang. 2022. "Migration, Housing Constraints, and Inequality: A Quantitative Analysis of China." *Labour Economics* 78: 102200.
- Freedman, M. 2013. "Targeted Business Incentives and Local Labor Markets." *Journal of Human Resources* 48, no. 2: 311–344.
- Fu, S., X. Xu, and J. Zhang. 2021. "Land Conversion Across Cities in China." *Regional Science and Urban Economics* 87: 103643.
- Glaeser, E. L., and J. D. Gottlieb. 2008. "The Economics of Place-Making Policies." *Brookings Papers on Economic Activity* 2008, no. 1: 155–253.
- Glaeser, E. L., J. Gyourko, and R. Saks. 2005. "Why is Manhattan So Expensive? Regulation and the Rise in Housing Prices." *Journal of Law and Economics* 48, no. 2: 331–369.
- Glaeser, E. L., and B. A. Ward. 2009. "The Causes and Consequences of Land Use Regulation: Evidence From Greater Boston." *Journal of Urban Economics* 65, no. 3: 265–278.
- Gourieroux, C., A. Monfort, and E. Renault. 1993. "Indirect Inference." *Journal of Applied Econometrics* 8, no. S1: S85–S118.
- Gyourko, J., and R. Molloy. 2015. "Regulation and Housing Supply." In *Handbook of Regional and Urban Economics*, Vol. 5, 1289–1337. Elsevier.
- Ham, J. C., C. Swenson, A. İmrohoroğlu, and H. Song. 2011. "Government Programs Can Improve Local Labor Markets: Evidence From State Enterprise Zones, Federal Empowerment Zones and Federal Enterprise Community." *Journal of Public Economics* 95, no. 7-8: 779–797.
- Hamilton, B. W. 1978. "Zoning and the Exercise of Monopoly Power." *Journal of Urban Economics* 5, no. 1: 116–130.
- Han, L., and M. Lu. 2017. "Housing Prices and Investment: An Assessment of China's Inland-Favoring Land Supply Policies." *Journal of the Asia Pacific Economy* 22, no. 1: 106–121.
- Hao, T., R. Sun, T. Tombe, and X. Zhu. 2020. "The Effect of Migration Policy on Growth, Structural Change, and Regional Inequality in China." *Journal of Monetary Economics* 113: 112–134.
- Helsley, R. W., and W. C. Strange. 1995. "Strategic Growth Controls." *Regional Science and Urban Economics* 25, no. 4: 435–460.
- 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.
- Hilber, C. A., and F. Robert-Nicoud. 2013. "On the Origins of Land Use Regulations: Theory and Evidence From US Metro Areas." *Journal of Urban Economics* 75: 29–43.
- Hsieh, C.-T., and E. Moretti. 2019. "Housing Constraints and Spatial Misallocation." *American Economic Journal: Macroeconomics* 11, no. 2: 1–39.
- Huang, Z., and J. Zhang. 2022. "School Restrictions, Migration, and Peer Effects: A Spatial Equilibrium Analysis of Children's Human Capital in China." SSRN Working Paper 3678300.
- Huynh, N. Q. 2023. "Place-Based Policy, Migration Barriers, and Spatial Inequality." SSRN Working Paper 5281304.
- 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, no. 2: 927–963.
- Kahn, M. E., R. Vaughn, and J. Zasloff. 2010. "The Housing Market Effects of Discrete Land Use Regulations: Evidence From the California Coastal Boundary Zone." *Journal of Housing Economics* 19, no. 4: 269–279.
- Katz, L. F., and K. M. Murphy. 1992. "Changes in Relative Wages, 1963–1987: Supply and Demand Factors." *Quarterly Journal of Economics* 107, no. 1: 35–78.
- Khanna, G., W. Liang, A. M. Mobarak, and R. Song. 2025. "The Productivity Consequences of Pollution-Induced Migration in China." *American Economic Journal: Applied Economics* 17, no. 2: 184–224.
- Kline, P., and E. Moretti. 2014. "Local Economic Development, Agglomeration Economies, and the Big Push: 100 Years of Evidence From the Tennessee Valley Authority." *Quarterly Journal of Economics* 129, no. 1: 275–331.
- Lagakos, D. 2020. "Urban-Rural Gaps in the Developing World: Does Internal Migration Offer Opportunities?" *Journal of Economic Perspectives* 34, no. 3: 174–192.
- Lagakos, D., S. Marshall, A. M. Mobarak, C. Vernet, and M. E. Waugh. 2020. "Migration Costs and Observational Returns to Migration in the Developing World." *Journal of Monetary Economics* 113: 138–154.
- Lagakos, D., A. M. Mobarak, and M. E. Waugh. 2023. "The Welfare Effects of Encouraging Rural–Urban Migration." *Econometrica* 91, no. 3: 803–837.
- Levinsohn, J., and A. Petrin. 2003. "Estimating Production Functions Using Inputs to Control for Unobservables." *Review of Economic Studies* 70, no. 2: 317–341.
- Li, X., L. Ma, and Y. Tang. 2024. "Migration and Resource Misallocation in China." *Journal of Development Economics* 167: 103218.

