Place-based Land Policy and Spatial Misallocation: Theory and Evidence from China*

Min Fang	Libin Han	Zibin Huang	Ming Lu	Li Zhang
UFlorida	DUFE	SUFE	SJTU	SYSU

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Abstract

Place-based policies may create spatial misallocation. We investigate a major inland-favoring land policy in China aimed at reducing regional development gaps by allocating more urban land quotas to underdeveloped inland regions. We first show empirical evidence that this policy decreased productivity in more developed eastern areas relative to inland regions. We then build a prefecture-level spatial equilibrium model with migration, land quota constraints, and agglomeration. The model reveals that this policy led to substantial output and productivity losses by distorting both labor and production across regions. Regional output gaps narrowed, but workers from the underdeveloped areas reduced their migration to developed regions and earned less. Counterfactuals suggest that national output would have been 1.8% higher in 2010 if the policy had not been implemented, and workers from underdeveloped areas would have earned 6.3% more income. Instead, regional monetary transfer policies could reduce regional inequality without significantly increasing spatial misallocation. Finally, we demonstrate that eliminating the place-based land quota system yields substantial benefits.

Keywords: Place-based Policy; Land Policy; Spatial Misallocation; Migration; Labor Mobility; Regional Inequality; China; **JEL Classification Numbers:** O18, R58, E24, J61, R52;

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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 towards 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

[1] All 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.

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; Lagakos, 2020; Lagakos, Mobarak, and Waugh, 2023; 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 (multi-prefecture, multi-skill, and multi-area), 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. Firstly, a clean causal identification of the impact of large-scale land-use regulations is usually hard to find. Secondly, 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, Gyourko, and Saks, 2005; Glaeser and Ward, 2009; Gyourko and Molloy, 2015). The focus has primarily been on the housing market in a few developed U.S. 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, Vaughn, and Zasloff, 2010; Yu, 2019) 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 policies[2] that result in spatial misallocation or welfare losses, including (urban-rural) migration frictions (Tombe and Zhu, 2019; Lagakos et al., 2020; Lagakos, 2020; Lagakos, Mobarak, and Waugh, 2023; Wu and You, 2025), housing constraints (Hsieh and Moretti, 2019), urban land expansion frictions (Yu, 2019; Fu, Xu, and Zhang, 2021), political manipulation (Henderson et al., 2022), and combinations of several of the frictions above (Li, Ma, and Tang, 2021; Deng et al., 2020; Chen et al., 2019). Among these, the most related study is Yu (2019), which investigates the effect of the "Farmland Red Line Policy" on economic development in China.[3] We compre-

[2]These papers include enterprise zones (Neumark and Kolko, 2010; Freedman, 2013; Ham et al., 2011; Busso, Gregory, and Kline, 2013), discretionary grants (Crozet, Mayer, and Mucchielli, 2004; Devereux, Griffith, and Simpson, 2007), infrastructure investment (Kline and Moretti, 2014; Glaeser and Gottlieb, 2008; Becker, Egger, and Von Ehrlich, 2010), special economic zones (Wang, 2013; Lu, Wang, and Zhu, 2019), and community development (Eriksen and Rosenthal, 2010; Accetturo and De Blasio, 2012; Romero, 2009), among others.

[3]Yu (2019) 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.

hensively 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. Additionally, 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 datasets 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, 2018; Fan, 2019; Zi, 2025), housing constraints (Fang and Huang, 2022), air quality (Khanna et al., 2021), and local public services for migrants (Sieg, Yoon, and Zhang, 2021; Huang, 2020). Studies of other developing countries include Malaysia (Bertaud and Malpezzi, 2001), Indonesia (Bryan and Morten, 2019; Civelli et al., 2022), Brazil (Pellegrina, 2022), Columbia (Tsivanidis, 2019), 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 Dataset, 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 datasets, 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 datasets. 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, 2019). 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.[4] In 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.[5] Additionally, 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]

Changes in Usage We first measure actual new land usage across regions in each year. Figure 1 panel (a) 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 1995-2003 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

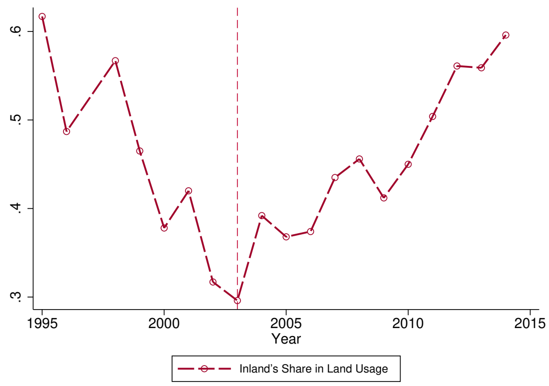
[4] Some studies have documented this significant change, see e.g. Lu and Xiang (2016), Han and Lu (2017), Liang, Lu, and Zhang (2016), or Fu, Xu, and Zhang (2021). Another part of the policy was that 70% of development zones, also known as special economic zones, that subsidize land usage, were closed 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).

[5] Decision of the State Council on deepening the reform of strict land management, issued on 12/21/2004 (link).

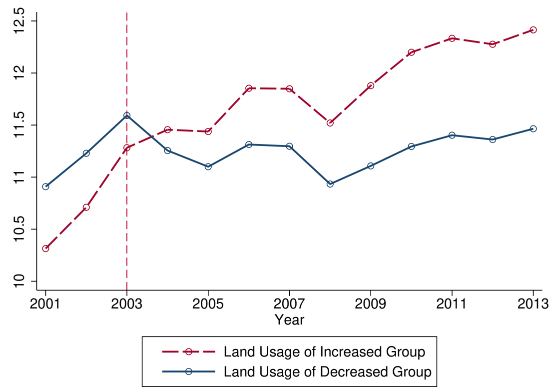
[6] The National Master Land Use Plan (2006–2020) is published by Xinhua Press in Chinese (link).

Figure 1: New Urban Land Usage Before and After 2003

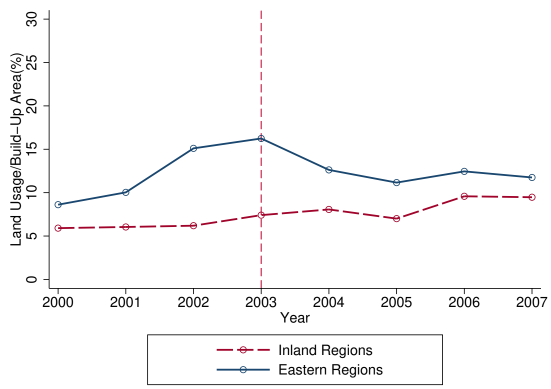
(a) Inland Provinces' Share of New Land



(b) Divergence Between Prefecture Groups



(c) Changes in New Land and Total Built Area

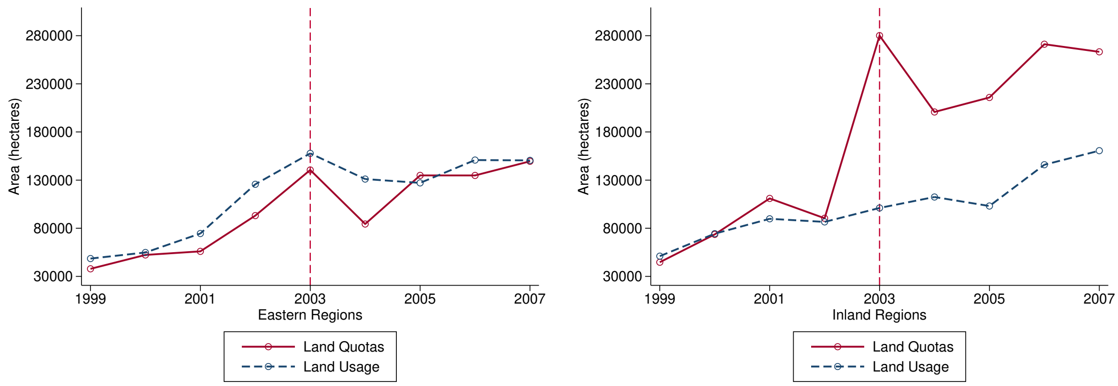


Notes: Subfigures (a) and (b) show changes in the usage of new urban land each year. Data sources include the National Bureau of Statistics of China, the Statistical Yearbook of China's Land and Resources (2000–2016), and the Yearbook of China's Land (1996–1999). The unit of subfigure (a) is between 0 and 1, and the unit of subfigure (b) is the log of hectares. Subfigure (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.

level. Figure 1 panel (b) 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 shows 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 1 panel (c) 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

Figure 2: Urban Land Usage and Quota Before and After 2003

(a) Land Supply and Quota in Eastern Regions (b) Land Supply and Quota in Inland Regions



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).

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 is 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).[7] We 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 pre-existing construction land.[8] Conversely, this constraint appears less stringent in 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 two 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

[7]We further show the land quota and land usage by provinces in 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.

[8]For 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.

surged. Overall, this period marked a cessation of land usage and quota growth in eastern areas, in contrast to encouraging growth inland.

2.2 Datasets

Data for the Empirical Analysis The primary data we use is 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 dataset accounts for over 90% of all industrial production in China.[9] The dataset 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, 1992). We also calculate productivity using the LP (Levinsohn and Petrin, 2003) and the ACF (Ackerberg, Caves, and Frazer, 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 datasets. Additional descriptions and results are in Appendix A.

Data for the Quantitative Analysis The primary dataset we use in the quantitative analysis is the Chinese Population Census. It is the most comprehensive household survey in China. Every ten 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. 10% 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 (manu-

[9]Since there is a major missing data issue after 2007, we only use data from 2001 to 2007.

[10]For unknown reasons, some companies provide missing or erroneous information. Some data cleaning and a 1% censoring process were applied to avoid abnormal observations.

Table 1: Summary Statistics

Variable	Description	Observations	Mean	Std. Dev.	Min	Median	Max
Panel A. Firm-level Variables							
Ln(tfp_op)	Firm TFP (OP)	877383	3.25	1.02	-0.04	3.27	5.63
Ln(tfp_lp)	Firm TFP (LP)	877383	6.36	1.09	3.08	6.32	9.02
Ln(tfp_acf)	Firm TFP (ACF)	877383	4.72	1.46	1.03	4.71	8.03
Ln(output)	Ln(1k yuan)	877383	8.62	1.29	5.31	8.51	12.22
Ln(wage)	Ln(1k yuan yearly)	876147	2.39	0.63	0.39	2.41	4.14
Employee	Person	877383	192.37	293.80	12	97	1985
East	Dummy	877383	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

Notes: 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.

ally 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 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 Appendix B.1.

[11] The 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).

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, migrantion, and employment, as supplementary evidence.

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.[12] For prefecture j in year t, we have the following regression:

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

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

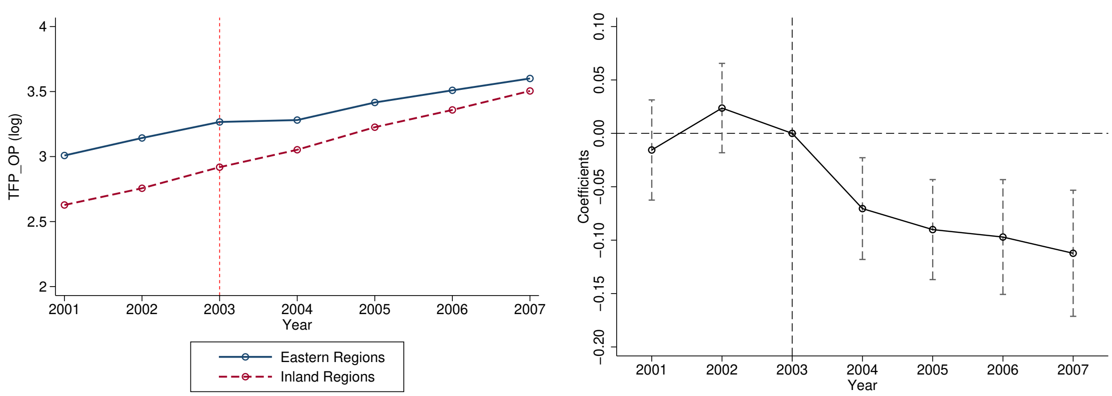
We validate our regression method by checking the key DID assumptions. First, we investigate the time trend of firm productivity in the eastern and inland regions. Our regression specification assumes that productivity in eastern and inland prefectures should have a similar time trend. Figure 3 panel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

[12] We consider northeastern provinces as inland.

tivity in the developed eastern region, and the grey 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.[13]

Figure 3: Regression Assumptions Validation

(a) Time Trends of Firm Productivity (b) Event Study of Firm Productivity



Notes: Subfigure (a) shows the time trends of firm-level productivity calculated using the Olley and Pakes (1992) 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. Subfigure (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.

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:

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

We plot the evolution of the coefficient δ_{1s} across time s in Figure 3 panel (b), 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

[13]We only show the event study figure for productivity calculated by Olley and Pakes (1992) method. For other methods, please refer to Appendix A.1.

distinguishable from zero only after the policy implementation. The results from this event study confirm that there is no divergent pre-trend 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 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 (1992) 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.

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	N	Y
Industry Share × Time Trend	N	Y
Year FE	Y	Y
Prefecture FE	Y	Y
Observations	1,792	1,792
R-squared	0.6350	0.7529

Notes: The dependent variable is prefecture-level average firm productivity. We first measure firm productivity using the Levinsohn and Petrin (2003) and Olley and Pakes (1992) 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 * $p < 0.1$.

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 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.

Table 3: Summary of Policy Effects on Other Variables

	Land Price	Housing Price	Average Wage	Migration Inflow	Employment
Post2003×East	0.513**	0.0721***	-0.0341	-7.04**	-0.2025†
	(0.220)	(0.0265)	(0.0044)	(2.88)	(0.1243)

Notes: 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 † $p < 0.15$.

Robustness Checks We further implement nine groups of robustness analyses to address an extensive set of potential empirical concerns. The results are available in Appendix A. Our main results are robust across all checks. First, in 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 Ackerberg, Caves, and Frazer (2015). We also use the prefecture-level GDP per labor as an alternative measure of productivity. Second, in Appendix A.2, we drop Zhejiang Province from our sample, which had a special land system reform during the 2000s. Third, in 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 variable in 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 Appendix A.5, we change the definition and include 2003 in the control group. Sixth, in Appendix A.6, we restrict our analysis to prefectures located near the border between the eastern and non-eastern regions to make them more comparable. We also address concerns about possible confounding policies around 2003. In 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 Appendix A.8, we try to rule out the impact of other firm subsidies and tax policies implemented around 2003. In 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 $i = 1, ..., K$. 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.[14]

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.[15] 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:

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

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:

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

[14]This 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.

[15]We 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 towards more developed regions. In our model, which does not include trade, such an effect would be mapped into the productivity of urban final goods.

where the shape parameter $\epsilon > 1$ controls the dispersion of idiosyncratic utility. We assume that migration costs can be separated into two parts, $\tau^s_{in,jk} = \bar{\tau^s_{in}} d_{in,jk}$, 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 $\bar{\tau^s_{in}}$ 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.[16]

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:

$$c^o_{in,jk} = \beta v^s_{in,jk}, \qquad s^o_{in,jk} = (1-\beta)\frac{v^s_{in,jk}}{Q_{jk}}$$

where $v^s_{in,jk}$ 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 $v^s_{in,jk}$ 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:

$$v^s_{in,jk} = w^s_{jk} + \frac{Q_{in} S^R_{in}}{H^R_{in}} \tag{4}$$

[16]The 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).

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.[17] Substituting equilibrium consumption of the final good and residential land use into utility, we obtain the following expression for the indirect utility function:

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

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:

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

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

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

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

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

[17] This 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.

large numbers implies that the proportion of workers who migrate to prefecture-region jk is

$$\pi^s_{in,jk} = \frac{(\tau^s_{in,jk} Q^{1-\beta}_{jk})^{-\epsilon} (v^s_{in,jk})^{\epsilon}}{\sum_{j'k'=11}^{JK} ((\tau^s_{in,j'k'} Q^{1-\beta}_{j'k'})^{-\epsilon} (v^s_{in,j'k'})^{\epsilon})} = \frac{\Phi^s_{in,jk}}{\Phi^s_{in}} \tag{6}$$

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^M_j:

$$Y_{ju} = (X_{ju})^{\alpha} (S^M_{ju})^{1-\alpha}, \text{ where } X_{ju} = [(A^h_{ju} H^h_{ju})^{\frac{\sigma-1}{\sigma}} + (A^l_{ju} H^l_{ju})^{\frac{\sigma-1}{\sigma}}]^{\frac{\sigma}{\sigma-1}} \tag{7}$$

where X_{ju} is a CES combination of high skill labor H^h_{ju} and low skill labor H^l_{ju} multiplied by their corresponding prefecture-level efficiencies A^h_{ju} and A^l_{ju}. 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.[18]

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 ($\{A^h_{ju}, A^l_{ju}\}$), 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:

$$w^l_{ju} = \alpha X^{\alpha-1}_{ju} S^{M\,1-\alpha}_{ju} A^{l\ \frac{\sigma-1}{\sigma}}_{ju} X^{\frac{1}{\sigma}}_{ju} H^{l\ -\frac{1}{\sigma}}_{ju} \tag{8}$$

$$w^h_{ju} = \alpha X^{\alpha-1}_{ju} S^{M\,1-\alpha}_{ju} A^{h\ \frac{\sigma-1}{\sigma}}_{ju} X^{\frac{1}{\sigma}}_{ju} H^{h\ -\frac{1}{\sigma}}_{ju} \tag{9}$$

$$S^M_{ju} = \left(\frac{1-\alpha}{q_{ju}}\right)^{\frac{1}{\alpha}} X_{ju} \tag{10}$$

The zero profit property from the constant returns to scale production function determines the

[18] We make a simplification such that $w^h_{jr} = w^l_{jr} = w_{jr}$.

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:

$$q_{ju} = (1-\alpha)\Big(\frac{\alpha}{W_{ju}}\Big)^{\frac{\alpha}{1-\alpha}} \tag{11}$$

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.

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

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.[19]

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

[19] We 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.

measurement of land quotas is explained in 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,

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

where ζ is the price elasticity of developed land as in Yu (2019). The endogenous land supply could be derived from a micro-founded urban land converter's problem as in Yu (2019). We provide a detailed derivation for equation (13) in 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:

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

where $\theta_j \in (0,1)$ is the measured proportion of floor space allocated to production use.[20]

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: $(1-\theta_j)S_j$. 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:

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

Rural Floor Space Clearing Rural housing markets are more straightforward as there is no

[20]Because 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.

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 $\{\beta, \epsilon, \alpha, \sigma, \mu, \gamma\}$.

Definition 1 A **Spatial General Equilibrium** for this economy is defined by a set of exogenous economic conditions $\{\tau^s_{in,jk}, a^s_j, \eta_j, \phi_j, R_j, \kappa_j, \bar{L}^u_j, H^s_{in}\}$, a list of endogenous prices $\{Q_{ju}, q_{ju}, w^s_{jk}\}$, quantities $\{v^s_{in,jk}, Y_{jk}, H^s_{jk}, L^u_j, S_{ju}\}$, and proportions $\{\pi^s_{in,jk}, \theta_j\}$ 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 $\{\tau^s_{in,jk}, A^s_{jk}\}$ and the aggregate prices $\{Q_{ju}, w^s_{jk}\}$ as given, workers' optimal migration choices pin down the equilibrium labor supply in each prefecture H^s_{jk}, the migration flow between each prefecture pair $\pi^s_{in,jk}$, and equilibrium residential floor space demand $(1-\theta_j)S_{ju}$

(ii).**[Firm Optimization]** Taking the exogenous economic conditions $\{A^s_{jk}\}$ and the aggregate prices $\{q_{ju}, w^s_{jk}\}$ as given, firms' optimal production choices pin down the equilibrium labor demand H^s_j 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 $\{Q_{ju}, q_{ju}, w^s_{jk}\}$, equilibrium land supply L^u_j, 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, Monfort, and Renault, 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.

Table 4: Parameters

Parameter	Description	Value	Source
From Our Microdata			
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
From Literature			
σ	elasticity of skill substitution	1.4	Katz and Murphy (1992)
ϵ	migration elasticity	1.9	Fang and Huang (2022)
ξ	price elasticity of land supply	3.2	Yu (2019)

Notes: 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 (ξ) is calibrated to 3.2 as in Yu (2019). We have conducted various sensitivity checks concerning all of our parameters and ensured the robustness of the model mechanisms.

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.[21] Hence, we choose β to be 0.77. Second, to match

[21] According to the old statistical standard, the average housing expenditure share ranged from 11.7% in 2012 to

$(1-\alpha)$, 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* (`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.[22] 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.[23] 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 (2019), which is estimated from micro-founded 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 $\{H^s_{jk}, \pi^s_{in,jk}, w^s_{jk}, Q_{jk}, q_{jk}\}$, we can calculate all unobserved variables except the agglomeration parameter and local urban development: productivities $\{A^l_{jk}$ and $A^h_{jk}\}$; migration costs $(\tau^s_{in,jk})$, floor spaces $\{S^M_{ju}, S^R_{ju}, S^R_{jr}\}$, and construction density (ϕ_i) in both 2005 and 2010 as follows. We then estimate the agglomera-

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.

[22] Unfortunately, we failed to generate a robust estimate for σ using our microdata and other individual-level datasets 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.

[23] Tombe and Zhu (2019) estimates 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.

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

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

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:

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

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 $\frac{Q_i S_i^R}{H_i}$ 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: $v_{in,jk}^s = w_{jk}^s + \frac{Q_{jn} S_{jn}^R}{H_{in}^R}$. 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}, $v_{in,jk}^s$ and $\pi_{in,jk}^s$ in hand, along with the gravity equation, we have:

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

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

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

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 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 $\hat{\delta}_1$. 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, Démurger, and Li (2013) estimates between 0.10 and 0.12. In a more recent paper, Wu and You (2025) uses 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^h_{ju} and a^l_{ju} 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 non-binding 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 $R_j - \kappa_j \left(\frac{Q_{ju}}{\phi_j}\right)^{-1/\zeta}$. 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.

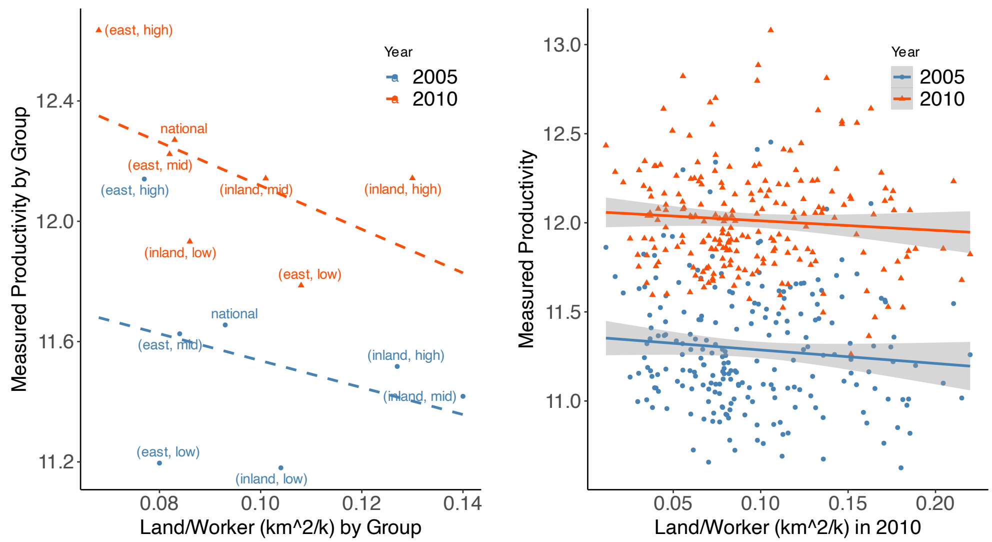
5.4 Characterizing Equilibrium Spatial Distribution

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 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 $ln(\widetilde{Prod}_{ju}) = ln\left(\frac{Y_{ju}}{(H^h_{ju}+H^l_{ju})^{\alpha}}\right)$, mirroring the productivity calculated in the empirical analysis. We then define land tightness as kilo-square meters per thousand workers. Figure 4 below shows the static spatial equilibrium distribution of measured productivity and land tightness across regions.

Figure 4: Correlation between Productivity and Land Tightness

(a) By Prefecture Group

(b) By Individual Prefecture



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 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.

Figure 4 Plot (a) 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 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 non-wage 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 will 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 non-linear interactions between skills and contains multiple floor space markets, classical hat algebra is not feasible. Therefore, we develop a multi-layer global solution iteration algorithm to compute the counterfactuals. The algorithm clears all markets, including labor, production floor space, and residential floor space markets across prefectures and areas. The details are described in 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:

$$\widehat{L_j(t)} = L_j(2003) + \underbrace{\sum_j [L_j(t) - L_j(2003)]}_{\text{actual total increment of land}} \times \underbrace{\frac{L_j(2003)(1+g_{L_j})^{t-2003}}{\sum_j L_j(2003)(1+g_{L_j})^{t-2003}}}_{\text{prefecture j's share if no inland-favoring}} \tag{18}$$

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

Table 5: Counterfactual Land Allocation (km^2)

Regions (loc., dev.)	No. of prefectures	Reality 2005	Reality 2010	Counterfactual $\widehat{2005}$	Counterfactual $\widehat{2010}$
National	225	22268	28336	22268	28336
(east, high)	21	5838	7272	6597	10958
(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

Notes: 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: km^2). Regions are classified by prefecture location (east or inland) and the level of development (GDP per capita) in 2005.

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 km^2 in 2010 without the inland-favoring policy instead of the observed 7,272 km^2. Conversely, the land quota for low-development inland prefectures would have been 4,244 km^2 in 2010 without the policy, compared to the observed 4,767 km^2. Further details of the changes are in 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 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 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 $G^s_{in}(u) = e^{-\Phi^s_{in} u^{-\epsilon}}$ where $\Phi^s_{in} = \sum_{j'k'=11}^{JK} (\tau^s_{in,j'k'} Q^{1-\beta}_{j'k'})^{-\epsilon} (v^s_{in,j'k'})^{\epsilon}$. Therefore, their expected utility is $\mathbf{E}^s_{in}[u] = \Gamma\left(1 - \frac{1}{\epsilon}\right) \times (\Phi^s_{in})^{\frac{1}{\epsilon}}$ where the Gamma function $\Gamma\left(1 - \frac{1}{\epsilon}\right)$ is a constant and Φ^s_{in} reflects the expected utility from access to all alternative regions and areas. Φ^s_{in} is positively correlated with potential income $v^s_{in,j'k'}$ 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:

$$\Delta \mathbf{E}^s_{in}[u] = \frac{\widehat{\mathbf{E}^s_{in}[u]}}{\mathbf{E}^s_{in}[u]} - 1 = \left(\frac{\sum_{j'k'=11}^{JK} (\tau^s_{in,j'k'} \widehat{Q_{j'k'}}^{1-\beta})^{-\epsilon} (\widehat{v^s_{in,j'k'}})^{\epsilon}}{\sum_{j'k'=11}^{JK} (\tau^s_{in,j'k'} Q^{1-\beta}_{j'k'})^{-\epsilon} (v^s_{in,j'k'})^{\epsilon}} \right)^{1/\epsilon} - 1$$

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

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 non-linear combination of migration costs, destination floor space price, destination wage, and housing asset return. Overall, welfare changes are non-linear 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.

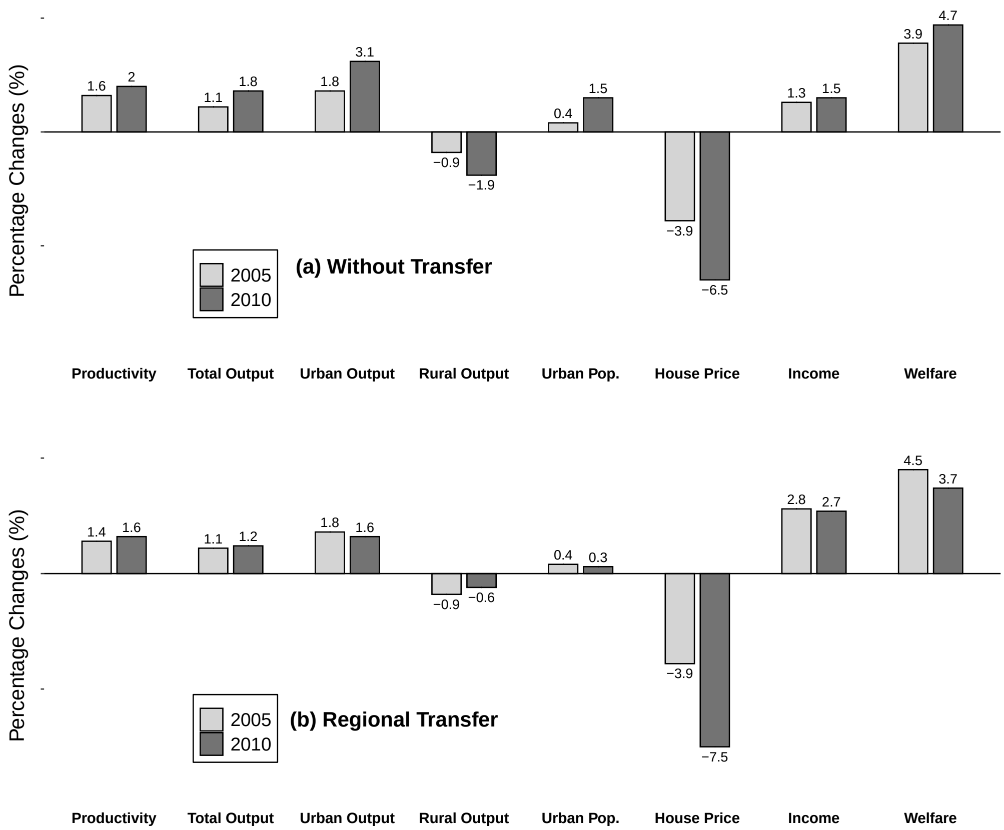
6.3 Aggregate Effects and Decomposition

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 1.4% 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 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

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. Grey 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.

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.

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

Table 6: Aggregate Effects Decomposition

Decomp.	Δ Productivity		Δ Total Output		Δ Urban Pop.		Δ House Price		Δ Income		Δ Welfare	
	$\widehat{2005}$	$\widehat{2010}$	$\widehat{2005}$	$\widehat{2010}$	$\widehat{2005}$	$\widehat{2010}$	$\widehat{2005}$	$\widehat{2010}$	$\widehat{2005}$	$\widehat{2010}$	$\widehat{2005}$	$\widehat{2010}$
	(a) Without Transfer											
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%
	(b) Regional 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%

Notes: 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 towards less productive regions, resulting in national productivity remaining relatively low. Please refer to Appendix C.5 for details of constructing the decomposition.

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 equilibrium. 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 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, 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. Additionally, 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 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

Table 7: Spatial Effects on Economic Development

Regions (loc., dev.)	No. of Cities	Δ Productivity $\widehat{2005}$	Δ Productivity $\widehat{2010}$	Δ Urban Output $\widehat{2005}$	Δ Urban Output $\widehat{2010}$	Δ Rural Output $\widehat{2005}$	Δ Rural Output $\widehat{2010}$	Δ Urban Pop. $\widehat{2005}$	Δ Urban Pop. $\widehat{2010}$	Δ House Price $\widehat{2005}$	Δ House Price $\widehat{2010}$
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%

Notes: 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.

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.

Table 8: Spatial Effects on Income and Welfare

Regions (loc., dev.)	No. of Cities	Without Transfer: Δ Income $\widehat{2005}$	Without Transfer: Δ Income $\widehat{2010}$	Without Transfer: Δ Welfare $\widehat{2005}$	Without Transfer: Δ Welfare $\widehat{2010}$	Regional Transfer: Δ Income $\widehat{2005}$	Regional Transfer: Δ Income $\widehat{2010}$	Regional Transfer: Δ Welfare $\widehat{2005}$	Regional Transfer: Δ Welfare $\widehat{2010}$
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%

Notes: 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.

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.

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 ($\sigma \in [1.0, 4.0]$)[24], share of consumption in

[24]In a recent paper, Bils, Kaymak, and Wu (2022) argue this elasticity should be as large as 4. Our results hold qualitatively and are robust even under this upper bound in the literature.

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 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 km^2 in 2010 without the land quota system, instead of the observed 7,272 km^2. 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.

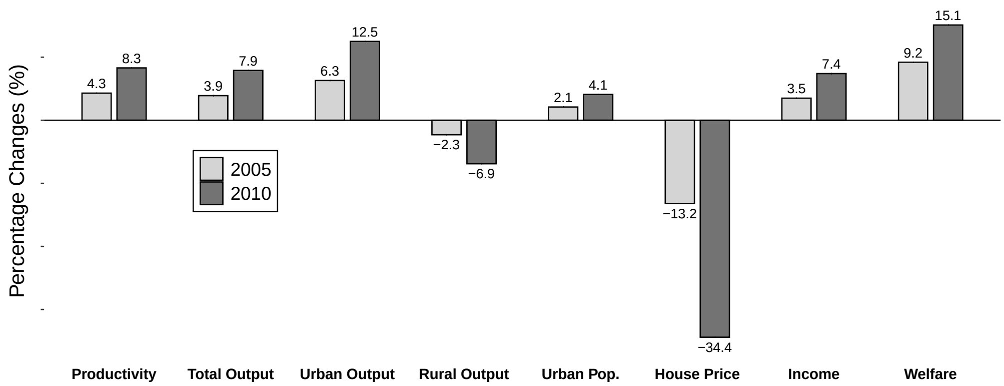
Table 9: Unconstrained Counterfactual Land Allocation (km^2)

Regions	No. of	Reality		Counterfactual		% Change	
(loc., dev.)	Cities	2005	2010	$\widehat{2005}$	$\widehat{2010}$	$\widehat{2005}$	$\widehat{2010}$
National	225	22268	28336	27701	46257	24%	63%
(east, high)	21	5838	7272	8847	15310	52%	111%
(east, mid)	51	5875	7832	7409	15205	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%

Notes: 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: km^2). Regions are classified by prefecture location (east or inland) and the level of development (GDP per capita) in 2005.

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

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. Grey 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.

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.[25] For all additional results on spatial effects, please refer to 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 to 4 in Table 10 show the changes in productivity, total output, urban population, and housing prices across different regions. For additional results, see 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 pop-

[25] Another 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.

ulation. 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.

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%

Notes: 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.

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 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.

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Online Appendix to
“Place-based Land Policy and Spatial Misallocation: Theory and Evidence from China”[*]

Min Fang	Libin Han	Zibin Huang	Ming Lu	Li Zhang
UFlorida	DUFE	SUFE	SJTU	SYSU

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[*]This is the online appendix to Fang et al. (2025a). Citation format: Min Fang, Libin Han, Zibin Huang, Ming Lu, Li Zhang (2025). Appendix to “Place-based Land Policy and Spatial Misallocation: Theory and Evidence from China”. If you have any questions or inquiries, please get in touch with Min Fang (min.fang.ur@gmail.com), Department of Economics, University of Florida. All errors are ours.

Contents

A Supplements to the Empirical Analysis

In this section, we implement six groups of robustness checks for our empirical analysis. We also investigate the policy effect on some other outcome variables in the last subsection to provide preliminary empirical evidence for the mechanism and motivate our quantitative model.

A.1 Robustness Checks for Productivity Estimation Method

First, we implement the empirical analysis using productivity calculated with methods proposed by Ackerberg, Caves, and Frazer (2015). Column (1) in Table A1 show the main regression results. Figures A1 and A2 show the results of the event study regression for LP and ACF methods. All results are very similar to the results when we calculate productivity using the OP method. The event study regressions detect no evidence for an unparalleled pre-trend.

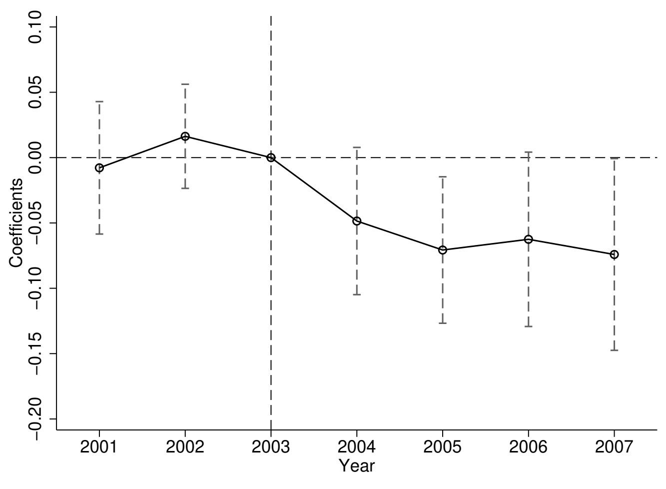
Table A1: **DID Results on Productivity (Alternative Measures)**

	(1) ACF	(2) GDP
Post2003×East	-0.0871**	-0.1170***
	(0.0347)	(0.0339)
GDP Per Capita × Time Trend	Y	Y
Industry Share × Time Trend	Y	Y
Year FE	Y	Y
Prefecture FE	Y	Y
Observations	1,792	1,765
R-squared	0.6377	0.7940

Notes: The dependent variables are prefecture-level average firm productivity measured by the Ackerberg, Caves, and Frazer (2015) method in column (1). In column (2), we change the dependent variable to be prefecture-level GDP per labor. The regression specifications are identical to Table 2. The standard errors are clustered at the prefecture level. *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$.

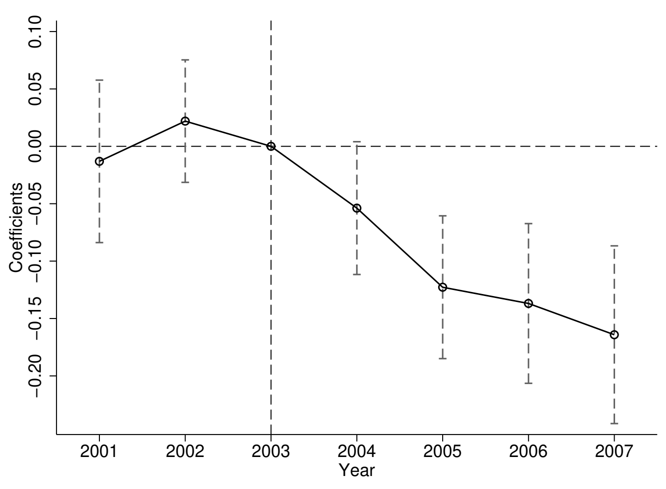
We also investigate the regression results when we change the productivity measure from average firm TFP to prefecture-level GDP per labor. Specifically, we calculate labor productivity at the prefecture level by dividing GDP by non-agricultural employment in each city, and then estimate the main regression using this new measure. Column (2) in Table A1 presents results that are consistent with those obtained using other productivity measures.

Figure A1: **Event Study - Productivity (LP)**



Notes: The dependent variable is the prefecture-level average firm productivity in different prefectures calculated using the Levinsohn and Petrin (2003) method. The corresponding confidence interval is 95%.

Figure A2: **Event Study - Productivity (ACF)**



Notes: The dependent variable is the prefecture-level average firm productivity in different prefectures calculated using the Ackerberg, Caves, and Frazer (2015) method. The corresponding confidence interval is 95%.

A.2 List of Provinces with Land Quota and Usage

Table A2: Land Quota and Usage by Province (1999-2007)

Province Name	Region (East/Inland)	Land Usage (hectares)	Land Quota (hectares)
Shanghai	East	84252.76	81181.83
Yunnan	Inland	42188.09	94062.65
Inner Mongolia	Inland	45438.21	53190.31
Beijing	East	38921.24	44293.81
Jilin	East	31369.61	42355.03
Sichuan	Inland	74055.08	76792.27
Tianjin	East	42333.34	40522.82
Ningxia	Inland	14840.55	79484.53
Anhui	Inland	78802.63	92400.71
Shandong	East	164905.4	153777.2
Shanxi	Inland	24189.91	45675.02
Guangdong	East	121920	56752.87
Guangxi	Inland	55626.86	96089.28
Xinjiang	Inland	91613.31	116611.3
Jiangsu	East	196959.5	182413.4
Jiangxi	Inland	40571.16	83003.92
Hebei	Inland	65541.13	70453.23
Henan	Inland	56544.4	92184.81
Zhejiang	East	213411.1	128664.9
Hainan	East	11544.07	9793.81
Hubei	Inland	60114.93	84881.62
Hunan	Inland	59408.8	113938.4
Gansu	Inland	22736.11	26394.63
Fujian	East	81077.53	115730.7
Tibet	Inland	3772.31	10410.23
Guizhou	Inland	13694.09	87399.13
Liaoning	Inland	82869.84	79434.73
Chongqing	Inland	41811.63	148435.3
Shaanxi	Inland	44019.84	47316.68
Qinghai	Inland	8196.92	15754.1
Heilongjiang	Inland	33173.97	64981.44

This table reports the new land quota and usage from 1999 to 2007 by province. In general, provinces in the eastern region have exhausted their land quotas, whereas inland provinces tend to have more quota than actual usage. Several provinces also report new land usage exceeding the quota, which can be attributed to historical land quota stocks and potential measurement error. One province stands out as a special case: Zhejiang. In Zhejiang, land usage is substantially higher than the recorded quota. There are several reasons for this. First, as one of the fastest-growing coastal (but meanwhile mountainous) provinces, Zhejiang made special request for additional land quotas from the central government that were not documented in the statistical yearbook. Second, the Zhejiang provincial government initiated a reform to establish an innovative land rights transaction system to relax land constraints. For example, it was the first province to allow prefecture-level governments to trade newly created farmland for new urban construction land. Specifically, if a prefecture managed to expand farmland by converting wasteland, it could use this increase in farmland to obtain additional urban construction land quota. This practice is known as the Zhejiang Model (*Zhejiang Mo Shi*). Please refer to Wang and Tao (2009) for more details.

To eliminate the potential influence of this reform, we re-estimate the main regressions excluding Zhejiang in Table A3 and find that the results remain qualitatively unchanged.

Table A3: DID Results on Productivity (Drop Zhejiang Province)

	(1)	(2)
Post2003×East	-0.1504***	-0.0618***
	(0.0294)	(0.0283)
GDP Per Capita × Time Trend	N	Y
Industry Share × Time Trend	N	Y
Year FE	Y	Y
Prefecture FE	Y	Y
Observations	1,715	1,715
R-squared	0.7198	0.7537

Notes: We drop Zhejiang Province in this regression. The dependent variable is prefecture-level average firm productivity. We first measure firm productivity using the Olley and Pakes (1992) method, 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 * $p < 0.1$.

A.3 Using Quota Changes as Treatment

Second, we change the regression specification and directly use the quota change as the treatment variable to run the following regression:

$$ln(Prod_{jt}) = \alpha + \delta_1 Post2003_t \times QS_j + \phi_j + \gamma_t + \epsilon_{jt} \tag{A1}$$

QS_j is the change (the 2000-2002 share minus the 2003-2007 share) in the quota share of the province where prefecture j is located before and after the policy. Compared with the principal regression, we use QS_j instead of $East_j$ as the treatment variable. This exposure design considers prefectures with larger quota changes as experiencing larger policy shocks. Unfortunately, we do not have prefecture-level quota data and have to use province-level quota to approximate this exposure. Similar to the principal regression, we find that prefectures in provinces with larger land quota losses experienced larger productivity reductions after the policy in 2003. Figures A3, A4, and A5 illustrate the dynamic effect using event study regressions, where quota shares serve as the treatment. We find no evidence of different pre-trends in productivity across regions with varying quota changes.

Another straightforward way to estimate the effect of the quota changes on TFP is to directly regress prefecture-level TFP on the absolute quota level of the province (where the prefecture is located) in each year. Table A5 shows that the province quota level is positively correlated with prefecture TFP. This suggests that policy-driven quota reductions result in TFP declines for prefectures in that province.

Another concern is whether the province-level quota share change used in our analysis serves as a good proxy for city-level quota changes. To address this, we impute prefecture-level quotas by allocating province-level land quotas based on each city's share of the built-up area in 2000, its GDP, and the registered Hukou population within the province. We then regress the imputed prefecture-level quota on $Post2003_t \times QS_j$, controlling for prefecture and year fixed effects. The results are reported in Table A6. We find that prefecture-level quotas are lower in cities located in provinces with larger quota gaps (measured as the difference between the 2000-2002 share and the 2003-2007 share) after 2003.