Liang, W., M. Lu, and H. Zhang. 2016. "Housing Prices Raise Wages: Estimating the Unexpected Effects of Land Supply Regulation in China." *Journal of Housing Economics* 33: 70–81.

Lu, M., and K. Xiang. 2016. "Great Turning: How Has the Chinese Economy Been Trapped in an Efficiency-and-Balance Tradeoff?" *Asian Economic Papers* 15, no. 1: 25–50.

Lu, Y., J. Wang, and L. Zhu. 2019. "Place-Based Policies, Creation, and Agglomeration Economies: Evidence From China's Economic Zone Program." *American Economic Journal: Economic Policy* 11, no. 3: 325–360.

Ma, L., and Y. Tang. 2020. "Geography, Trade, and Internal Migration in China." *Journal of Urban Economics* 115: 103181.

Monras, J. 2020. "Immigration and Wage Dynamics: Evidence From the Mexican Peso Crisis." *Journal of Political Economy* 128, no. 8: 3017–3089.

Morten, M. 2019. "Temporary Migration and Endogenous Risk Sharing in Village India." *Journal of Political Economy* 127, no. 1: 1–46.

Neumark, D., and J. Kolko. 2010. "Do Enterprise Zones Create Jobs? Evidence From California's Enterprise Zone Program." *Journal of Urban Economics* 68, no. 1: 1–19.

Neumark, D., and H. Simpson. 2015. "Place-Based Policies." In *Handbook of Regional and Urban Economics*, Vol. 5, 1197–1287. Elsevier.

Olley, G. S., and A. Pakes. 1996. "The Dynamics of Productivity in the Telecommunications Equipment." *Econometrica* 64, no. 6: 1263–1297.

Pellegrina, H. S. 2022. "Trade, Productivity, and the Spatial Organization of Agriculture: Evidence From Brazil." *Journal of Development Economics* 156: 102816.

Quigley, J. M., and L. A. Rosenthal. 2005. "The Effects of Land Use Regulation on the Price of Housing: What Do We Know? What Can We Learn?" *Cityscape* 8, no. 1: 69–137.

Romero, R. G. 2009. "Estimating the Impact of England's Area-Based Intervention 'New Deal for Communities' on Employment." *Regional Science and Urban Economics* 39, no. 3: 323–331.

Sieg, H., C. Yoon, and J. Zhang. 2023. "The Impact of Local Fiscal and Migration Policies on Human Capital Accumulation and Inequality in China." *International Economic Review* 64, no. 1: 57–93.

Song, Y. 2014. "What Should Economists Know About the Current Chinese Hukou System?" *China Economic Review* 29: 200–212.

Tian, Y. 2024. "International Trade Liberalization and Domestic Institutional Reform: Effects of WTO Accession on Chinese Internal Migration Policy." *Review of Economics and Statistics* 106, no. 3: 794–813.

Tombe, T., and X. Zhu. 2019. "Trade, Migration, and Productivity: A Quantitative Analysis of China." *American Economic Review* 109, no. 5: 1843–1872.

Tsivanidis, N. 2026. "Evaluating the Impact of Urban Transit Infrastructure: Evidence From Bogotá's Transmilenio." *American Economic Review* 116, no. 2: 418–463.

Wallace, N. E. 1988. "The Market Effects of Zoning Undeveloped Land: Does Zoning Follow the Market?" *Journal of Urban Economics* 23, no. 3: 307–326.

Wang, J. 2013. "The Economic Impact of Special Economic Zones: Evidence From Chinese Municipalities." *Journal of Development Economics* 101: 133–147.

Wu, W., and W. You. 2025. "Should Governments Promote or Restrain Urbanization?" *Journal of International Economics* 155: 104084.

Yu, Y. Forthcoming. "The Local and Aggregate Effects of Land-Use Regulation on Farmland Protection." *Journal of Urban Economics*.

Zi, Y. 2025. "Trade Liberalization and the Great Labor Reallocation." *International Economic Review* 66, no. 2: 933–963.

Supporting Information

Additional supporting information can be found online in the Supporting Information section.

Data S1