Table A4: **Quota Regression**

	(1) OP	(2) LP	(3) ACF
Post2003×QS	-0.0147**	-0.0117	-0.0152*
	(0.0073)	(0.0080)	(0.0089)
GDP Per Capita × Time Trend	Y	Y	Y
Industry Share × Time Trend	Y	Y	Y
Year FE	Y	Y	Y
Prefecture FE	Y	Y	Y
Observations	1,792	1,792	1,792
R-squared	0.7525	0.6350	0.6365

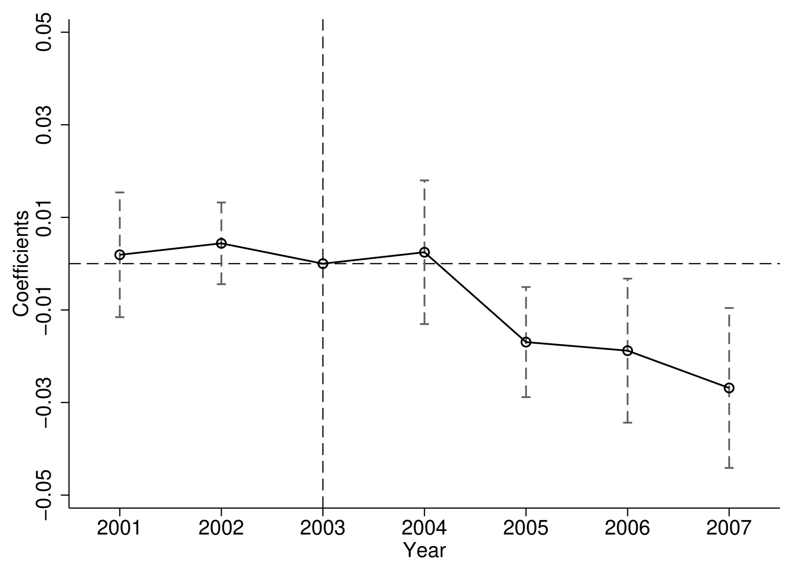
Notes: The dependent variables are prefecture-level average firm productivity measured by the Olley and Pakes (1992), the Levinsohn and Petrin (2003), and the Ackerberg, Caves, and Frazer (2015) methods. We use quota changes in each province as the treatment variable. The standard errors are clustered at the prefecture level. *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$.

Table A5: **Quota Level Regression**

	(1) OP	(2) LP	(3) ACF
Quota Level	0.0125**	0.0064	0.0147*
	(0.0058)	(0.0057)	(0.0088)
GDP Per Capita × Time Trend	Y	Y	Y
Industry Share × Time Trend	Y	Y	Y
Year FE	Y	Y	Y
Prefecture FE	Y	Y	Y
Observations	1,792	1,792	1,792
R-squared	0.7514	0.6338	0.6357

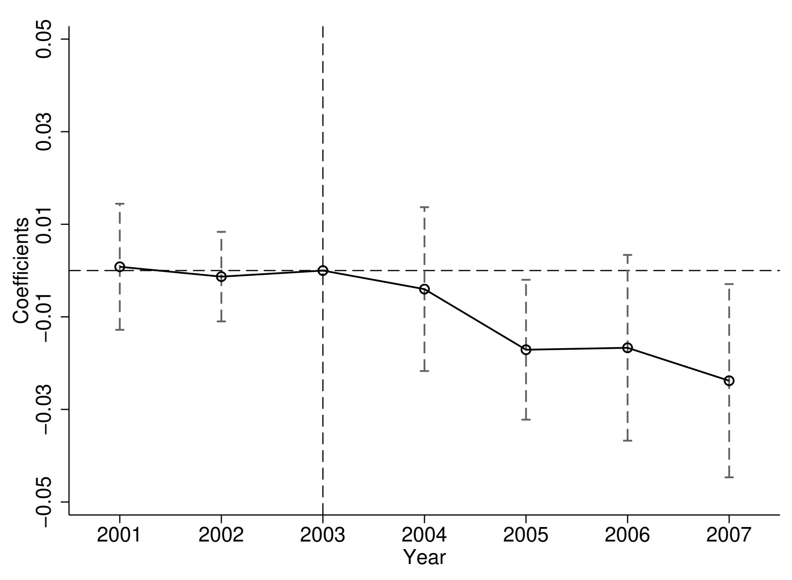
Notes: The dependent variables are prefecture-level average firm productivity measured by the Olley and Pakes (1992), the Levinsohn and Petrin (2003), and the Ackerberg, Caves, and Frazer (2015) methods. We use the quota level (10 thousand hectares) in each province as the treatment variable. The standard errors are clustered at the prefecture level. *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$.

Figure A3: **Province Quota Event Study - Productivity (OP)**



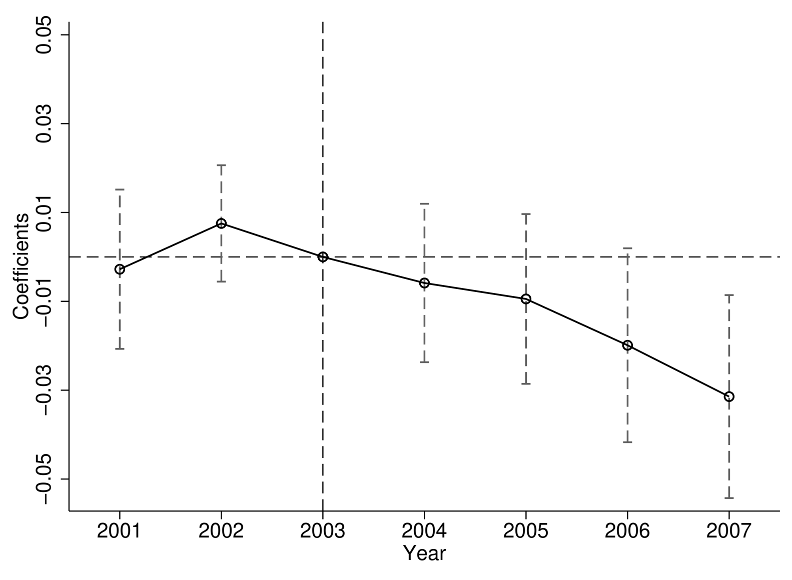
Notes: This is the province quota event study regression. The dependent variable is the average firm productivity in different prefectures calculated using the Olley and Pakes (1992) method. The corresponding confidence interval is 95%.

Figure A4: **Province Quota Event Study - Productivity (LP)**



Notes: This is the province quota event study regression. The dependent variable is the average firm productivity in different prefectures calculated using the Levinsohn and Petrin (2003) method. The corresponding confidence interval is 95%.

Figure A5: **Province Quota Event Study - Productivity (ACF)**



Notes: This is the province quota event study regression. The dependent variable is the average firm productivity in different prefectures calculated using the Ackerberg, Caves, and Frazer (2015) method. The corresponding confidence interval is 95%.

Table A6: **City Imputed Quota and Province Quota**

	(1) By Built-up Area	(2) By GDP	(3) By Population
Post2003×QS_j	-0.182***	-0.167***	-0.169***
	(0.0099)	(0.0105)	(0.0105)
GDP Per Capita × Time Trend	Y	Y	Y
Industry Share × Time Trend	Y	Y	Y
Year FE	Y	Y	Y
Prefecture FE	Y	Y	Y
Observations	1,761	1,750	1,752
R-squared	0.5874	0.5486	0.5501

Notes: The dependent variables are prefecture-level imputed land quota. In the first column, we impute the prefecture-level quota by built-up areas. In the second column, we impute the prefecture-level quota by GDP. In the third column, we impute the prefecture-level quota by Hukou-registered population. The standard errors are clustered at the prefecture level. *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$.

A.4 Province-level Regression

Third, we implement our empirical analysis at the province level. We run two sets of regressions. To begin with, we estimate the main regression specified in equation (1) at the province level, where the dependent variable is the province-level average firm productivity. Table A7 shows a consistently negative impact on productivity for provinces in the eastern region after 2003.

Table A7: **Province-level DID Results on Productivity**

	(1) OP	(2) LP	(3) ACF
Post2003×East	-0.1843***	-0.1126***	-0.2379***
	(0.0352)	(0.0375)	(0.0460)
Year FE	Y	Y	Y
Province FE	Y	Y	Y
Observations	196	196	196
R-squared	0.9046	0.8777	0.8288

Notes: The dependent variable is province-level average firm productivity. We first measure firm productivity using the methods of Olley and Pakes (1992) (column 1), Levinsohn and Petrin (2003) (column 2), and Ackerberg, Caves, and Frazer (2015) (column 3), then calculate the average for each province, weighted by firm employment. The standard errors are clustered at the province level. *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$.

In addition, we estimate the quota regression specified in equation (A1), again using province-level average productivity as the dependent variable. The results, presented in Table A8, indicate that provinces experiencing significant reductions in quota shares suffered productivity losses after 2003. These findings are consistent with the prefecture-level results reported in Table A4.

Table A8: **Quota Regression (Province Level)**

	(1) OP	(2) LP	(3) ACF
Post2003×QS	-0.0205*	-0.0122	-0.0240
	(0.0108)	(0.0147)	(0.0153)
Year FE	Y	Y	Y
Province FE	Y	Y	Y
Observations	196	196	196
R-squared	0.8867	0.8678	0.7975

Notes: The dependent variables are province-level average firm productivity measured by the Olley and Pakes (1992), the Levinsohn and Petrin (2003), and the Ackerberg, Caves, and Frazer (2015) methods. We use quota changes in each province as the treatment variable. The standard errors are clustered at the province level. *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$.

A.5 Excluding the Year of 2003 from the Treatment

Fourth, we include 2003 in the treatment group. However, the policy was officially enacted in the middle of 2003, when the new administration of Hu Jintao and Wen Jiabao took office, leaving the market with limited time to respond. In this robustness check, we exclude 2003 from the treatment and implement the principal regression. Table A9 shows that the results are moderately amplified but not changed qualitatively.

Table A9: **The Year of 2003 in the Control Group**

	(1) OP	(2) LP	(3) ACF
Post2003×East	-0.0935***	-0.0659**	-0.1170***
	(0.0266)	(0.0315)	(0.0333)
GDP Per Capita × Time Trend	Y	Y	Y
Industry Share × Time Trend	Y	Y	Y
Year FE	Y	Y	Y
Prefecture FE	Y	Y	Y
Observations	1,792	1,792	1,792
R-squared	0.7550	0.6363	0.6406

Notes: The dependent variables are prefecture-level average firm productivity measured by the Olley and Pakes (1992), the Levinsohn and Petrin (2003) and the Ackerberg, Caves, and Frazer (2015) methods. We exclude 2003 from the treatment group and consider the policy effect to start from 2004. The standard errors are clustered at the prefecture level. *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$.

A.6 Robustness Checks for Border Prefectures

In the main regression, we use a traditional DID specification, comparing the eastern and the non-eastern regions. However, one concern is that prefectures in the east and non-eastern regions may differ substantially. To address this issue, we restrict the sample to only those prefectures located along the border between the eastern and non-eastern regions. These prefectures are more comparable. Table A10 shows that the results remain consistent with those from our main regression.

Table A10: **DID Results on Border Prefecture Productivity**

	(1)	(2)
Post2003×East	-0.1809***	-0.1017*
	(0.0524)	(0.0518)
GDP Per Capita × Time Trend	N	Y
Industry Share × Time Trend	N	Y
Year FE	Y	Y
Prefecture FE	Y	Y
Observations	497	497
R-squared	0.7556	0.7816

Notes: The dependent variable is prefecture-level average firm productivity. We first measure firm productivity using the Olley and Pakes (1992) method, then calculate the average for each prefecture, weighted by firm employment. We keep only prefectures located along the border between the eastern and non-eastern regions. The standard errors are clustered at the prefecture level. *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$.

A.7 Robustness Checks for The WTO Effect

Fifth, China joined the WTO at the end of 2001, significantly changing the country's economic structure. While two years before the inland-favoring land supply policy, we are still concerned about the potential confounding effects of reducing trade barriers, which may have influenced eastern and inland prefectures differently. In column (1) of Table A11, we run the main regression while controlling for prefecture-level exporting. In column (2) of the same table, we calculate the average productivity for each prefecture, restricting our analysis to firms that report zero exports. This approach is based on the premise that firms with no export activity will likely be the least affected by any WTO-related effects. We do not detect any qualitative changes when eliminating WTO-related influences.

Table A11: **Eliminating WTO Effects**

	(1)	(2)
Post2003×East	-0.0701**	-0.0745**
	(0.0278)	(0.0314)
ln(Export)	0.0066	
	(0.0042)	
GDP Per Capita × Time Trend	Y	Y
Industry Share × Time Trend	Y	Y
Year FE	Y	Y
Prefecture FE	Y	Y
Observations	1,792	1,792
R-squared	0.7459	0.7404

Notes: The dependent variable is prefecture-level average firm productivity measured by the Olley and Pakes (1992) method. In column (1), we control for prefecture-level export aggregated from the firm dataset. In column (2), we drop all firms involved in exporting when calculating TFP. The standard errors are clustered at the prefecture level. *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$.

A.8 Robustness Checks for Subsidy and Tax Policies

Sixth, we attempt to rule out the effects of other concurrent subsidy and tax policies that may have been implemented alongside the land reform. Apart from the land supply policy, the Chinese government also enacted other inland-favoring measures to promote inland economic growth, such as manufacturing subsidies. We calculate average government subsidies, financing costs (interest cost divided by total debt), and taxes for firms in different prefectures. Then, we conduct the DID regression using these prefecture-level variables as the outcomes to check whether government support for firms in other dimensions changed differently for eastern and inland regions around 2003. Table A12 indicates that firms in each region experienced similar government subsidies, financing costs, and taxes before and after 2003. We then estimate the productivity regressions with these three variables as additional controls. Table A13 demonstrates that the main results are consistent across all regression settings.

Table A12: **Effect on Subsidies, Financing Costs, and Taxes**

	(1) Subsidies	(2) Financing Costs	(3) Taxes
Post2003×East	0.4528	-0.1091	0.3276
	(0.5145)	(0.1038)	(0.5884)
GDP Per Capita × Time Trend	Y	Y	Y
Industry Share × Time Trend	Y	Y	Y
Year FE	Y	Y	Y
Prefecture FE	Y	Y	Y
Observations	1,792	1,792	1,792
R-squared	0.4371	0.7373	0.5778

Notes: The dependent variables are prefecture-level average firm subsidies, financing costs, and taxes. The standard errors are clustered at the prefecture level. *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$.

Table A13: **Main Regression Controlling for Other Policies**

	(1) OP	(2) LP	(3) ACF
Post2003×East	-0.0669***	-0.0487	-0.0795**
	(0.0257)	(0.0298)	(0.0327)
Subsidy	-0.0027**	-0.0021*	-0.0013
	(0.0011)	(0.0012)	(0.0016)
Financing Cost	0.0708***	0.0465***	0.0884***
	(0.0096)	(0.0104)	(0.0104)
Tax	-0.0027	-0.0009	-0.0011
	(0.0021)	(0.0021)	(0.0025)
GDP Per Capita × Time Trend	Y	Y	Y
Industry Share × Time Trend	Y	Y	Y
Year FE	Y	Y	Y
Prefecture FE	Y	Y	Y
Observations	1,792	1,792	1,792
R-squared	0.7660	0.6500	0.6660

Notes: The dependent variables are prefecture-level average firm productivity measured by the Olley and Pakes (1992), the Levinsohn and Petrin (2003), and the Ackerberg, Caves, and Frazer (2015) method. We also control government subsidies, financing costs, and taxes. The standard errors are clustered at the prefecture level. *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$.

A.9 Robustness Checks for Rural Reforms

During the early 2000s, there were two other important reforms happening in rural China: the passage of the Rural Land Contracting Law (Chari et al., 2021) and the removal of the agricultural tax (Wang and Shen, 2014). We further check the robustness of our main results by controlling for the effect of these two policies.

For the passage of the Rural Land Contracting Law (RLCL), we additionally control for a traditional staggered DID dummy term of whether the treated province started to implement this policy in a given year in the main regression. For the removal of the agricultural tax, we additionally employ an exposure design to add an interaction term between the agricultural tax share before the policy year (average of 1999 to 2005) and the starting policy year (2006) indicator. The agricultural tax share is calculated by dividing the average annual agricultural tax income from 1999 to 2005 by the average annual government total income in the prefecture. That is, prefectures with a higher agricultural tax share before the reform were more exposed to the abolition of the tax. Table A14 shows that when we control for these two rural reform policies, the main regression result is not changed. In addition, we do not detect any effects of these two rural reforms on prefecture-level TFP gaps between the eastern and the inland regions.

Table A14: **Main Regression Controlling for Rural Reforms**

	(1) OP	(2) LP	(3) ACF	(4) OP	(5) LP	(6) ACF	(7) OP	(8) LP	(9) ACF
Post2003×East	-0.0680**	-0.0482	-0.0853**	-0.0922***	-0.0705**	-0.0999***	-0.0900***	-0.0684**	-0.0983***
	(0.0272)	(0.0304)	(0.0350)	(0.0272)	(0.0283)	(0.0361)	(0.0273)	(0.0284)	(0.0360)
Agricultural Tax Share × Abolition	-0.0019	-0.0018	-0.0014				-0.0015	-0.0014	-0.0011
	(0.0025)	(0.0027)	(0.0029)				(0.0023)	(0.0026)	(0.0028)
RLCL Passing Dummy				0.0007	-0.0360	0.0257	0.0004	-0.0363	0.0255
				(0.0215)	(0.0230)	(0.0287)	(0.0214)	(0.0229)	(0.0286)
GDP Per Capita × Time Trend	Y	Y	Y	Y	Y	Y	Y	Y	Y
Industry Share × Time Trend	Y	Y	Y	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Prefecture FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Observations	1,792	1,792	1,792	1,789	1,789	1,789	1,789	1,789	1,789
R-squared	0.7532	0.6353	0.6378	0.7563	0.6411	0.6387	0.7565	0.6412	0.6388

Notes: The dependent variable are prefecture-level average firm productivity measured by the Olley and Pakes (1992), the Levinsohn and Petrin (2003) and the Ackerberg, Caves, and Frazer (2015) method. We also control for the effect of two rural reform policies, the passage of the Rural Land Contracting Law and the abolition of the agricultural tax. The standard errors are clustered at the prefecture level. *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$.

A.10 Additional Results for Mechanism Validation

This section investigates the inland-favoring land supply policy's effect on other variables, illustrating the potential channels to validate our mechanism in the quantitative model. First, we use land transaction data to examine the direct effect on land prices and land quantities. Second, we consider the transmission channels on wages and housing prices from the City Statistical Yearbooks. Finally, we show the resulting indirect effect on migrations and employment using the Chinese Population Census data. Our findings indicate that, in comparison to inland regions, the 2003 inland-favoring land supply policy resulted in a notable increase in relative land prices in eastern areas. This policy then suppressed relative wages and elevated relative housing prices in these regions. The combined effect of reduced labor demand and increased living costs subsequently acted as a deterrent to migration inflow and employment in eastern regions.

A.10.1 Additional Data for Additional Results

We use two additional datasets in this Appendix section. To estimate the effect of the inland-favoring land policy on land prices, we first utilize land transaction data from 2002 to 2018, collected from the China Land Market Website (`http://www.landchina.com/`). The dataset includes unique land IDs, parcel locations, land usage (industrial land, commercial/service sector land, housing land, and others), land area, and leasing prices. Table A15 shows the summary statistics of land prices by their selling categories. There are three categories based on the function of the land, including land parcels for housing construction, commercial business construction, and manufacturing factory construction. We detect a price disparity such that land prices for commercial constriction are more expensive. Secondly, we utilize another dataset titled *Land Price Monitoring Report of Main Cities in China* to further validate our land price results. This report is officially published by the Ministry of Natural Resources of the People's Republic of China and monitors land price changes in 52 major prefectures across the country. Although it does not contain land parcel-level micro data, it provides prefecture-level average land prices calculated by the local administrative authorities.

Table A15: **Summary Statistics of Land Prices**

Variable	Observations	Mean	Std. dev.	Min	Median	Max
Panel A. Land Prices in (2002-2007)						
Ln(landprice)	192317	4.69	1.45	0.62	4.68	9.92
Ln(landprice Housing)	84553	4.63	1.67	0.62	4.61	9.62
Ln(landprice Commercial)	29080	5.74	1.44	2.48	5.73	9.92
Ln(landprice Manufacturing)	78684	4.37	0.94	1.94	4.49	7.03
Panel B. Land Prices (2002-2018)						
Ln(landprice)	1549444	5.79	1.47	0.61	5.70	9.93
Ln(landprice Housing)	749495	5.95	1.70	0.61	6.05	9.62
Ln(landprice Commercial)	275739	6.56	1.31	2.48	6.58	9.93
Ln(landprice Manufacturing)	524210	5.14	0.78	1.94	5.19	7.03

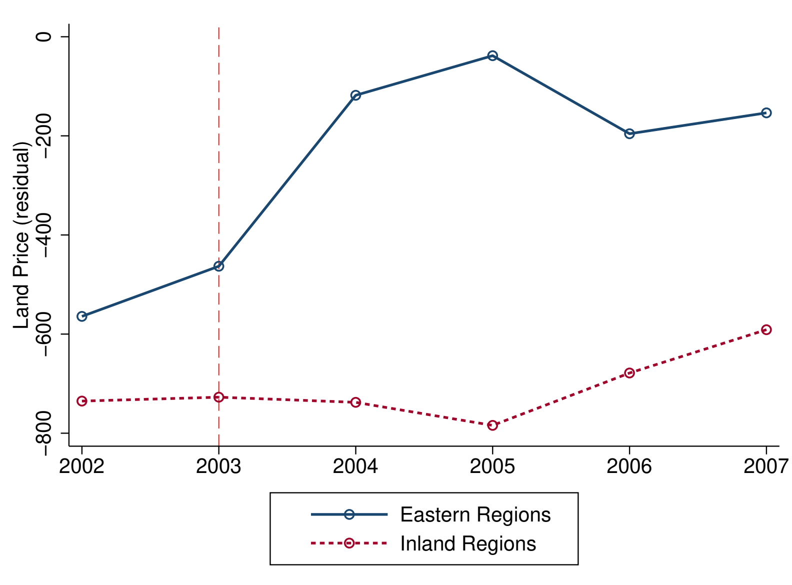
Notes: We summarize land transaction data from 2002 to 2018, collected from the China Land Market Website. Panel A uses data from 2002 to 2007. Panel B uses data from 2002 to 2018.

A.10.2 Policy Effect on Land Prices

Our empirical strategy for analyzing land prices is a simple DID regression at the land parcel level, similar to the main regression. Additionally, we control for land selling categories. Local land administration departments were required to publish information on the transfer of state-owned land-use rights only after the passage of *The Regulations on the Disposition of State-Owned Land Use Rights for Auctions and Biddings* in 2007. Consequently, the transaction data before 2007 is not comprehensive. The sample size becomes reasonable only after 2002; therefore, we ran the regression using data from 2002 to 2018. Figure A6 and A7 display the time trends and the event study regression results for land prices. The coefficient before 2003 is insignificant (although we have only one data point). Furthermore, we observe a notable increase in the land price gap between eastern and inland regions after 2003. Table A16 presents the DID regression results. Column (1) showcases the results when using the same sample years as in the productivity regression (before 2007), while column (2) includes the results when incorporating all available sample years. Our findings suggest that the inland-favoring land policy expanded the land price gap between eastern and inland regions by 50 percentage points.

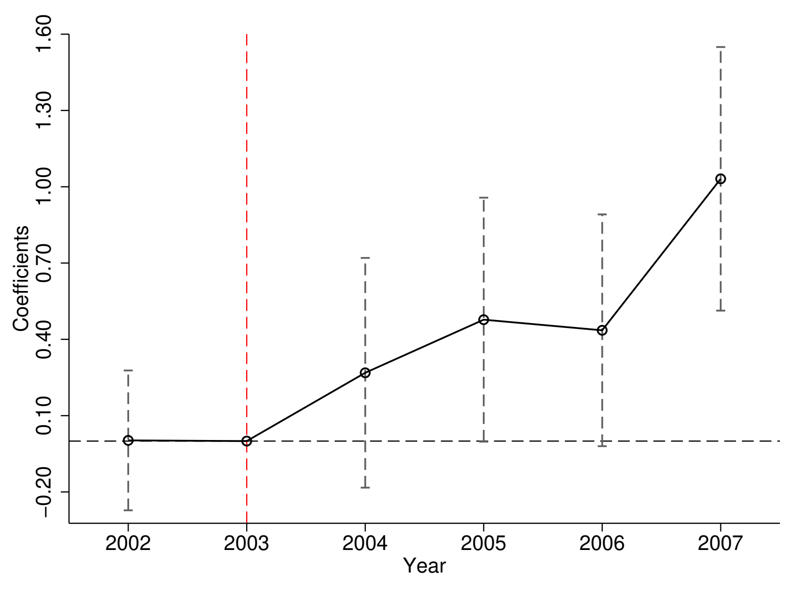
As we have explained, although the data from the China Land Market Website provide granular land parcel-level information, local land administration departments were only required to publish land transfer records after 2007, which limits the availability of our sample before that year. Table A17 shows that in 2002, there were 4,758 land parcels recorded in the inland region and 1,771 parcels in the eastern region. By 2007, these numbers had increased to 61,206 and 28,359, respectively. To further validate our findings, we utilize the *Land Price Monitoring Report of Main Cities in China*, which reports average land prices in 52 major cities. We use data from 2002 to 2007. Tables A18 and A19 present the results from the main DID specification and the quota regression, respectively. We find a consistent positive effect of the 2003 policy on land prices in the eastern region, which was more exposed to the quota reduction. Figure A8 displays the corresponding event study results using this dataset.

Figure A6: **Time Trends of Land Price**



Notes: This figure shows land parcel price time trends. The black line is the average outcome value in the developed eastern region, and the grey line is the average outcome value in the inland region. The dashed vertical line indicates the implementation of the inland-favoring land policy.

Figure A7: **Event Study - Land Price**



Notes: The dependent variable is the land price. The corresponding confidence interval is 95%.

Table A16: **DID Results on Land Prices**

	(1) Sample 02-07	(2) Sample 02-18
Post2003×East	0.513**	0.625**
	(0.220)	(0.274)
GDP Per Capita × Time Trend	Y	Y
Industry Share × Time Trend	Y	Y
Year FE	Y	Y
Prefecture FE	Y	Y
Observations	189,619	1,421,487
R-squared	0.502	0.469

Notes: The dependent variable is land parcel prices from China Land Market Website. We also control for land parcel level selling categories. The standard errors are clustered at the prefecture level. *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$.

Table A17: **Sample Size of the Data from the China Land Market Website**

	2002	2003	2004	2005	2006	2007	Total
Inland	4,758	7,037	11,704	11,503	18,377	61,206	114,585
East	1,771	2,420	16,823	11,015	14,646	28,359	75,034
National	6,529	9,457	28,527	22,518	33,023	89,565	189,619

Notes: This table reports the sample size (at the land parcel level) of the land transaction data obtained from the China Land Market Website for the period 2002 to 2007. The first row presents the sample size for land parcels located in inland regions, while the second row presents the corresponding figures for land parcels located in eastern regions.

Table A18: **DID Results on Land Prices (Prefecture Average Price)**

	(1) Overall	(2) Housing
Post2003×East	0.0522*	0.0803*
	(0.0301)	(0.0419)
Year FE	Y	Y
Prefecture FE	Y	Y
Observations	315	315
R-squared	0.773	0.777

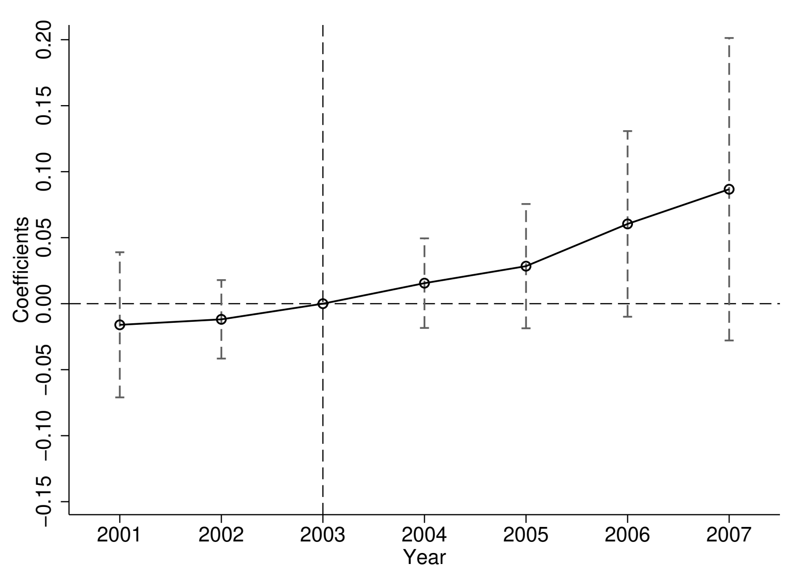
Notes: The dependent variable is prefecture-level average land prices from *Land Price Monitoring Report of Main Cities in China*. The first column shows the average land price for all land categories. The second column shows the average land price for housing construction. The standard errors are clustered at the prefecture level. *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$.

Table A19: **Quota Regression - Land Price (Prefecture Average Price)**

	(1) Overall	(2) Housing
Post2003×QS	0.0087	0.0139
	(0.0071)	(0.0109)
Year FE	Y	Y
Prefecture FE	Y	Y
Observations	315	315
R-squared	0.771	0.774

Notes: The dependent variable is prefecture-level average land prices from *Land Price Monitoring Report of Main Cities in China*. We use quota changes in each province as the treatment variable. The first column shows the average land price for all land categories. The second column shows the average land price for housing construction. The standard errors are clustered at the prefecture level. *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$.

Figure A8: **Event Study (Land Price Monitoring) - Land Price**



Notes: The dependent variable is the prefecture-level average land prices from *Land Price Monitoring Report of Main Cities in China*. The corresponding confidence interval is 95%.

A.10.3 Policy Effect on Urban Land Quantity

To validate the mechanism analysis, we further investigate the policy's effect on urban land quantity. We use two measures. First, we use total land sold at the prefecture level from China Land and Resources Almanac. Second, we investigate built-up urban areas across different prefectures from City Statistical Yearbooks. It is also the same data we use in the quantitative model. If our proposed mechanism is correct, we should observe relatively slower expansion of built-up urban areas in eastern prefectures with slower land quota growth. Tables A20 and A21 present the results from the main DID regression and the quota regression, respectively. In column (1), we use total land sold at the prefecture level as the dependent variable. In column (2), we use built-up urban area at the prefecture level as the dependent variable. The results indicate that, after 2003, eastern regions and regions with slower land quota growth experienced slower increases in land sales and built-up urban areas. Figures A9 and A10 show the event study results of these two land quantity measures.

Table A20: **DID Results on Built-up Area**

	(1)	(2)
Post2003×East	-0.2045**	-4.5286**
	(0.0829)	(2.0217)
Year FE	Y	Y
Prefecture FE	Y	Y
Observations	1,690	1,690
R-squared	0.447	0.169

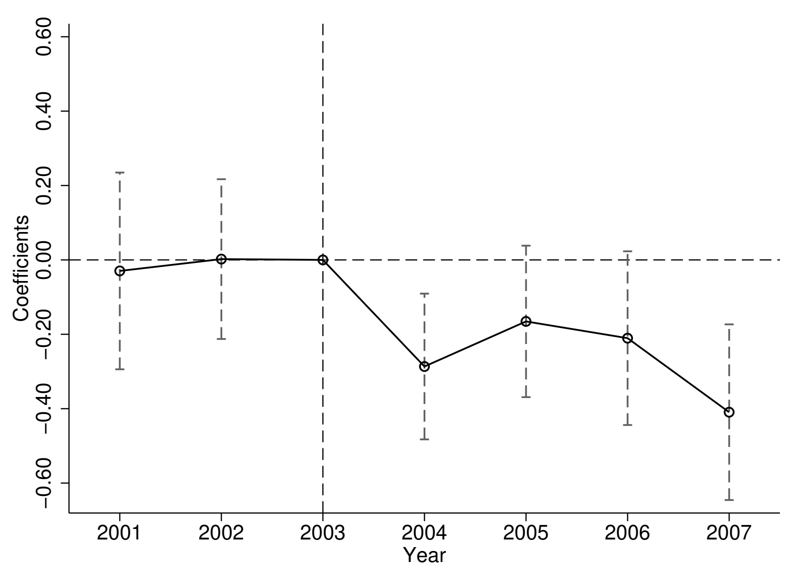
Notes: The dependent variables are prefecture total land sold (column 1) and built-up area (column 2). The standard errors are clustered at the prefecture level. *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$.

Table A21: **Quota Regression on Built-up Area**

	(1)	(2)
Post2003×QS	-0.0188	-1.4027***
	(0.0247)	(0.5029)
Year FE	Y	Y
Prefecture FE	Y	Y
Observations	1,690	1,690
R-squared	0.444	0.173

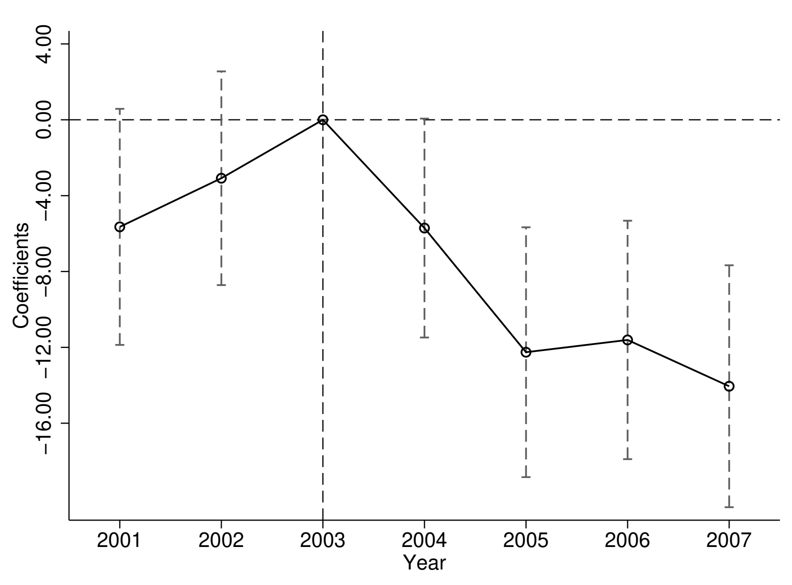
Notes: The dependent variables are prefecture total land sold (column 1) and built-up area (column 2). We use quota changes in each province as the treatment variable. The standard errors are clustered at the prefecture level. *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$.

Figure A9: **Event Study - Land Sold**



Notes: The dependent variable is the total land sold in each prefecture. The corresponding confidence interval is 95%.

Figure A10: **Event Study - Built-up Urban Area**



Notes: The dependent variable is the built-up urban area in each prefecture. The corresponding confidence interval is 95%.

A.10.4 Policy Effect on Wages and Housing Prices

Furthermore, we examine the impact of the inland-favoring policy on wages and housing prices between eastern and inland regions. For wages, we use the average wages for each firm in the *NIED* dataset. For housing prices, we employ prefecture-level data from City Statistical Yearbooks. The outcomes of the simple DID regression are presented in Table A22. Our findings show that the inland-favoring land policy reduced relative wages by two percentage points and increased relative housing prices by seven percentage points in eastern regions compared with inland regions. Figures A11 and A12 further illustrate the event study regression results for wages and housing prices. We find that there is no evident divergent pre-trend in wages or housing prices before the policy in 2003. After the policy was implemented, in eastern regions, relative wages fell and relative housing prices increased gradually and significantly.

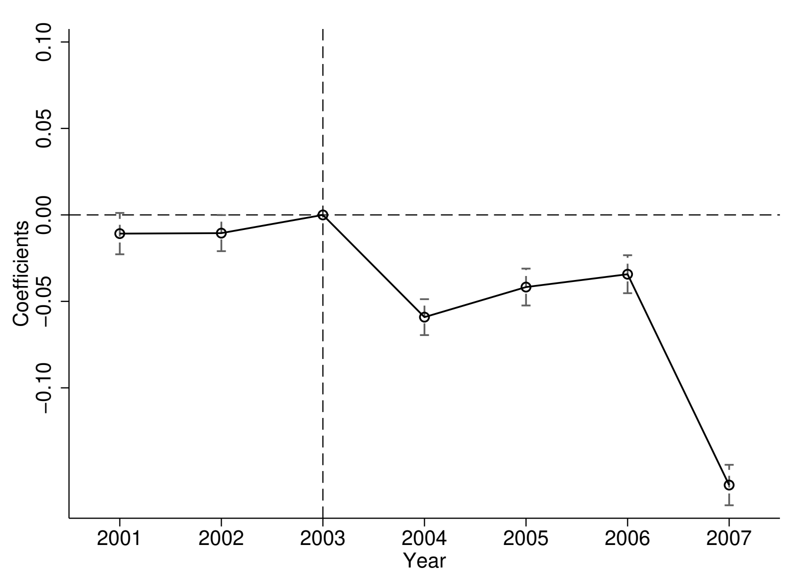
In Table A23, we further show the results using the quota regression specification. Consistent with earlier findings, we find that firms or prefectures more exposed to quota reductions experienced declines in wages and increases in housing prices.

Table A22: **DID Results on Wages and Housing Prices**

	(1) Wages	(2) Housing Prices
Post2003×East	-0.0341***	0.0721**
	(0.0044)	(0.0240)
Year FE	Y	Y
Prefecture FE	Y	Y
Observations	800,365	1,789
R-squared	0.2399	0.7397

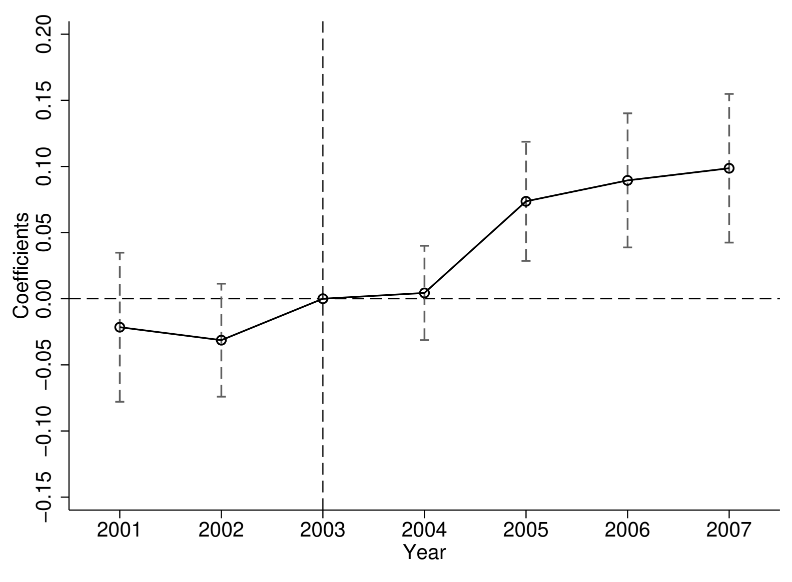
Notes: Firm-level average wages and prefecture-level housing prices are dependent variables. Standard errors are clustered at the prefecture level. *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$.

Figure A11: **Event Study - Wage**



Notes: The dependent variable is the firm-level wages. The corresponding confidence interval is 95%.

Figure A12: **Event Study - Housing Price**



Notes: The dependent variable is the prefecture-level housing prices. The corresponding confidence interval is 95%.

Table A23: **Quota Regression on Wages and Housing Prices**

	(1) Wages	(2) Housing Prices
Post2003×East	-0.0207***	0.0165**
	(0.0007)	(0.0066)
Year FE	Y	Y
Prefecture FE	Y	Y
Observations	800,365	1,925
R-squared	0.2413	0.7179

Notes: The results are from the quota regression specification. Firm-level average wages and prefecture-level housing prices are dependent variables. Standard errors are clustered at the prefecture level. *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$.

A.10.5 Policy Effect on Migration and Employment

We finally conduct a simple DID regression to investigate the policy effect on prefecture-level labor migration and employment.

We employ the Census 2005 and 2010 to infer the scale of migration in each prefecture from 2002 to 2010. Migration connects directly to our mechanism by investigating the location choices of workers. In the first column, we evaluate the effects on net migration. In the second column, we evaluate the effects on migration inflows. In the third column, we evaluate the effects on migration outflows. The units of the dependent variables are one thousand people. Table A24 shows that the 2003 policy reduced the eastern migration inflow and the net migration gap between eastern and inland regions.

Table A24: **DID Results on Migration**

	(1) Net Migration	(2) Migration Inflow	(3) Migration Outflow
Post2003×East	-7.87**	-7.04**	0.83
	(3.12)	(2.88)	(0.98)
GDP per capita × Time Trend	Y	Y	Y
Industry Share × Time Trend	Y	Y	Y
Year FE	Y	Y	Y
Prefecture FE	Y	Y	Y
Observations	2,181	2,181	2,181
R-squared	0.10	0.17	0.45

Notes: In the first column, we evaluate the effects on net migrations. In the second column, we evaluate the effects on migration inflows. In the third column, we evaluate the effects on migration outflows. The units of the dependent variables are 1 thousand people. The standard errors are clustered at the prefecture level. *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$.

Table A25 further validates the migration pattern by implementing the quota regression. We find that regions experiencing relatively larger quota reductions saw greater migration outflows.

We then use the same dataset to examine the policy's impact on log employment. Table A26 shows the results. Column (1) presents the results from the simple DID regression, while Column (2) reports the results from the quota-based specification. As expected, we find a negative effect of the policy on employment at the prefecture level, although the estimates are imprecise.

Table A25: **Quota Regression on Migration**

	(1) Net Migration	(2) Migration Inflow	(3) Migration Outflow
Post2003×QS	-0.54	-0.02	0.52**
	(0.54)	(0.44)	(0.25)
GDP Per Capita × Time Trend	Y	Y	Y
Industry Share × Time Trend	Y	Y	Y
Year FE	Y	Y	Y
Prefecture FE	Y	Y	Y
Observations	2,181	2,181	2,181
R-squared	0.10	0.17	0.45

Notes: In the first column, we evaluate the effects on net migrations. In the second column, we evaluate the effects on migration inflows. In the third column, we evaluate the effects on migration outflows. The units of the dependent variables are 1 thousand people. We use quota changes in each province as the treatment variable. The standard errors are clustered at the prefecture level. *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$.

Table A26: **Results on Employment**

	(1) DID	(2) Quota
Post2003×East	-0.2025†	
	(0.1243)	
Post2003×QS		-0.0084
		(0.0106)
GDP per capita × Time Trend	Y	Y
Industry Share × Time Trend	Y	Y
Year FE	Y	Y
Prefecture FE	Y	Y
Observations	498	498
R-squared	0.0147	0.0597

Notes: In the first column, we evaluate the effects using the DID regression. In the second column, we evaluate the effects using the quota regression. The dependent variable is log(employment). The standard errors are clustered at the prefecture level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$, and $^{\dagger} p < 0.15$.

B Supplements to Model Quantification

B.1 List of Cities by Productivity and Land Tightness

Table B1: List of Cities

City Code	City Name	Group	GDP Per Capita	TFP 05	TFP 10	Land Tightness 05	Land Tightness 10
1101	Beijing	East, High	38315	12.45	13.08	0.13	0.11
1201	Tianjin	East, Middle	34170	12.08	12.81	0.03	0.14
1301	Shijiazhuang City	East, Middle	31850	11.37	12.16	0.12	0.04
1302	Tangshan	East, Middle	27995	11.44	12.38	0.18	0.07
1303	Qinhuangdao	East, High	39214	10.72	12.16	0.25	0.09
1304	Handan	East, Middle	19687	11.18	12.10	0.14	0.05
1305	Xingtai City	East, Middle	18043	11.15	12.02	0.11	0.04
1306	Baoding	East, Middle	23312	11.19	12.04	0.07	0.04
1307	Zhangjiakou	East, Middle	24225	11.07	12.03	0.18	0.06
1308	Chengde	East, Middle	20145	11.20	11.85	0.14	0.19
1401	Taiyuan	Non-east, Middle	20622	11.66	12.30	0.10	0.12
1402	Datong	Non-east, Middle	16655	11.29	12.13	0.08	0.12
1403	Yangquan	Non-east, Middle	16700	11.52	12.15	0.06	0.10
1404	Changzhi	Non-east, Middle	20807	11.48	12.22	0.04	0.07
1405	Jincheng	Non-east, Middle	20974	11.50	12.08	0.03	0.06
1406	Shuozhou	Non-east, Low	13665	11.15	11.90	0.07	0.08
1407	Jinzhong	Non-east, Low	9873	11.14	11.91	0.02	0.04
1408	Yuncheng	Non-east, Low	7584	11.14	11.70	0.03	0.06
1409	Xinzhou	Non-east, Low	4795	10.96	11.60	0.02	0.05
1410	Linfen City	Non-east, Low	10588	11.32	11.82	0.03	0.03
1501	Hohhot	Non-east, Middle	31585	11.57	12.12	0.27	0.17
1502	Baotou	Non-east, High	39561	11.58	12.28	0.20	0.17
1503	Wuhai	Non-east, Middle	20081	11.29	12.03	0.11	0.24
1504	Chifeng	Non-east, Low	7547	11.02	11.92	0.19	0.09
1505	Tongliao	Non-east, Low	13789	10.96	11.78	0.15	0.13
1506	Ordos	Non-east, Middle	35380	11.68	12.63	0.05	0.13
1507	Hulunbeir	Non-east, Low	13785	11.59	12.07	0.06	0.05
2101	Shenyang City	East, Middle	34345	11.66	12.45	0.18	0.12
2102	Dalian	East, High	54183	11.79	12.55	0.18	0.15
2103	Anshan City	East, High	43816	11.45	12.06	0.21	0.13
2104	Fushun City	East, Middle	19635	11.36	12.07	0.24	0.18
2106	Dandong	East, Low	15440	11.09	11.72	0.11	0.07
2109	Fuxin City	East, Low	11242	10.62	11.69	0.19	0.18
2112	Tieling	East, Low	11041	10.88	11.90	0.12	0.08
2113	Chaoyang	East, Low	10781	11.17	11.97	0.07	0.08
2201	Changchun City	East, Middle	37003	11.55	12.23	0.14	0.21
2202	Jilin City	East, Middle	23046	11.31	12.05	0.15	0.16
2203	Siping	East, Low	14560	10.78	11.73	0.08	0.10
2204	Liaoyuan City	East, Low	12097	11.02	11.68	0.17	0.21
2205	Tonghua	East, Low	14717	11.29	11.89	0.06	0.07
2208	white City	East, Low	9091	10.81	11.52	0.06	0.11
2301	Harbin City	East, Middle	30534	11.54	12.24	0.19	0.13
2302	Qiqihar City	East, Low	13431	11.23	11.26	0.15	0.15
2303	Jixi	East, Low	8480	11.16	11.36	0.18	0.16
2304	Hegang City	East, Low	8432	11.14	11.83	0.16	0.13
2305	Shuangyashan	East, Low	12678	11.01	11.52	0.32	0.18
2307	Yichun	East, Low	8546	10.84	11.59	0.66	0.53
2308	Jiamusi	East, Low	14080	10.85	11.78	0.14	0.18
3101	Shanghai	East, High	57423	12.30	12.82	0.04	0.06
3201	Nanjing	East, Middle	35464	12.11	12.64	0.32	0.16
3202	Wuxi	East, High	58976	11.76	12.49	0.12	0.06
3203	Xuzhou	East, Middle	31592	11.50	12.13	0.13	0.10
3204	Changzhou City	East, Middle	36335	11.73	12.34	0.08	0.06

Table B2: List of Cities (Continued)

City Code	City Name	Group	GDP Per Capita	TFP 05	TFP 10	Land Tightness 05	Land Tightness 10
3205	Suzhou City	East, High	60326	11.93	12.64	0.08	0.04
3206	Nantong city	East, Middle	35059	11.52	12.33	0.04	0.04
3207	Lianyungang City	East, Middle	29298	11.10	11.93	0.20	0.09
3208	Huaian city	East, Low	11557	11.25	12.20	0.17	0.08
3209	Yancheng	East, Middle	15929	11.17	12.04	0.08	0.04
3211	Zhenjiang	East, Middle	34988	11.72	12.22	0.13	0.08
3301	Hangzhou	East, High	49055	12.17	12.68	0.16	0.07
3302	Ningbo	East, High	60381	11.92	12.52	0.06	0.05
3303	Wenzhou city	East, High	45795	11.64	12.35	0.07	0.03
3304	Jiaxing	East, Middle	30988	11.63	12.29	0.08	0.03
3305	Huzhou	East, Middle	26260	11.66	12.16	0.14	0.05
3306	Shaoxing	East, Middle	35753	11.69	12.32	0.08	0.04
3307	Jinhua City	East, Middle	19113	11.61	12.23	0.06	0.02
3309	Zhoushan	East, Middle	21215	11.55	12.32	0.17	0.10
3310	Taizhou	East, Middle	30647	11.82	12.32	0.09	0.04
3311	Yeosu	East, Middle	17653	11.34	12.26	0.07	0.05
3401	Hefei	Non-east, Middle	29058	11.71	12.56	0.29	0.15
3402	Wuhu	Non-east, Middle	33544	11.30	12.14	0.22	0.17
3403	Bengbu	Non-east, Low	15456	11.10	11.85	0.29	0.20
3404	Huainan City	Non-east, Low	9784	11.22	12.18	0.23	0.18
3405	Ma'anshan	Non-east, Middle	29536	11.56	12.19	0.24	0.17
3406	Huaibei City	Non-east, Low	15007	11.16	12.13	0.23	0.15
3408	Anqing	Non-east, Middle	19917	10.78	11.85	0.11	0.08
3411	Chuzhou	Non-east, Middle	17353	10.99	11.91	0.07	0.08
3412	Fuyang City	Non-east, Low	4229	10.89	11.69	0.26	0.07
3413	Suzhou City	Non-east, Low	4900	11.09	11.74	0.10	0.09
3415	Lu'an	Non-east, Low	3039	10.93	11.86	0.18	0.08
3416	Bozhou	Non-east, Low	6314	10.76	11.77	0.14	0.10
3417	Chizhou	Non-east, Low	7290	10.96	11.86	0.10	0.12
3418	Xuancheng	Non-east, Low	8989	11.24	12.10	0.11	0.07
3501	Fuzhou	East, High	43600	11.64	12.29	0.12	0.07
3502	Xiamen City	East, High	40146	11.89	12.88	0.15	0.10
3504	Sanming	East, Middle	25396	11.35	12.06	0.05	0.04
3505	Quanzhou	East, Middle	28010	11.48	12.19	0.02	0.04
3506	Zhangzhou	East, Middle	29056	11.41	12.15	0.05	0.04
3507	Nanping	East, Middle	16169	11.24	11.91	0.04	0.03
3508	Longyan	East, Middle	24690	11.37	12.08	0.07	0.04
3509	Ningde	East, Low	12408	11.13	11.91	0.03	0.03
3601	Nanchang	Non-east, Middle	28388	11.49	12.22	0.15	0.11
3602	Jingdezhen	Non-east, Middle	19486	11.07	11.47	0.23	0.17
3603	Pingxiang	Non-east, Low	13828	11.07	11.93	0.21	0.07
3604	Jiujiang	Non-east, Middle	29840	11.10	11.85	0.07	0.07
3605	Xinyu City	Non-east, Low	12046	11.09	11.93	0.24	0.15
3606	Yingtan City	Non-east, Low	11379	11.07	11.83	0.14	0.12
3607	Ganzhou City	Non-east, Low	12262	11.07	11.86	0.05	0.04
3608	Ji'an	Non-east, Low	14198	10.96	11.59	0.06	0.04
3609	Yichun	Non-east, Low	4600	11.05	11.78	0.05	0.04
3611	Shangrao	Non-east, Low	12052	11.00	11.82	0.04	0.03
3701	Jinan City	East, Middle	36697	11.70	12.30	0.18	0.14
3702	Qingdao	East, High	43327	11.81	12.55	0.10	0.07
3703	Zibo	East, Middle	37104	11.44	12.18	0.19	0.14
3704	Zaozhuang City	East, Low	13923	11.06	11.79	0.18	0.12
3705	Dongying City	East, High	86523	11.58	12.57	0.26	0.15
3706	City of Yantai	East, Middle	35583	11.60	12.24	0.13	0.13
3707	Weifang	East, Middle	24267	11.29	12.25	0.09	0.06
3708	Jining City	East, Middle	18548	11.32	12.12	0.05	0.06
3709	Tai'an	East, Middle	16938	11.09	12.02	0.14	0.08
3710	Weihai	East, High	48100	11.26	12.03	0.15	0.14
3711	Rizhao	East, Middle	16930	11.11	12.10	0.16	0.15
3712	Laiwu	East, Middle	18042	11.26	12.08	0.32	0.14

Table B3: List of Cities (Continued)

City Code	City Name	Group	GDP Per Capita	TFP 05	TFP 10	Land Tightness 05	Land Tightness 10
3713	Linyi City	East, Middle	17479	11.15	12.11	0.13	0.08
3714	Dezhou	East, Middle	24777	10.90	11.89	0.09	0.08
3715	Liaocheng	East, Low	8844	10.96	11.80	0.13	0.08
3716	Binzhou	East, Middle	19158	11.08	12.03	0.11	0.12
4101	Zhengzhou City	Non-east, Middle	27261	11.47	12.23	0.26	0.10
4102	Kaifeng	Non-east, Low	11976	10.76	11.74	0.39	0.17
4103	Luoyang City	Non-east, Middle	26555	11.23	12.06	0.22	0.12
4104	Pingdingshan	Non-east, Middle	18337	11.21	12.01	0.17	0.08
4105	Anyang	Non-east, Middle	19362	11.09	11.85	0.18	0.07
4106	Hebi City	Non-east, Low	14703	10.88	11.62	0.39	0.16
4110	Xuchang	Non-east, Low	14306	10.87	11.90	0.16	0.11
4111	Luohe	Non-east, Middle	23156	10.67	11.60	0.53	0.14
4112	Sanmenxia	Non-east, Low	15414	11.04	11.88	0.17	0.08
4113	Nanyang	Non-east, Middle	25615	10.97	11.70	0.23	0.08
4114	Shangqiu	Non-east, Low	14764	10.66	11.66	0.16	0.07
4116	Zhoukou	Non-east, Low	13144	10.60	11.46	0.15	0.39
4201	Wuhan	Non-east, Middle	24963	11.61	12.41	0.12	0.11
4203	Shiyan City	Non-east, Middle	35874	11.18	11.76	0.14	0.08
4205	Yichang City	Non-east, Middle	26548	11.00	11.71	0.09	0.10
4206	Xiangfan	Non-east, Low	12493	10.87	11.81	0.15	0.10
4207	Ezhou	Non-east, Low	13519	10.82	12.07	0.23	0.18
4208	Jingmen	Non-east, Middle	19907	11.01	11.65	0.12	0.08
4209	Xiaogan City	Non-east, Low	6977	11.01	11.66	0.08	0.03
4210	Jingzhou	Non-east, Low	10007	10.93	11.83	0.09	0.06
4211	Huanggang City	Non-east, Low	10270	10.72	11.75	0.05	0.06
4212	Xianning	Non-east, Low	8278	10.82	11.65	0.08	0.12
4213	Suizhou	Non-east, Low	8350	10.69	11.66	0.54	0.11
4301	Changsha City	Non-east, Middle	34131	11.72	12.33	0.10	0.10
4302	Zhuzhou	Non-east, Middle	24835	11.43	12.16	0.12	0.09
4303	Xiangtan City	Non-east, Middle	26112	11.37	12.18	0.12	0.10
4304	Hengyang	Non-east, Low	15457	11.26	12.04	0.15	0.08
4305	Shaoyang	Non-east, Low	8988	11.11	11.86	0.07	0.05
4306	Yueyang City	Non-east, Middle	28512	11.22	11.94	0.12	0.08
4307	Changde	Non-east, Middle	18270	11.29	11.94	0.10	0.08
4308	Zhangjiajie	Non-east, Low	6514	11.30	11.85	0.19	0.13
4309	Yiyang City	Non-east, Low	8840	11.12	11.79	0.11	0.08
4310	Chenzhou	Non-east, Low	14959	11.32	12.04	0.06	0.07
4311	Yongzhou	Non-east, Low	8503	11.17	12.01	0.13	0.09
4312	Huaihua City	Non-east, Middle	15795	11.20	12.01	0.09	0.07
4401	Guangzhou City	East, High	63819	12.41	12.80	0.08	0.10
4402	Shaoguan City	East, Middle	19590	11.66	12.05	0.03	0.12
4403	Shenzhen	East, High	59271	12.34	12.70	0.08	0.07
4404	Zhuhai city	East, High	64960	11.90	12.18	0.06	0.10
4405	city of Shantou	East, Low	12456	11.18	11.77	0.06	0.11
4406	Foshan City	East, High	47500	11.82	12.21	0.03	0.03
4407	Jiangmen	East, Middle	30791	11.61	12.07	0.04	0.08
4408	Zhangjiang City	East, Middle	24248	11.40	11.84	0.04	0.09
4409	Maoming City	East, Middle	20541	11.54	11.95	0.03	0.10
4412	Zhaoqing	East, Middle	25943	11.62	11.93	0.03	0.11
4413	Huizhou	East, Middle	37681	11.58	12.10	0.04	0.11
4414	Meizhou	East, Low	10984	11.34	11.74	0.02	0.07
4415	Shanwei	East, Low	10193	11.16	11.75	0.01	0.03
4416	Heyuan City	East, Low	11453	11.46	11.68	0.01	0.07
4417	Yangjiang	East, Middle	18778	11.07	11.57	0.04	0.09
4418	Qingyuan	East, Low	12004	11.64	12.08	0.03	0.10
4419	Dongguan city	East, High	71997	11.86	12.43	0.01	0.01
4420	Zhongshan City	East, High	44005	11.70	12.29	0.02	0.02
4453	Yunfu City	East, Low	12543	11.17	11.61	0.02	0.06

Table B4: List of Cities (Continued)

City Code	City Name	Group	GDP Per Capita	TFP 05	TFP 10	Land Tightness 05	Land Tightness 10
4501	NanNing City	Non-east, Middle	24296	11.09	11.91	0.19	0.11
4502	Liuzhou	Non-east, Middle	23042	11.45	12.21	0.21	0.12
4503	Guilin	Non-east, Middle	22192	11.35	12.04	0.10	0.06
4505	Beihai	Non-east, Middle	18530	10.94	11.83	0.23	0.16
4509	Yulin City	Non-east, Low	8573	11.20	11.90	0.10	0.07
4510	Baise	Non-east, Low	12227	11.27	11.85	0.08	0.07
4512	Hechi	Non-east, Low	9114	11.07	11.76	0.07	0.04
4513	Laibin City	Non-east, Low	5947	11.07	11.84	0.15	0.11
4514	Chongzuo	Non-east, Low	6633	10.92	11.73	0.04	0.09
4601	Haikou	East, Middle	17928	11.62	12.06	0.08	0.14
4602	Sanya	East, Low	9538	11.38	11.91	0.10	0.12
5001	Chongqing	Non-east, Low	13342	11.64	12.41	0.10	0.12
5101	Chengdu	Non-east, Middle	29463	11.69	12.26	0.24	0.07
5103	Zigong	Non-east, Low	14452	11.01	11.84	0.22	0.18
5104	Panzhihua City	Non-east, Middle	20725	11.32	12.15	0.42	0.15
5105	Luzhou	Non-east, Low	10166	11.03	11.76	0.25	0.13
5106	Deyang	Non-east, Low	15421	11.46	12.23	0.07	0.06
5107	Mianyang	Non-east, Middle	18200	11.22	12.05	0.16	0.10
5108	Guangyuan City	Non-east, Low	6323	10.92	11.84	0.34	0.08
5109	Suining	Non-east, Low	5207	10.95	11.76	0.25	0.08
5111	Leshan city	Non-east, Low	9887	11.00	11.75	0.19	0.07
5113	Nanchong	Non-east, Low	6373	10.93	11.71	0.19	0.07
5114	Meishan	Non-east, Low	8575	11.16	11.90	0.20	0.09
5115	Yibin City	Non-east, Middle	16042	11.17	11.96	0.09	0.08
5116	Guang'an City	Non-east, Low	4584	10.90	11.64	0.24	0.07
5120	Ziyang City	Non-east, Low	7540	11.09	11.69	0.10	0.09
5201	Guiyang City	Non-east, Middle	18874	11.44	12.11	0.16	0.11
5202	Liupanshui City	Non-east, Low	13504	11.28	12.02	0.16	0.08
5203	Zunyi City	Non-east, Low	15180	11.37	11.97	0.08	0.05
5204	Anshun	Non-east, Low	4921	11.02	11.86	0.14	0.11
5301	Kunming	Non-east, Middle	31780	11.66	12.22	0.11	0.09
5303	Qujing	Non-east, Middle	17659	11.37	12.04	0.23	0.06
5304	Yuxi	Non-east, High	52230	11.44	11.85	0.03	0.05
5305	Baoshan City	Non-east, Low	4656	11.14	11.67	0.05	0.07
5306	Zhaotong City	Non-east, Low	6819	11.26	11.93	0.04	0.05
5307	Lijiang City	Non-east, Low	11223	11.09	11.80	0.12	0.10
6101	Xi'an	Non-east, Middle	17528	11.61	12.31	0.09	0.08
6102	Tongchuan	Non-east, Low	8160	10.98	11.81	0.12	0.18
6103	Baoji City	Non-east, Middle	24210	11.36	11.98	0.06	0.13
6104	Xianyang	Non-east, Middle	18391	11.05	11.91	0.42	0.07
6105	Weinan	Non-east, Low	5411	11.09	11.89	0.05	0.06
6106	Yan'an City	Non-east, Low	10092	11.17	12.08	0.03	0.06
6108	Yulin City	Non-east, Low	5932	11.16	12.25	0.12	0.06
6201	Lan'Zhou City	Non-east, Middle	22470	11.46	12.09	0.14	0.13
6202	Jiayuguan City	Non-east, Middle	25206	11.51	12.05	0.31	0.44
6203	Jinchang City	Non-east, Middle	31236	11.13	12.03	0.12	0.28
6204	Baiyin	Non-east, Middle	17406	11.26	11.82	0.13	0.22
6205	Tianshui	Non-east, Low	6311	10.88	11.59	0.10	0.11
6206	Wuwei	Non-east, Low	7307	10.91	11.50	0.10	0.14
6207	Zhangye City	Non-east, Low	8654	11.01	11.53	0.05	0.17
6208	Pingliang	Non-east, Low	7591	11.12	11.86	0.11	0.08
6301	Xining	Non-east, Low	11160	11.53	12.04	0.05	0.08
6401	Yinchuan	Non-east, Low	13956	11.49	12.24	0.10	0.12
6402	Shizuishan	Non-east, Low	15503	11.34	12.07	0.16	0.31

Notes: This table displays the cities used in the quantitative model. The third column indicates the category of the city based on its location and GDP per capita (RMB). The fourth column shows the GDP per capita in 2005. We categorize cities into three levels of development equality based on their GDP per capita. The following two columns display the productivity in 2005 and 2010, as calculated by the quantitative model. The last two columns show the land tightness in 2005 and 2010, measured in square kilometers per thousand workers, calculated in the quantitative model.

B.2 Micro-foundation of Endogenous Urban Land Supply

In the paper, when the desired land supply in prefecture j reaches the quota, they cannot build anymore; otherwise, the local builders are willing to convert more urban land. As a result, the actual construction land supply inequality $L_j^u \leq \bar{L}_j^u$ 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

$$S_{ju} = \phi_j L_j^u \leq \phi_j \bar{L}_j^u$$

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 inverted construction density $1/\phi_j$, floor space price Q_{ju}, and local urban development conditions κ_j. Therefore,

$$L_j^u = \min\left\{ R_j - \kappa_j \left(\frac{Q_{ju}}{\phi_j} \right)^{-1/\zeta}, \bar{L}_j^u \right\} \tag{A2}$$

where ζ is the price elasticity of developed land as in Yu (2019), more specifically, the elasticity of construction land supply to density-adjusted floor space prices in our setting. Below, we derive the microeconomic foundation of endogenous urban land development equation (A2).

Our micro foundation is a form of variation of Yu (2019)'s urban land developers' problem. At each location j, an immobile representative local government manages developable land with measure R_j. A developable land parcel l can be developed into urban land at the cost of $p_j x_j$ where p_j is the local price of developing urban land and x_j represents the land-development suitability that varies across land parcels within a location.

For the model tractability, we assume that x_j follows the Pareto distribution:

$$x_j \sim F(X) = 1 - X^{-\frac{1}{\zeta}}$$

The local government obtains a payoff $p_j^L \equiv Q_{ju}/\phi_j$ by providing one unit of urban land in the urban land rental market. Urban land is rented by workers in the manufacturing sector for both housing and production purposes. The profit from land development is obtained by the immobile representative local government and transferred to its Hukou residents. The urban land supply function can be derived by solving a local government's problem of profit maximization.

Without any policy intervention from the central government, a local government will develop a land parcel into urban land if and only if $p_j^L \geq p_j x_j$. So, at given land rents p_j^L, the proportion of land developed into urban land is

$$\frac{L_j^u}{R_j} = 1 - \left(\frac{p_j^L}{p_j}\right)^{-\frac{1}{\zeta}}$$

Therefore, we could reformulate it as

$$L_j^u = R_j - \kappa_j \left(\frac{Q_{ju}}{\phi_j}\right)^{-1/\zeta}$$

where $\kappa_j \equiv R_j p_j^{1/\zeta}$ is a combination of total land measure and local land development unit cost.

B.3 Calculating the Prefecture-level Land Quota

We calculate the prefecture-level land quota following a two-step method due to data limitations. The major data limitations are (1) the land quota increment data is only available at the province level, (2) some prefectures' current year's actual land supply may exceed their pre-assigned current year's land quota increment, and (3) unused historical land quota may be depreciated by the central government. As a result, we cannot use the cumulative land quota stock as the actual land quota for each specific year. Therefore, we use the following procedure.

In the first step, we compare the actual land usage increment and the land quota increment for each province around 2005 and 2010, respectively. To avoid measurement errors, we use both the corresponding year and the year before that year, specifically, 2004 and 2009. If a province has a land usage increment larger than the land quota increment in that corresponding year, we classify all prefectures in that province as binding. For these prefectures in that corresponding year, the total land quota is equal to the actual land usage (total land supply).

In the second step, we deal with all the non-binding provinces. We first impute the province-level land quota increment to the prefecture-level according to their previous year's total land usage. We then determine that the total land quota is equal to the prior year's total land usage plus the imputed land quota increment. Finally, we make sure that the total land quota does not exceed the natural limits of all potential usable land.

B.4 Computational Method of Solving the Model

Given the exogenous variables and parameters, we need to calculate the responses of endogenous variables resulting from model policy changes. As mentioned, we select the equilibrium that is closest to the one observed in the real world. Thus, the initial values of the variables are set equal to the data in 2005 and 2010. Since we have a within-city land market that balances residential and production uses, we adopt a double-loop variation of the method in Fang and Huang (2022). Since the method is a global method, it could be easily adapted further to allow other inner loops. For instance, Fang et al. (2025b) introduces the marriage choice as an additional loop.

We first specify the exogenous variables and the model equation system. The exogenous variables are $\{H_i^s, \epsilon_j^s, \tau_{ij}^s, \bar{L}_j^u, \phi_j, \eta_j, R_j, \kappa_j\}$ where i indexes Hukou city, j indexes destination city, and s indexes skill. The equation system consists of three blocks: 1) Migration Block: worker income and gravity equations; 2) Production Block: production, wage, and floor space price equations; 3) Housing Block: construction equations and market-clearing equations.

To calculate the counterfactuals following policy changes, we begin with the block where the changes occur and then iterate block by block to update the endogenous variables until all endogenous variables converge within a certain small threshold. We present the process of calculating a counterfactual following an increase in land supply as an example below. Suppose a land quota reallocation policy is $\bar{L}_j^{u\prime} = \Delta_j \times \bar{L}_j^u$ for every city j. We have the following process of updating variables $\{\hat{x_{jk}}\}^O$ or $\{\hat{x_{jk}}\}^{OI}$, which indicates the O^{th} outer loop iteration and I^{th} inner loop iteration of variable x. Start with the housing block to initiate the process.

Outer Loop: In the outer loop, we first update the endogenous land supply under the new land supply quotas. We then update the floor space distribution between residential and production uses according to the inner loop equilibrium unit prices of residential and production floor space. The outer loop converges when the prices satisfy the equilibrium price equation between both markets. We start the outer loop notation with the first iteration 1.

Step 1: Initiation (ensuring non-zero floor space supply)

$$\{L_j^u\}^1 = \min\left\{R_j - \kappa_j\left(\frac{Q_{ju}}{\phi_j}\right)^{-1/\zeta}, \bar{L}_j^{u\prime}\right\} \tag{A3}$$

$$\{\hat{S_{ju}}\}^1 = \phi_j \{L^u_j\}^1 \tag{A4}$$

$$\{\hat{S^R_{ju}}\}^1 = S^R_{ju} \times (\{\hat{S_{ju}}\}^1 / S_{ju}) \tag{A5}$$

$$\{\hat{S^M_{ju}}\}^1 = S^M_{ju} \times (\{\hat{S_{ju}}\}^1 / S_{ju}) \tag{A6}$$

Step 2: Complete the **Inner Loop** and then feedback prices to Outer Loop (x^{1*} means Inner Loop for x converges) to finish the iteration in the below equations

$$\{\hat{Q_{ju}}\}^{\mathbf{1}^*} = \frac{1-\beta}{\beta} \frac{\{w^l_{ju} H^l_{ju} + w^h_{ju} H^h_{ju}\}^{\mathbf{1}^*}}{\{\hat{S^R_{ju}}\}^0} \tag{A7}$$

$$\{\hat{q_{ju}}\}^{\mathbf{1}^*} = (1-\alpha)\Big(\frac{\alpha}{\{\hat{W_{ju}}\}^{\mathbf{1}^*}}\Big)^{\frac{\alpha}{1-\alpha}} \tag{A8}$$

$$\{L^u_j\}^{\mathbf{1}^*} = \min\left\{ R_j - \kappa_j \left(\frac{\{\hat{Q_{ju}}\}^{\mathbf{1}^*}}{\phi_j} \right)^{-1/\zeta}, \bar{L^u_j}' \right\} \tag{A9}$$

$$\{\hat{S_{ju}}\}^{\mathbf{1}^*} = \phi_j \{L^u_j\}^{\mathbf{1}^*} \tag{A10}$$

$$\{\hat{S^R_{ju}}\}^{\mathbf{1}^*} = \{\hat{S^R_{ju}}\}^1 \times (\{\hat{S_{ju}}\}^{\mathbf{1}^*} / \{\hat{S_{ju}}\}^1) \tag{A11}$$

$$\{\hat{S^M_{ju}}\}^{\mathbf{1}^*} = \{\hat{S^M_{ju}}\}^1 \times (\{\hat{S_{ju}}\}^{\mathbf{1}^*} / \{\hat{S_{ju}}\}^1) \tag{A12}$$

Step 3: Compare floor space prices and generate excess demand for residential space. The core idea is that if $\{\hat{Q_{ju}}\}^{\mathbf{1}^*} > \frac{\{\hat{q_{ju}}\}^{\mathbf{1}^*}}{\eta_j}$, residential floor space is smaller than equilibrium and production floor space is larger than equilibrium, so we need to redistribute more residential floor space to production floor space, until $\{\hat{Q_{ju}}\}^{\mathbf{1}^*} = \frac{\{\hat{q_{ju}}\}^{\mathbf{1}^*}}{\eta_j}$. We update partially with step size γ.

$$\{ED^R_j\}^{\mathbf{1}^*} = \gamma \left(\frac{\{\hat{Q_{ju}}\}^{\mathbf{1}^*} - \frac{\{\hat{q_{ju}}\}^{\mathbf{1}^*}}{\eta_j}}{\{\hat{Q_{ju}}\}^{\mathbf{1}^*} + \frac{\{\hat{q_{ju}}\}^{\mathbf{1}^*}}{\eta_j}} \right) \times \{\hat{S^R_{ju}}\}^{\mathbf{1}^*} \tag{A13}$$

Step 4: Update floor space

$$\{\hat{S^R_{ju}}\}^2 = \{\hat{S^R_{ju}}\}^{\mathbf{1}^*} + \{ED^R_j\}^{\mathbf{1}^*} \tag{A14}$$

$$\{\hat{S^M_{ju}}\}^2 = \{\hat{S^M_{ju}}\}^{\mathbf{1}^*} - \{ED^R_j\}^{\mathbf{1}^*} \tag{A15}$$

Finally, we repeat Step 2 to Step 4 until the market-clearing condition holds: $\{\hat{Q_{ju}}\}^{**} = \frac{\{\hat{q_{ju}}\}^{**}}{\eta_j}$.

Inner Loop: Within the inner loop, we update migration and production decisions based on the residential and production floor space. This Inner Loop is almost identical to Fang and Huang (2022)'s method. Notation: for variable x^{OI}, O denotes the step in the Outer Loop, and I denotes the step in the Inner Loop. Here, we demonstrate with $O = 1$.

Step 2-1: Update the housing block

$$\{\hat{Q_{ju}}\}^{11} = \frac{1-\beta}{\beta}\frac{w^l_{ju}H^l_{ju} + w^h_{ju}H^h_{ju}}{\{\hat{S^R_{ju}}\}^1} \tag{A16}$$

$$\{\hat{Q_{jr}}\}^{11} = \tau\{\hat{Q_{ju}}\}^{11} \tag{A17}$$

$$\{S^R_{jr}\}^{11} = \frac{1-\beta}{\beta}\frac{w_{jr}H_{jr}}{\{\hat{Q_{jr}}\}^{11}} \tag{A18}$$

Step 2-2: Update the migration block

$$\{\hat{v^s_{in,jk}}\}^{11} = w^s_{jk} + \frac{\{\hat{Q_{in}}\}^{11}\{\hat{S^R_{in}}\}^{11}}{H^R_{in}} \quad \text{from eq.(4)} \tag{A19}$$

$$\{\hat{\pi^s_{in,jk}}\}^{11} = \frac{(\tau^s_{in,jk}\{\hat{Q_{jk}}\}^{11^{1-\beta}})^{-\epsilon}(\{\hat{v^s_{in,jk}}\}^{11})^{\epsilon}}{\sum_{j'k'=11}^{JK}(\tau^s_{in,jk}\{\hat{Q_{j'k'}}\}^{11^{1-\beta}})^{-\epsilon}(\{\hat{v^s_{in,j'k'}}\}^{11})^{\epsilon}} \text{ from eq.(6)} \tag{A20}$$

Then, combining $\{\hat{\pi^s_{in,jk}}\}^{11}$ with $\{H^s_{in}\}$, we are able to calculate $\{\hat{H^s_{jk}}\}^{11}$.

Step 2-3: Update the production block

$$\{\hat{X_{ju}}\}^{11} = [(\{A^h_{ju}\}^{11}\{\hat{H^h_{ju}}\}^{11})^{\frac{\sigma-1}{\sigma}} + (\{A^l_{ju}\}^{11}\{\hat{H^l_{ju}}\}^{11})^{\frac{\sigma-1}{\sigma}}]^{\frac{\sigma}{\sigma-1}} \text{ from eq.(7)} \tag{A21}$$

$$\{\hat{w^l_{ju}}\}^{11} = \alpha(\{\hat{X_{ju}}\}^{11})^{\alpha-1}(\{\hat{S^M_{ju}}\}^{1})^{1-\alpha}(\{A^l_{ju}\}^{11})^{\frac{\sigma-1}{\sigma}}(\{\hat{X_{ju}}\}^{11})^{\frac{1}{\sigma}}(\{\hat{H^l_{ju}}\}^{11})^{-\frac{1}{\sigma}} \text{ from eq.(8)} \tag{A22}$$

$$\{\hat{w^h_{ju}}\}^{11} = \alpha(\{\hat{X_{ju}}\}^{11})^{\alpha-1}(\{\hat{S^M_{ju}}\}^{1})^{1-\alpha}(\{A^h_{ju}\}^{11})^{\frac{\sigma-1}{\sigma}}(\{\hat{X_{ju}}\}^{11})^{\frac{1}{\sigma}}(\{\hat{H^h_{ju}}\}^{11})^{-\frac{1}{\sigma}} \text{ from eq.(9)} \tag{A23}$$

Step 2-4: Update prices

$$\{\hat{Q_{ju}}\}^{12} = \frac{1-\beta}{\beta}\frac{\{w^l_{ju}H^l_{ju} + w^h_{ju}H^h_{ju}\}^{11}}{\{\hat{S^R_{ju}}\}^1} \tag{A24}$$

We repeat Step 2-1 to Step 2-4 until residential floor space prices $\{\hat{Q_{ju}}\}^{1t}$ converge to $\{\hat{Q_{ju}}\}^{1*}$. We then output $\{\hat{Q_{ju}}\}^{1*}$ and $\{\hat{q}_{ju}\}^{1*}$ for the use in outer loop.

$$\{\hat{Q_{ju}}\}^{1*} = \frac{1-\beta}{\beta} \frac{\{w^l_{ju} H^l_{ju} + w^h_{ju} H^h_{ju}\}^{1*}}{\{\hat{S^R_{ju}}\}^1} \tag{A25}$$

$$\{\hat{W_{ju}}\}^{11} = \frac{\{\hat{w^h_{ju}}\}^{11}\{\hat{H^h_{ju}}\}^{11} + \{\hat{w^l_{ju}}\}^{11}\{\hat{H^l_{ju}}\}^{11}}{\{\hat{X_{ju}}\}^{11}} \tag{A26}$$

$$\{\hat{q}_{ju}\}^{1*} = (1-\alpha)\Big(\frac{\alpha}{\{\hat{W_{ju}}\}^{1*}}\Big)^{\frac{\alpha}{1-\alpha}} \tag{A27}$$

Optimal Policy: To find the optimal policy, we first need to repeat the **Outer Loop** with modification in Step 3 to enforce $\eta_j = 1$ for any j and then add an additional Step 5 for updating the land distribution according to the price gap. The procedure of solving **Optimal Policy** is:

Step 1 to Step 4 from the **Outer Loop** with Step 3 modified as $\eta_j = 1$ for any j.

Step 5: Update land distribution according to the updated prices $\{\hat{Q_{ju}}\}^{\mathbf{1^*}}$.

$$\hat{L_j}^{\mathbf{1^*}} = \hat{L_j} \times (1 + \gamma_o \times \frac{\{\hat{Q_{ju}}\}^{\mathbf{1^*}} - \overline{\{\hat{Q_{ju}}\}^{\mathbf{1^*}}}}{\overline{\{\hat{Q_{ju}}\}^{\mathbf{1^*}}}}) \tag{A28}$$

$$\{\hat{L_j}\}^{\mathbf{1^*}} = \frac{\hat{L_j}^{\mathbf{1^*}}}{\sum \hat{L_j}^{\mathbf{1^*}}} \times \sum L_j \tag{A29}$$

where γ_o is the tuning parameter for the spread of updating and $\overline{\{\hat{Q_{ju}}\}^{\mathbf{1^*}}}$ is the national average floor space price. The updating of construction land distribution in equation (A28) is to distribute more construction land quota to the prefecture with a higher price. We then scale to satisfy the equation's total land constraint (A29).

Finally, we repeat Steps 1 to 5 until all prices are equal: $\{Q_{ju}\}^{**} = \overline{\{Q_{ju}\}^{**}}$.

B.5 Details on Estimating the Agglomeration Parameters

Constructing Counterfactual Land Allocation To begin with, we calculate the counterfactual urban land allocation in 2005 and 2010 if there were 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. We chose the 2000-2003 growth rate because pre-1999 land supply data at the prefecture level are unavailable. The details are as follows:

$$\widehat{L_j(t)} = L_j(2003)(1 + g_{L_j})^{t-2003} \tag{A30}$$

where the first component $L_j(2003)$ is prefecture j's total urban land usage in 2003, just before the policy change happened. The second component is the multiplier if the total land supply were to follow the pre-2003 prefectural-level annual growth rate g_{L_j}.[1] With this land allocation, we can calculate a counterfactual equilibrium if there were no inland-favoring land policy. A key question is whether the developed binding regions have sufficient reserve land R_j to fulfill these allocations. We contend that this issue is not a concern. First, according to satellite data, for instance, in 2005, only 23% of land in tier-1 prefectures was developed, and a mere 9.3% of land in tier-2 prefectures was developed (Wu and You, 2025). Second, a significant portion of land in developed regions remains farmland due to the farmland redline policy (Yu, 2019).

Three Steps of Estimating Agglomeration Parameters A simple but naive way to identify these parameters is to log-linearize the agglomeration equation (12) and run a regression:

$$log(A^s_{ju}) = \gamma log(D_{ju}) + log(a^s_{ju})$$

However, the above regression suffers from a severe endogeneity issue. Fundamental productivity a^s_{ju} is absolutely correlated with D_{ju} since locations with higher fundamental productivity

[1] We use the original pre-2003 prefectural-level annual growth rate g_{L_j} for each prefecture from 2003 to 2005 to calculate counterfactual urban land allocation, given that the time gap is only two years. To project 2010, however, we need to be more conservative for the numbers on the upper side. Therefore, we cap g_{L_j} at the third quartile of the distribution among binding cities and also ensure that the projected land allocation is within the natural limit R_j. We check for robustness to ensure such a choice does not significantly affect the results.

will naturally attract more workers. Usually, people choose instruments such as long population lags or soil fertility to estimate this regression (Ciccone and Hall, 1996; Rosenthal and Strange, 2008; Combes et al., 2010). Nevertheless, due to data limitations, there has been almost no successful attempt to estimate the prefecture-level agglomeration effect in China.

Fortunately, we can pin down the parameter with indirect inference. The basic idea is to find the parameter value that can reproduce the observed effect of the inland-favoring land policy within the model. We first execute a prefecture-level DID regression to obtain the real-world impact of the inland-favoring policy, which has been done in our empirical part. Next, we simulate the model to examine prefecture-level productivity if we eliminate the land supply policy. By employing these simulated data, we conduct the same regression and match the simulated regression coefficients with their corresponding ones in the empirical regression.

We need a consistent comparison between productivity in the model and the empirical analysis. This requires us to calculate measured productivity in the model for two reasons. First, the labor productivities A^s_{ju} are inconsistent with the productivity used in our empirical analysis. Our measurements of productivity in the empirical analysis follow Olley and Pakes (1992), Levinsohn and Petrin (2003), and Ackerberg, Caves, and Frazer (2015), which do not consider land as one of the production inputs. Second, data on land input costs at the firm level is not available, nor are the fundamental skill-augmented labor productivities A^h_{ju} and A^l_{ju} distinguishable in the data. Thus, we calculate measured productivity in the model as output net of measured labor inputs:

$$ln(\widetilde{Prod}_{ju}) = ln\left(\frac{Y_{ju}}{(H^h_{ju} + H^l_{ju})^{\alpha}}\right) \tag{A31}$$

With the measured productivity for each prefecture, we can estimate the production fundamentals (a^h_{ju} and a^l_{ju}) and the agglomeration elasticity (γ) jointly.

We now delve into the details in three steps.

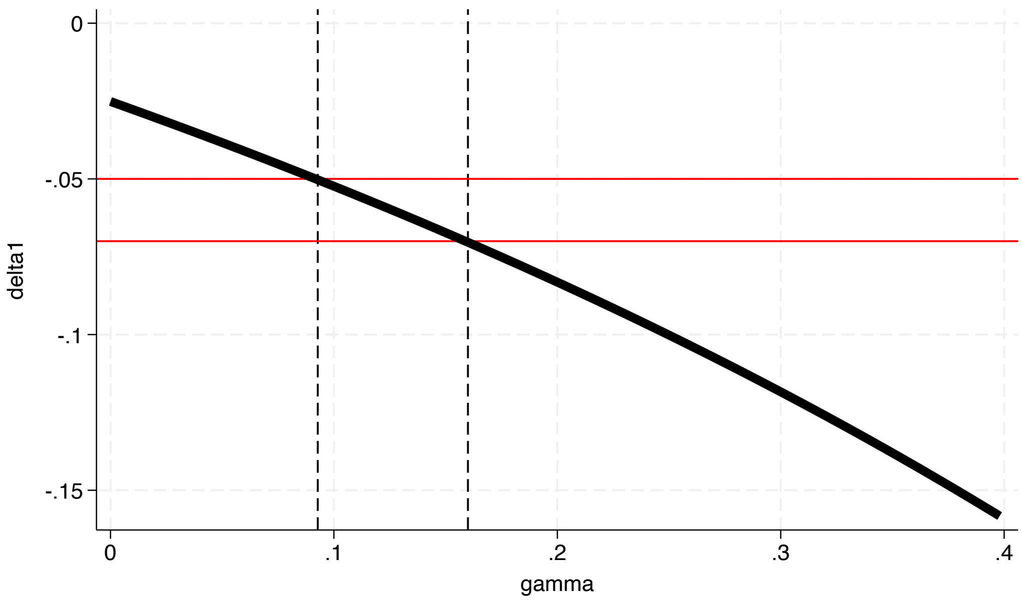
In the first step, we run a DID regression for productivity using equation (1) to get $\hat{\delta}_1^*$.

In the second step, we construct a counterfactual 2005 equilibrium by guessing the agglomeration parameter γ^0 (and correspondingly, $a_j^{s,0}$) and derive simulated productivity. Given all the variables and parameters we have derived, we can solve for the 2005 equilibrium, except γ and a_j^s. For an initial guess of γ^0, we simulate the counterfactual case with no inland-favoring policy. We get this counterfactual equilibrium using the algorithm described in Appendix B.4 with the counterfactual labor productivity $A_j^{s,0}$. Then, given the counterfactual labor productivity $A_j^{s,0}$, we calculate the counterfactual measured productivity $\widetilde{Prod}_{ju}^0$ using equation (A31).

In the third step, we run the same regression (1) using the simulated data from both the original equilibrium and the counterfactual equilibrium as $ln(\widetilde{Prod}_{ju}^0) = \alpha + \delta_1 Post2003 \times East_j + \phi_j + \gamma_t + \epsilon_{jut}$, where $Post2003 = 1$ indicates the original equilibrium and $Post2003 = 0$ indicates the counterfactual equilibrium without the inland-favoring land policy. This yields the estimate of $\hat{\delta}_1^0$. Finally, we calculate the absolute distance between $\hat{\delta}_1^0$ and the real-world estimate $\hat{\delta}_1^*$. We then repeat this process, say n times, until we find the γ^* that minimizes this distance between the simulated regression coefficient $\hat{\delta}_1^n$ and the real regression coefficient $\hat{\delta}_1^*$.

We use two methods to measure firm productivity (OP and LP) and then calculate the average firm productivity in each prefecture, weighted by total firm employment. The 2003 inland-favoring policy led to a 5-7% decrease in eastern prefecture average productivity relative to the inland. This yields an estimate of $\hat{\delta}_1^*$ between -0.07 and -0.05. Figure B1 shows the relationship between the value of the agglomeration parameter γ and the regression estimate of $\hat{\delta}_1$ from the simulated data. We find a monotonic negative relationship: the stronger the agglomeration effect is, the larger the loss generated by the inland-favoring land policy in the model. Matching $\hat{\delta}_1^* \in [-0.07, -0.05]$ gives us a range of estimates $\gamma \in [0.09, 0.16]$.

Figure B1: Relationship between γ and $\hat{\delta}_1$

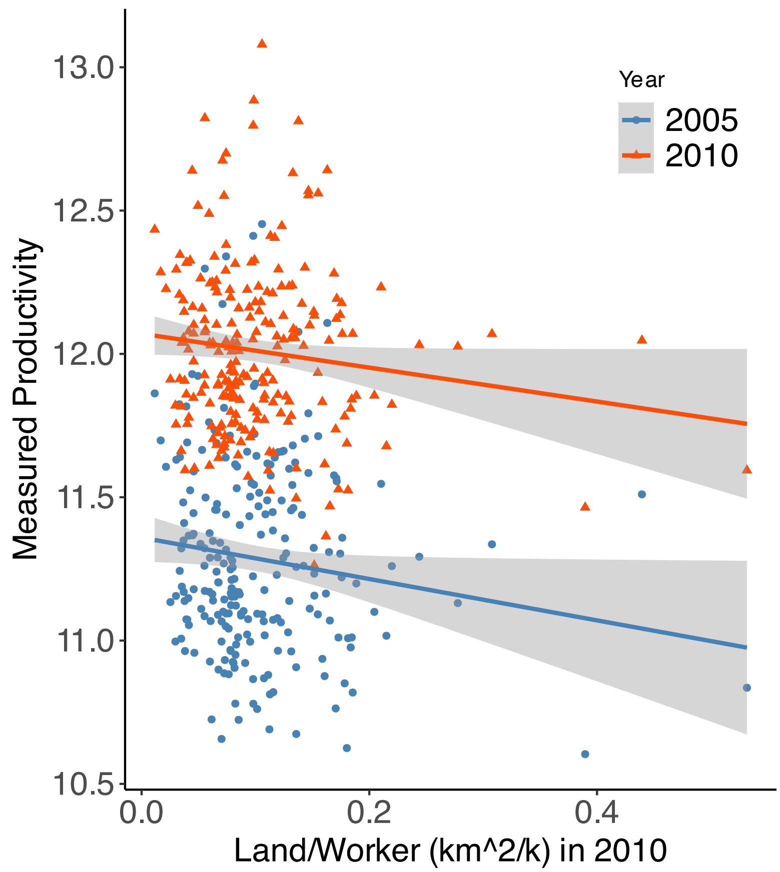


Notes: This figure plots how γ affects the estimation of $\hat{\delta}_1$ from the model-simulated data. The regression result uses the data simulated by the model from both the original equilibrium and the counterfactual equilibrium from estimating $ln(\widetilde{Prod}_j^0) = \alpha + \delta_1 Post2003 \times East_j + \phi_j + \gamma_t + \epsilon_{jt}$, where $Post2003 = 1$ indicates the original equilibrium and $Post2003 = 0$ indicates the counterfactual equilibrium without the inland-favoring land policy. This yields an estimated coefficient $\hat{\delta}_1$ for a choice of the agglomeration elasticity γ. The range of the estimation is $\hat{\delta}_1^* \in [-0.07, -0.05]$ (the red solid horizontal lines), which gives us a range of estimates $\gamma \in [0.09, 0.16]$ (the black dotted vertical lines).

B.6 Correlation between Productivity and Land Tightness

Figure B2 plots the correlation between productivity and land tightness in the model at the prefecture level, including the extreme values omitted in the main paper. We find a strong negative correlation between productivity and land tightness, including the extreme values.

Figure B2: Correlation between Productivity and Land Tightness By Individual Prefecture (Including Extreme Values)



Notes: This figure plots the correlation between productivity and land abundance in the model at the prefecture level, including the extreme values omitted in the main paper.

B.7 Additional Results of Model Quantification

In this section, we present additional results from the quantitative analysis of the spatial distribution of economic development, income, and welfare that are not included in the main context.

Economic Development Tables B5 and B6 show the spatial distributions of total output, urban output, rural output, and urban population. Across these tables, we have two observations consistent with our findings in the main context of the paper. First, more developed eastern cities have significantly higher output, especially in urban areas. Second, these cities are much more populated with higher floor space prices. These results supplement our main findings on the spatial misallocation created by the place-based land policy.

Income Table B7 shows the spatial distribution of total income, wage income, and non-wage income for Hukou workers in 2005 and 2010. Workers in more developed cities earn higher incomes (higher wages for all workers and higher non-wage incomes for Hukou workers). It supplements our main findings on the spatial misallocation created by the place-based land policy.

Table B5: Spatial Distribution of Economic Development (Part I)

Regions (loc., dev.)	No. of Cities	Total Output	Urban Output	Rural Output	Urban Pop.
		Units are Chinese Yuan and Person			
		Year 2005			
National	225	7.27E+12	5.07E+12	2.21E+12	2.38E+08
(east, high)	21	2.37E+12	2.22E+12	1.52E+11	7.55E+07
(east, mid)	51	1.95E+12	1.38E+12	5.67E+11	6.97E+07
(east, low)	25	4.63E+11	2.51E+11	2.11E+11	1.76E+07
(inland, high)	2	6.01E+10	2.67E+10	3.34E+10	1.33E+06
(inland, mid)	50	1.13E+12	6.55E+11	4.72E+11	3.68E+07
(inland, low)	76	1.31E+12	5.39E+11	7.70E+11	3.70E+07
		Year 2010			
National	225	1.64E+13	1.28E+13	3.62E+12	3.40E+08
(east, high)	21	5.35E+12	5.11E+12	2.46E+11	1.08E+08
(east, mid)	51	4.50E+12	3.41E+12	1.09E+12	9.53E+07
(east, low)	25	6.44E+11	4.14E+11	2.30E+11	1.55E+07
(inland, high)	2	8.25E+10	5.86E+10	2.39E+10	1.59E+06
(inland, mid)	50	2.99E+12	2.21E+12	7.82E+11	6.52E+07
(inland, low)	76	2.88E+12	1.63E+12	1.25E+12	5.52E+07

Notes: This table displays a summary of economic development variables by city group (weighted by population in 2005 and 2010). Regions are classified by the location of the city (east or inland) and the level of development (GDP per capita) in 2005.

Table B6: 2005 Spatial Distribution of Economic Development (Part II)

Regions (loc., dev.)	No. of Cities	Urban Pop. High-skill	Urban Pop. Low-skill	Rural Pop. High-skill	Rural Pop. Low-skill	Floor Space Price
				Year 2005		
National	225	4.24E+07	1.96E+08	5.82E+05	2.20E+08	62.74
(east, high)	21	1.41E+07	6.14E+07	6.31E+04	8.85E+06	123.67
(east, mid)	51	1.07E+07	5.90E+07	1.34E+05	5.33E+07	48.09
(east, low)	25	2.53E+06	1.51E+07	8.74E+04	2.40E+07	43.87
(inland, high)	2	2.56E+05	1.07E+06	6.22E+03	1.96E+06	52.19
(inland, mid)	50	8.06E+06	2.87E+07	1.25E+05	4.66E+07	47.14
(inland, low)	76	6703915	3.03E+07	166592.3	8.50E+07	38.34
				Year 2010		
National	225	6.20E+07	2.78E+08	1.45E+06	1.83E+08	114.73
(east, high)	21	1.97E+07	8.79E+07	1.31E+05	8.03E+06	176.09
(east, mid)	51	1.62E+07	7.91E+07	4.44E+05	5.26E+07	96.39
(east, low)	25	2.29E+06	1.32E+07	1.01E+05	1.36E+07	73.56
(inland, high)	2	3.60E+05	1.23E+06	9.27E+03	9.24E+05	102.84
(inland, mid)	50	1.42E+07	5.10E+07	3.46E+05	3.91E+07	107.83
(inland, low)	76	9280769	4.59E+07	417630.6	6.86E+07	78.52

Notes: This table displays a summary of economic development variables by group (weighted by population) in 2005. Regions are classified by the location of the city (east or inland) and the level of development (GDP per capita) in 2005.

Table B7: Spatial Distribution of Hukou-based Income

Regions (loc., dev.)	No. of Cities	Total Income 2005	Total Income 2010	Wage Income 2005	Wage Income 2010	Non-Wage Income 2005	Non-Wage Income 2010
National	225	1.89E+04	3.70E+04	1.46E+04	2.85E+04	4.35E+03	8.49E+03
(east, high)	21	3.73E+04	7.02E+04	2.47E+04	4.11E+04	1.26E+04	2.91E+04
(east, mid)	51	1.94E+04	3.72E+04	1.51E+04	2.89E+04	4.30E+03	8.26E+03
(east, low)	25	1.47E+04	2.93E+04	1.18E+04	2.43E+04	2.86E+03	5.06E+03
(inland, high)	2	2.26E+04	4.01E+04	1.74E+04	3.04E+04	5.21E+03	9.73E+03
(inland, mid)	50	1.71E+04	3.50E+04	1.37E+04	2.76E+04	3.45E+03	7.35E+03
(inland, low)	76	1.47E+04	3.05E+04	1.21E+04	2.61E+04	2.55E+03	4.45E+03

Notes: This table displays a summary of income variables by group (weighted by population) in 2005 and 2010. Regions are classified by the location of the city (east or inland) and the level of development (GDP per capita) in 2005.

C Supplements to Removing Inland-favoring Distortions

C.1 Constructing the Constrained Counterfactual Policy

Table C1 and C2 provide additional summary statistics of the counterfactual land allocation policy when we redistribute the land supply according to equation (18). In general, if we maintain the pre-2003 land policy instead of adopting the inland-favoring policy, we would distribute more urban land to more developed cities and increase their land per worker, as indicated by the data. This increases the land tightness in more developed cities.

Table C1: Removing the Inland-favoring Distortions: Spatial Distribution of Land Tightness

Regions (loc., dev.)	No. of Cities	Reality 2005	Reality 2010	Counterfactual $\widehat{2005}$	Counterfactual $\widehat{2010}$
National	225	0.093	0.083	0.092	0.082
(east, high)	21	0.077	0.068	0.082	0.090
(east, mid)	51	0.084	0.082	0.083	0.071
(east, low)	25	0.080	0.108	0.084	0.106
(inland, high)	2	0.127	0.130	0.127	0.107
(inland, mid)	50	0.140	0.101	0.126	0.079
(inland, low)	76	0.104	0.086	0.103	0.080

Notes: This table displays a summary of urban land supply relative to workers by city group (weighted by urban population) as well as the counterfactual migration-based land supply in 2005 and 2010 (unit: km^2/k). Regions are classified by the location of the city (east or inland) and the level of development (GDP per capita) in 2005, consistently as in Table 5.

Table C2: Removing the Inland-favoring Distortions: Changes in Total Land Supply

Regions (loc., dev.)	No. of Cities	Changes 2005	Changes 2010
National	225	0%	0%
(east, high)	21	13%	51%
(east, mid)	51	-2%	-16%
(east, low)	25	4%	-5%
(inland, high)	2	0%	-18%
(inland, mid)	50	-12%	-27%
(inland, low)	76	-2%	-11%

Notes: This table displays changes in counterfactual total urban land supply by group (summations within the group) in 2005 and 2010. Regions are classified by the location of the city (east or inland) and the level of development (GDP per capita) in 2005, consistently as in Table 5.

C.2 A Sophisticated Rule of Regional Transfer

Without loss of generality, we design a direct regional transfer rule instead of the place-based land allocation policy. We first need to determine who gains and who loses from removing the inland-favoring land policy, and then design a direct regional transfer rule to reduce the income gap between workers from developed and underdeveloped regions.

Who Gains and Who Loses We first discuss workers in four subgroups without considering cross-city migration. Firstly, developed regions experience direct gains. Urban workers in developed cities benefit from higher local wages, lower local housing prices, and increased land income. Rural workers in developed cities benefit from higher wages and lower housing prices in the nearby urban sector. Secondly, underdeveloped regions face direct losses. Urban workers in underdeveloped cities often face lower local wages, higher local housing prices, and reduced land income. Rural workers in underdeveloped cities suffer from two components: lower wages and higher housing prices in the nearby urban sector.

We then discuss workers in four subgroups, taking into account cross-city migration. All workers in underdeveloped cities benefit from more indirect gains, including higher wages and lower housing prices, in developed cities, especially rural workers in underdeveloped areas. Meanwhile, rural workers in developed cities also experience indirect gains, although they may not be as significant as those for workers in underdeveloped cities. Urban workers in developed cities typically experience minimal indirect benefits. Lastly, the government directly benefits from higher returns on production floor space.

The Regional Transfer Rule Based on the above qualitative analysis, we could design a regional transfer rule to replace the place-based land policy. The rule does not target optimal policy design, but it demonstrates that a better policy design could be possible. The rule could directly aim at transferring the direct gains. First, define the national gains in land income as follows:

$$\Delta\Pi_L^R = \sum_i \left(\hat{Q}_{iu}\hat{S}_{iu}^R - Q_{iu}S_{iu}^R\right) \tag{A32}$$

$$\Delta\Pi_L^M = \sum_i \left(\hat{q}_{iu}\hat{S}_{iu}^M - q_{iu}S_{iu}^M\right) \tag{A33}$$

where $\hat{Q}_{iu}\hat{S}_{iu}^R$ and $\hat{q}_{iu}\hat{S}_{iu}^M$ are regional land income in the counterfactual and $Q_{iu}S_{iu}^R$ and $q_{iu}S_{iu}^M$ are regional land income in the original equilibrium. The regional transfers $\{\widehat{DT_{iu}}, \widehat{DT_{ir}}\}$ must satisfy the following balance of budgets:

$$\sum_i \left(\widehat{DT_{iu}} + \widehat{DT_{ir}}\right) = \Delta\Pi_L^R + \Delta\Pi_L^M \tag{A34}$$

We assume the following rule for each city i:

$$\widehat{DT_{iu}} = \underbrace{-\left(\hat{Q}_{iu}\hat{S}_{iu}^R - Q_{iu}S_{iu}^R\right)}_{\text{restore urban land income}} + \underbrace{\left.\frac{\frac{\hat{Q}_{iu}-Q_{iu}}{Q_{iu}}Q_{iu}S_{iu}^R}{\sum_i \frac{|\hat{Q}_{iu}-Q_{iu}|}{Q_{iu}}Q_{iu}S_{iu}^R} \times \gamma_u^1 \times \Delta\Pi_L^R\right|_{\hat{Q}_{iu}-Q_{iu}>0}}_{\text{adjust for housing price }\uparrow} + \underbrace{\left.\frac{\frac{\hat{Q}_{iu}-Q_{iu}}{Q_{iu}}Q_{iu}S_{iu}^R}{\sum_i \frac{|\hat{Q}_{iu}-Q_{iu}|}{Q_{iu}}Q_{iu}S_{iu}^R} \times \gamma_u^2 \times \Delta\Pi_L^R\right|_{\hat{Q}_{iu}-Q_{iu}<0}}_{\text{adjust for housing price }\downarrow} \tag{A35}$$

$$\widehat{DT_{ir}} = \underbrace{\frac{\Delta\Pi_L^M H_{ir}}{\sum_i H_{ir}}}_{\text{urban-rural transfer}} + \underbrace{\left.\frac{\frac{\hat{Q}_{ir}-Q_{ir}}{Q_{ir}}Q_{ir}S_{ir}^R}{\sum_i \frac{|\hat{Q}_{ir}-Q_{ir}|}{Q_{ir}}Q_{ir}S_{ir}^R} \times \gamma_r^1 \times \Delta\Pi_L^R\right|_{\hat{Q}_{ir}-Q_{ir}>0}}_{\text{adjust for housing price }\uparrow} + \underbrace{\left.\frac{\frac{\hat{Q}_{ir}-Q_{ir}}{Q_{ir}}Q_{ir}S_{ir}^R}{\sum_i \frac{|\hat{Q}_{ir}-Q_{ir}|}{Q_{ir}}Q_{ir}S_{ir}^R} \times \gamma_r^2 \times \Delta\Pi_L^R\right|_{\hat{Q}_{ir}-Q_{ir}<0}}_{\text{adjust for housing price }\downarrow} \tag{A36}$$

where $\{\gamma_u^1, \gamma_u^2, \gamma_r^1, \gamma_r^2\}$ are tunning parameters for housing price transfer adjustments. The weights reflect the importance of the local housing market in the country in terms of housing prices.

To satisfy the balanced budget condition (A34), the following equation $\gamma_u^1 + \gamma_r^1 = \gamma_u^2 + \gamma_r^2 + 2$ must hold. The first part of $\widehat{DT_{iu}}$ is to restore gains and losses in direct land income, and the second and third parts adjust for gains and losses in floor space prices. The first part of $\widehat{DT_{ir}}$ is to redistribute additional urban production land income to rural households, and the second and third parts adjust for gains and losses in floor space prices.

Feasibility of the Regional Transfer This counterfactual is feasible to implement and still fulfills the central government's goal of balancing regional development. This mechanism mimics a "land quota market" policy, as recommended by previous literature, such as Lu and Xiang (2016). The basic idea is that the central government can balance the development of different regions by transferring revenues from developed cities to underdeveloped cities rather than allocating the land supply directly. Since land and wage incomes in land-gaining towns are higher than in land-losing towns, and the total land supply remains unchanged, this redistribution is feasible, allowing the central government to generate an additional financial surplus.

Turning the Redistribution Parameters Since the distribution of gains is mainly between housing price drops in developed urban regions and housing price increases in underdeveloped rural regions, because it is more costly to move to nearby urban areas. We could mainly focus on γ_r^1 and γ_u^2. Currently, we choose $\gamma_r^1 = 20$ and $\gamma_u^2 = 18$ to satisfy significant redistribution. We prefer $\gamma_u^1 = 0.2$ and $\gamma_r^2 = 0.2$ to make non-zero adjustments in the other directions.

C.3 A Simple Rule of Regional Transfer

We could also design a very simple, direct regional transfer rule without considering the changes from the new equilibrium to the original equilibrium. There are certainly more efficient regional transfer rules. The simple rule is as follows for each city i:

$$\widehat{DT}_{iu} = \underbrace{\hat{Q}_{iu}\hat{S}^R_{iu} \times \gamma^l_u \times \frac{-\Delta L_i}{L_i}}_{\text{urban land income transfer}} + \underbrace{(\hat{w}^l_{iu}H^l_{iu} + \hat{w}^h_{iu}H^h_{iu}) \times \gamma^w_u \times \frac{-\Delta L_j}{L_j}}_{\text{urban wage income transfer}}$$

$$\widehat{DT}_{ir} = \underbrace{(\hat{w}_{ir}H_{ir}) \times \gamma_r \times \frac{-\Delta L_j}{L_j}}_{\text{rural wage income transfer}}$$

where $\widehat{DT}_{iu}$ stands for direct transfer to urban workers and $\widehat{DT}_{ir}$ stands for direct transfer to rural workers. For a city losing $\frac{\Delta L_i}{L_i}$ (<0) of its land, urban workers will be compensated with a fraction γ^l_u of their floor space income $\hat{Q}_{iu}\hat{S}^R_{iu}$, and a fraction γ^w_u of their wage income $(\hat{w}^l_{iu}H^l_{iu} + \hat{w}^h_{iu}H^h_{iu})$. Since rural workers also face losses in their wage for losing access to their closest urban sector (the urban sector in their own city), they will be compensated with a fraction γ_r of their indirect wage income $\hat{w}_{ir}H_{ir}$. These direct transfers are feasible to implement because land-gaining cities ($\frac{\Delta L_i}{L_i} > 0$) have much higher floor space prices and wages.

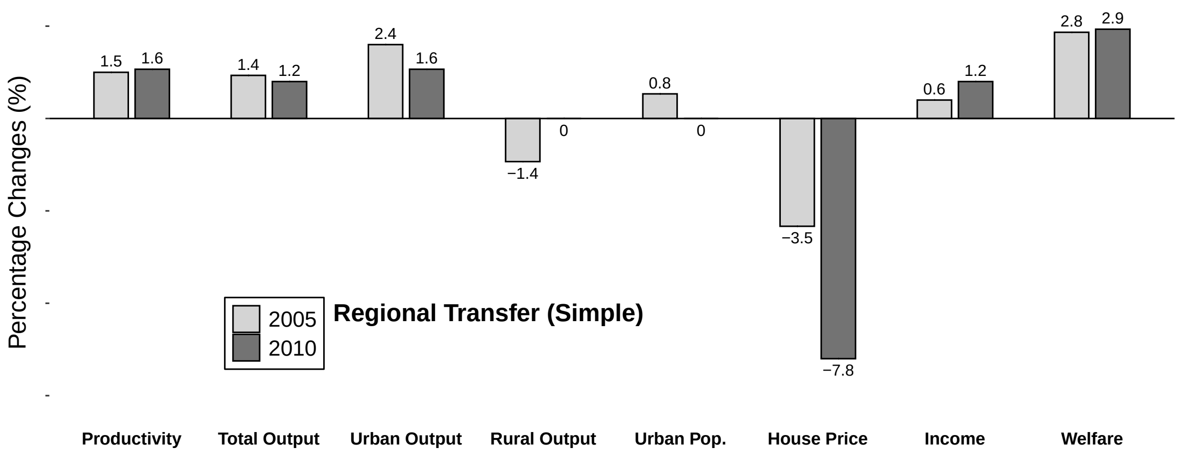
The transfer scale depends on the tuning parameters $\{\gamma^l_u, \gamma^w_u, \gamma_r\}$. As we mentioned, we cannot discuss the design of optimal redistribution policy in this paper. We show the results from one set of tuning parameters $\{\gamma^l_u, \gamma^w_u, \gamma_r\} = \{0.5, 0.1, 0.5\}$ for 2010 and $\{\gamma^l_u, \gamma^w_u, \gamma_r\} = \{0.75, 0.1, 0.5\}$ for 2005 which are sufficient to generate substantial redistribution and clarify the key mechanisms of the transfer results. We tested other sets of parameters, and the results were similar.

One thing to note is that the simple rule does not utilize the additional income from the more productive production land, and the government keeps the surplus.

C.4 Aggregate Effects with the Simple Rule of Regional Transfer

We show the aggregate effects of replacing the inland-favoring land policy with the simple rule of regional transfer on national productivity, urban output, rural output, urban population, and national average income and welfare. The results are plotted in Figure C1. Removing the place-based land policy significantly increased productivity, urban output, income, and welfare in 2005 and 2010. It also helps to increase the urban population due to lower residential floor space prices in more developed cities. Rural output falls due to worker emigration.

Figure C1: Aggregate Effects with the Simple Rule of Regional Transfer



Notes: This figure shows the aggregate effects of replacing the inland-favoring policy with the regional transfer on the Chinese economy in 2005 and 2010. We find substantial national gains in TFP, total output, urban output, urban population, income, and welfare.

One thing to note is that the simple rule does not utilize the additional income from the more productive production land, and the government keeps the surplus. Therefore, the aggregate incomes in both years are much lower than the sophisticated rule of regional transfer.

C.5 Aggregate Effects Decomposition

Construction To show the decomposition of the aggregate effects into three channels, we need to construct two intermediate equilibrium counterfactuals to separate the direct, the indirect, and the agglomeration effects. The idea is to follow the transmission path sequentially: (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.

Suppose the initial equilibrium is a collection of variables X_{ini} and the final counterfactual equilibrium with the policy change is a collection of variables X_{fin}. We must construct two equilibrium collections of variables X_{de} and X_{die}.

In the direct effect equilibrium X_{de}, we would only consider how the policy change affects each prefecture's production floor space. We start with the production land supply equation (14) and then end with the production function (7). We assume that workers do not relocate during the process, agglomeration effects remain constant, and residential floor space and corresponding prices remain unchanged. As a result, measured productivity, urban output, income, and welfare would change, but other variables would remain the same as in X_{ini}.

We would only shut down the agglomeration effects in the direct and indirect effects equilibrium X_{die}. The idea is that we allow the counterfactual policy change to move workers across prefectures and regions. Still, we assume the agglomeration component $(D_{ju})^{\gamma}$ in equation (12) to be the same as X_{ini}. Alternatively, we solve the counterfactual policy change with the agglomeration elasticity $\gamma = 0$ to generate the equilibrium X_{die}.

Finally, we could calculate the percentage changes of specific variable $x \in X$ in the direct, indirect, and agglomeration effects following the chain rule:

$$\underbrace{\frac{x_{fin} - x_{ini}}{x_{ini}}}_{total} = \underbrace{\frac{x_{de} - x_{ini}}{x_{ini}}}_{direct} + \underbrace{\frac{x_{die} - x_{de}}{x_{ini}}}_{indirect} + \underbrace{\frac{x_{fin} - x_{die}}{x_{ini}}}_{agglomeration} \tag{A37}$$

C.6 Spatial Effects on Economic Development

Table C3: Spatial Effects on Economic Development (Regional Transfer)

Regions (loc., dev.)	No. of prefectures	Δ Productivity $\widehat{2005}$	Δ Productivity $\widehat{2010}$	Δ Urban Output $\widehat{2005}$	Δ Urban Output $\widehat{2010}$	Δ Rural Output $\widehat{2005}$	Δ Rural Output $\widehat{2010}$	Δ Urban Pop. $\widehat{2005}$	Δ Urban Pop. $\widehat{2010}$	Δ House Price $\widehat{2005}$	Δ House Price $\widehat{2010}$
National	225	1.4%	1.6%	1.8%	1.6%	-0.9%	-0.6%	0.4%	0.3%	-3.9%	-7.5%
(east, high)	21	1.6%	4.6%	6.8%	14.7%	-0.7%	1.6%	5.6%	11.1%	-18.5%	-34.2%
(east, mid)	51	-0.3%	-2.0%	-1.4%	-5.0%	0.0%	0.9%	-1.3%	-3.6%	0.8%	11.1%
(east, low)	25	0.0%	-1.5%	-1.6%	-4.8%	-0.9%	-2.6%	-1.7%	-3.2%	-4.2%	2.6%
(inland, high)	2	-0.2%	-2.6%	0.0%	-3.6%	0.0%	2.1%	-0.1%	-1.2%	1.5%	18.2%
(inland, mid)	50	-1.0%	-4.9%	-3.1%	-11.8%	-0.4%	-1.0%	-2.4%	-7.8%	1.1%	9.4%
(inland, low)	76	-0.3%	-2.7%	-2.0%	-6.7%	-0.9%	-1.6%	-1.9%	-4.9%	-4.1%	-1.6%

Notes: This table displays a summary of changes in core economic development variables by prefecture group (weighted by population) in 2005 and 2010. All numbers are relative changes from the observed data to the counterfactual results without the inland-favoring policy. For each variable, we show the changes 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.

Table C4: Spatial Effects on Economic Development (Regional Transfer with Simple Rule)

Regions (loc., dev.)	No. of prefectures	Δ Productivity $\widehat{2005}$	Δ Productivity $\widehat{2010}$	Δ Urban Output $\widehat{2005}$	Δ Urban Output $\widehat{2010}$	Δ Rural Output $\widehat{2005}$	Δ Rural Output $\widehat{2010}$	Δ Urban Pop. $\widehat{2005}$	Δ Urban Pop. $\widehat{2010}$	Δ House Price $\widehat{2005}$	Δ House Price $\widehat{2010}$
National	225	1.5%	1.6%	2.4%	1.6%	-1.4%	0.0%	0.8%	0.0%	-3.5%	-7.8%
(east, high)	21	1.6%	4.7%	7.2%	13.9%	-0.7%	0.4%	6.2%	10.2%	-18.1%	-34.6%
(east, mid)	51	-0.2%	-1.9%	-0.7%	-5.0%	-0.4%	0.9%	-0.9%	-3.8%	1.1%	11.0%
(east, low)	25	0.1%	-1.5%	-1.2%	-4.8%	-1.4%	-2.2%	-1.1%	-3.2%	-3.7%	2.7%
(inland, high)	2	-0.2%	-2.5%	0.0%	-3.6%	0.0%	2.1%	0.0%	-1.3%	1.6%	18.2%
(inland, mid)	50	-1.0%	-4.9%	-2.7%	-12.2%	-0.8%	-0.1%	-2.2%	-8.1%	1.4%	9.1%
(inland, low)	76	-0.2%	-2.7%	-1.7%	-6.7%	-1.6%	-0.8%	-1.6%	-5.1%	-3.7%	-1.7%

Notes: This table displays a summary of changes in core economic development variables by prefecture group (weighted by population) in 2005 and 2010. All numbers are relative changes from the observed data to the counterfactual results without the inland-favoring policy. For each variable, we show the changes 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.

C.7 Spatial Effects on Migration

Table C5: Spatial Effects on Migration in 2005 (Without Transfer)

Regions (loc., dev.)	No. of Cities	Urban Pop. High-skill	Urban Pop. Low-skill	Rural Pop. High-skill	Rural Pop. Low-skill
National	225	0.0%	1.5%	-1.2%	-1.8%
(east, high)	21	2.1%	7.8%	-0.3%	-0.1%
(east, mid)	51	-0.9%	-0.5%	-1.4%	-0.8%
(east, low)	25	-0.5%	-0.7%	-2.3%	-1.3%
(inland, high)	2	-0.1%	0.1%	-0.2%	0.1%
(inland, mid)	50	-1.6%	-1.7%	-1.4%	-1.7%
(inland, low)	76	-1.1%	-1.7%	-0.8%	-2.1%

Notes: This table displays a summary of economic development variables by city group (weighted by population) in 2005. Regions are classified by the location of the city (east or inland) and the level of development (GDP per capita) in 2005, consistently as in Table 5.

Table C6: Spatial Effects on Migration in 2010 (Without Transfer)

Regions (loc., dev.)	No. of Cities	Urban Pop. High-skill	Urban Pop. Low-skill	Rural Pop. High-skill	Rural Pop. Low-skill
National	225	0.0%	1.8%	-1.4%	-2.2%
(east, high)	21	8.6%	14.9%	5.3%	2.9%
(east, mid)	51	-2.5%	-2.9%	-1.8%	-0.8%
(east, low)	25	-3.6%	-3.0%	-0.8%	-2.2%
(inland, high)	2	-1.0%	-1.0%	3.4%	1.8%
(inland, mid)	50	-6.3%	-7.5%	-2.4%	-3.1%
(inland, low)	76	-3.1%	-5.0%	-2.5%	-3.8%

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

Table C7: Spatial Effects on Migration in 2005 (Regional Transfer)

Regions (loc., dev.)	No. of Cities	Urban Pop. High-skill	Urban Pop. Low-skill	Rural Pop. High-skill	Rural Pop. Low-skill
National	225	0.0%	0.5%	-3.6%	-0.9%
(east, high)	21	2.8%	6.2%	-5.8%	-1.0%
(east, mid)	51	-0.9%	-1.4%	-8.3%	-0.2%
(east, low)	25	-1.3%	-2.0%	-3.7%	-0.8%
(inland, high)	2	-0.1%	-0.1%	-0.2%	0.0%
(inland, mid)	50	-1.8%	-2.4%	-1.1%	-0.6%
(inland, low)	76	-1.6%	-2.0%	-0.9%	-0.9%

Notes: This table displays a summary of economic development variables by city group (weighted by population) in 2005. Regions are classified by the location of the city (east or inland) and the level of development (GDP per capita) in 2005, consistently, as in Table 5.

Table C8: Spatial Effects on Migration in 2010 (Regional Transfer)

Regions (loc., dev.)	No. of Cities	Urban Pop. High-skill	Urban Pop. Low-skill	Rural Pop. High-skill	Rural Pop. Low-skill
National	225	-0.2%	0.4%	2.8%	-0.5%
(east, high)	21	8.6%	12.4%	2.7%	1.5%
(east, mid)	51	-2.5%	-3.8%	3.3%	1.0%
(east, low)	25	-4.1%	-3.0%	4.1%	-0.7%
(inland, high)	2	-1.3%	-1.2%	6.0%	1.9%
(inland, mid)	50	-6.3%	-8.2%	2.2%	-0.5%
(inland, low)	76	-3.2%	-5.2%	2.5%	-1.6%

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

Table C9: Spatial Effects on Migration in 2005 (Regional Transfer with Simple Rule)

Regions (loc., dev.)	No. of Cities	Urban Pop. High-skill	Urban Pop. Low-skill	Rural Pop. High-skill	Rural Pop. Low-skill
National	225	0.0%	1.0%	-4.6%	-1.4%
(east, high)	21	2.8%	7.0%	-4.7%	-0.8%
(east, mid)	51	-0.9%	-0.8%	-7.2%	-0.8%
(east, low)	25	-1.1%	-1.3%	-7.4%	-1.3%
(inland, high)	2	-0.2%	0.0%	-2.0%	0.1%
(inland, mid)	50	-1.6%	-2.1%	-3.2%	-1.3%
(inland, low)	76	-1.5%	-1.7%	-2.1%	-1.5%

Notes: This table displays a summary of economic development variables by city group (weighted by population) in 2005. Regions are classified by the location of the city (east or inland) and the level of development (GDP per capita) in 2005, consistently, as in Table 5.

Table C10: Spatial Effects on Migration in 2010 (Regional Transfer with Simple Rule)

Regions (loc., dev.)	No. of Cities	Urban Pop. High-skill	Urban Pop. Low-skill	Rural Pop. High-skill	Rural Pop. Low-skill
National	225	0.0%	0.0%	1.3%	0.0%
(east, high)	21	9.1%	11.4%	2.1%	0.7%
(east, mid)	51	-3.1%	-3.9%	0.6%	1.5%
(east, low)	25	-4.3%	-3.0%	0.6%	-0.7%
(inland, high)	2	-1.3%	-1.2%	3.2%	2.0%
(inland, mid)	50	-7.0%	-8.4%	1.6%	0.5%
(inland, low)	76	-3.6%	-5.2%	1.6%	-0.9%

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

C.8 Spatial Effects on Income and Welfare

Table C11: Spatial Effects on Income (Without Transfer)

Regions (loc., dev.)	No. of Cities	Δ Total Income $\widehat{2005}$	Δ Total Income $\widehat{2010}$	Δ Wage Income $\widehat{2005}$	Δ Wage Income $\widehat{2010}$	Δ Land Income $\widehat{2005}$	Δ Land Income $\widehat{2010}$
National	225	1.3%	1.5%	1.3%	1.5%	1.3%	1.5%
(east, high)	21	2.5%	6.8%	0.2%	0.4%	7.0%	15.9%
(east, mid)	51	0.3%	-0.2%	0.5%	0.7%	-0.6%	-3.1%
(east, low)	25	1.0%	1.6%	1.5%	2.8%	-1.2%	-4.1%
(inland, high)	2	0.0%	-1.6%	0.0%	-1.6%	0.0%	-1.6%
(inland, mid)	50	0.8%	-1.0%	1.6%	1.1%	-2.0%	-8.8%
(inland, low)	76	2.0%	1.6%	2.8%	2.8%	-1.7%	-5.1%

Table C12: Spatial Effects on Income (Regional Transfer)

Regions (loc., dev.)	No. of Cities	Δ Total Income $\widehat{2005}$	Δ Total Income $\widehat{2010}$	Δ Wage Income $\widehat{2005}$	Δ Wage Income $\widehat{2010}$	Δ Land Income $\widehat{2005}$	Δ Land Income $\widehat{2010}$
National	225	2.8%	2.7%	1.0%	1.0%	9.0%	8.3%
(east, high)	21	-10.1%	-11.1%	0.3%	0.7%	-30.4%	-27.9%
(east, mid)	51	0.5%	4.5%	0.3%	0.1%	0.8%	19.8%
(east, low)	25	0.6%	5.7%	1.6%	2.4%	-3.6%	21.7%
(inland, high)	2	2.1%	4.9%	0.0%	-1.7%	9.2%	25.5%
(inland, mid)	50	18.5%	6.2%	0.9%	0.3%	88.5%	28.6%
(inland, low)	76	6.0%	6.3%	2.1%	2.1%	24.5%	30.9%

Table C13: Spatial Effects on Income (Regional Transfer with Simple Rule)

Regions (loc., dev.)	No. of Cities	Δ Total Income $\widehat{2005}$	Δ Total Income $\widehat{2010}$	Δ Wage Income $\widehat{2005}$	Δ Wage Income $\widehat{2010}$	Δ Land Income $\widehat{2005}$	Δ Land Income $\widehat{2010}$
National	225	0.6%	1.2%	1.2%	0.8%	-1.2%	2.7%
(east, high)	21	-7.0%	-14.5%	0.3%	0.5%	-21.1%	-35.7%
(east, mid)	51	-2.1%	1.3%	0.5%	0.0%	-11.4%	5.8%
(east, low)	25	-0.9%	5.7%	1.7%	2.4%	-11.8%	21.2%
(inland, high)	2	-1.3%	-2.3%	0.0%	-1.6%	-5.9%	-4.3%
(inland, mid)	50	11.3%	6.6%	1.2%	0.1%	51.8%	31.1%
(inland, low)	76	3.1%	6.4%	2.4%	1.9%	6.5%	32.8%

Table C14: Spatial Effects on Welfare

Regions (loc., dev.)	No. of Cities	Without Transfer (Year 2005)				
		Welfare	(Urban, High)	(Urban, Low)	(Rural, High)	(Rural, Low)
National	225	3.9%	2.1%	1.4%	4.6%	0.8%
(east, high)	21	10.4%	6.7%	6.2%	15.5%	2.2%
(east, mid)	51	-0.2%	-0.7%	-0.7%	-0.2%	-0.6%
(east, low)	25	-1.7%	0.8%	0.8%	-2.6%	1.2%
(inland, high)	2	-0.3%	-0.3%	-0.2%	0.0%	-0.7%
(inland, mid)	50	-0.2%	-2.3%	-2.0%	0.4%	-2.3%
(inland, low)	76	2.5%	-0.1%	0.7%	3.1%	0.6%

Notes: This table displays a summary of welfare by city group (summations within the group) in 2005. Regions are classified by the location of the prefecture/city (east or inland) and the level of development (GDP per capita) in 2005, consistently as in Table 5.

Table C15: Spatial Effects on Welfare

Regions (loc., dev.)	No. of Cities	Without Transfer (Year 2010)				
		Welfare	(Urban, High)	(Urban, Low)	(Rural, High)	(Rural, Low)
National	225	4.7%	3.1%	0.0%	7.9%	4.5%
(east, high)	21	8.8%	18.3%	15.6%	17.0%	6.9%
(east, mid)	51	-4.0%	-4.5%	-5.6%	-3.3%	-3.5%
(east, low)	25	1.1%	-2.7%	-2.1%	6.9%	1.0%
(inland, high)	2	-5.2%	-5.7%	-6.8%	-5.4%	-4.5%
(inland, mid)	50	-5.2%	-10.2%	-9.1%	-5.0%	-3.3%
(inland, low)	76	-3.5%	-4.7%	-3.8%	-9.3%	-0.5%

Notes: This table displays a summary of welfare by city group (summations within the group) in 2010. Regions are classified by the location of the prefecture/city (east or inland) and the level of development (GDP per capita) in 2005, consistently as in Table 5.

Table C16: Spatial Effects on Welfare

Regions (loc., dev.)	No. of Cities	Welfare	Regional Transfer (Year 2005) (Urban, High)	(Urban, Low)	(Rural, High)	(Rural, Low)
National	225	4.5%	-10.0%	-8.5%	5.8%	4.9%
(east, high)	21	7.5%	-17.9%	-16.1%	14.5%	0.4%
(east, mid)	51	1.0%	-4.0%	-4.0%	1.2%	2.8%
(east, low)	25	1.8%	-7.1%	-8.6%	1.8%	5.7%
(inland, high)	2	1.9%	-0.3%	-0.3%	1.6%	2.6%
(inland, mid)	50	5.2%	-4.6%	-5.3%	2.9%	21.9%
(inland, low)	76	4.7%	-6.6%	-7.3%	4.7%	8.0%

Notes: This table displays a summary of welfare by city group (summations within the group) in 2005. Regions are classified by the location of the prefecture/city (east or inland) and the level of development (GDP per capita) in 2005, consistently as in Table 5.

Table C17: Spatial Effects on Welfare

Regions (loc., dev.)	No. of Cities	Welfare	Regional Transfer (Year 2010) (Urban, High)	(Urban, Low)	(Rural, High)	(Rural, Low)
National	225	3.7%	-14.0%	-11.3%	6.3%	5.6%
(east, high)	21	4.2%	-25.1%	-22.9%	9.5%	5.0%
(east, mid)	51	1.7%	-6.9%	-7.1%	0.8%	5.6%
(east, low)	25	5.6%	-5.9%	-6.1%	7.3%	9.5%
(inland, high)	2	2.0%	-4.6%	-5.4%	2.2%	6.4%
(inland, mid)	50	3.1%	-8.3%	-7.8%	4.0%	8.1%
(inland, low)	76	3.2%	-6.8%	-6.8%	0.0%	7.2%

Notes: This table displays a summary of welfare by city group (summations within the group) in 2010. Regions are classified by the location of the prefecture/city (east or inland) and the level of development (GDP per capita) in 2005, consistently as in Table 5.

Table C18: Spatial Effects on Welfare

Regions (loc., dev.)	No. of Cities	Regional Transfer with Simple Rule (Year 2005)				
		Welfare	(Urban, High)	(Urban, Low)	(Rural, High)	(Rural, Low)
National	225	2.8%	-8.8%	-8.8%	4.5%	0.9%
(east, high)	21	4.7%	-12.1%	-12.4%	11.3%	-3.1%
(east, mid)	51	0.7%	-8.0%	-8.6%	1.4%	1.7%
(east, low)	25	0.8%	-5.6%	-6.9%	1.4%	1.6%
(inland, high)	2	-1.3%	-7.4%	-7.9%	0.7%	0.7%
(inland, mid)	50	3.2%	-5.5%	-6.0%	2.2%	12.3%
(inland, low)	76	2.7%	-5.7%	-6.6%	3.1%	3.4%

Notes: This table displays a summary of welfare by city group (summations within the group) in 2005. Regions are classified by the location of the prefecture/city (east or inland) and the level of development (GDP per capita) in 2005, consistently as in Table 5.

Table C19: Spatial Effects on Welfare

Regions (loc., dev.)	No. of Cities	Regional Transfer with Simple Rule (Year 2010)				
		Welfare	(Urban, High)	(Urban, Low)	(Rural, High)	(Rural, Low)
National	225	2.9%	-20.9%	-20.8%	8.3%	5.2%
(east, high)	21	2.0%	-28.5%	-31.0%	7.2%	3.1%
(east, mid)	51	0.4%	-18.0%	-20.0%	2.5%	8.6%
(east, low)	25	6.8%	-12.2%	-13.7%	6.5%	14.4%
(inland, high)	2	-3.7%	-16.1%	-18.7%	1.3%	4.5%
(inland, mid)	50	5.1%	-15.4%	-15.9%	6.0%	14.6%
(inland, low)	76	7.6%	-14.7%	-15.0%	13.0%	10.4%

Notes: This table displays a summary of welfare by city group (summations within the group) in 2010. Regions are classified by the location of the prefecture/city (east or inland) and the level of development (GDP per capita) in 2005, consistently as in Table 5.

C.9 Spatial Effects on Productivity Decomposition

We decompose the spatial effects on productivity 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. Table C20 reports the spatial decomposition of productivity. For land-gaining regions, 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 in the most developed regions. Finally, agglomeration effects are also significant: although smaller than the indirect effect in the most developed areas, they are of sizable magnitude. For land-losing regions, the main effect comes from the direct channel.

Table C20: Spatial Effects on Productivity Decomposition

Regions (loc., dev.)	No. of Cities	$\widehat{2005}$ Total	Direct	Indirect	Agglom.	$\widehat{2010}$ Total	Direct	Indirect	Agglom.
National	225	1.6%	0.1%	1.0%	0.4%	2.0%	-1.3%	2.6%	0.6%
(east, high)	21	1.6%	0.2%	1.2%	0.2%	4.8%	1.0%	2.8%	1.0%
(east, mid)	51	-0.2%	-0.3%	0.1%	0.0%	-1.8%	-2.5%	0.8%	-0.1%
(east, low)	25	0.2%	0.3%	-0.1%	-0.1%	-1.4%	-1.5%	0.4%	-0.2%
(inland, high)	2	-0.2%	-0.2%	-0.1%	0.1%	-2.4%	-2.4%	-0.1%	0.2%
(inland, mid)	50	-0.8%	-1.3%	0.6%	-0.1%	-4.7%	-4.1%	-0.3%	-0.4%
(inland, low)	76	-0.2%	-0.4%	0.5%	-0.2%	-2.6%	-2.3%	0.3%	-0.5%

Notes: This table displays a summary of changes in spatial productivity measures by city group (summations within the group) in 2010. Regions are classified by the location of the prefecture/city (east or inland) and the level of development (GDP per capita) in 2005, consistently as in Table 5.

C.10 Selected Aggregate Results Regarding the Sensitivity Checks

Table C21: Selected Aggregate Results Regarding the Sensitivity Checks

Year	Δ Productivity	Δ Total Output	Δ Urban Output	Δ Rural Output	Δ Urban Pop.	Δ House Price	Δ Income	Δ Welfare
	[1] Low Migration Elasticity ($\epsilon = 1$)							
2005	0.82%	0.83%	1.59%	-0.45%	0.42%	-4.26%	0.78%	1.75%
2010	0.35%	0.61%	0.78%	-0.82%	0.59%	-8.03%	0.48%	1.03%
	[2] High Elasticity of Substitution between H/L-skills ($\sigma = 4$)							
2005	1.57%	1.37%	2.76%	-0.91%	1.26%	-3.19%	1.34%	3.30%
2010	1.99%	1.21%	3.13%	-1.66%	1.17%	-6.51%	1.51%	5.84%
	[3] No Agglomeration Effects ($\gamma = 0$)							
2005	3.5%	1.0%	2.0%	-1.4%	1.3%	-3.8%	0.9%	3.4%
2010	5.0%	0.6%	2.3%	-1.7%	1.2%	-7.3%	0.9%	3.5%
	[4] Purged Wage Data Input following Fajgelbaum and Gaubert (2020)							
2005	2.06%	2.15%	3.51%	-1.39%	1.26%	-4.13%	1.91%	3.59%
2010	2.55%	1.85%	3.17%	-2.21%	1.47%	-10.64%	2.09%	4.23%
	[5] Counterfactual Allocations Using the Pre-2003 Prefecture-level GDP Growth Rate							
2005	2.42%	1.48%	4.57%	-0.73%	1.07%	-1.88%	1.35%	0.93%
2010	2.80%	1.98%	4.50%	-1.15%	1.53%	-3.08%	1.44%	1.62%
	[6] Counterfactual Allocations Using the Pre-2003 Prefecture-level Migration Inflow Growth Rate							
2005	1.16%	1.10%	1.97%	-1.36%	1.26%	-5.82%	0.97%	2.80%
2010	0.40%	0.61%	0.78%	-1.66%	1.18%	-10.32%	0.18%	2.06%
	[7] Partially Elastic Floor Space Supply							
2005	1.69%	1.64%	2.94%	-1.36%	1.26%	-3.65%	1.43%	3.74%
2010	2.28%	1.81%	3.08%	-2.23%	1.46%	-8.12%	1.75%	6.42%
	[8] Congestion Effects Besides Floor Space Constraints							
2005	1.53%	1.51%	2.56%	-1.36%	1.26%	-3.22%	1.32%	3.74%
2010	1.88%	1.83%	3.13%	-1.93%	1.47%	-6.56%	1.46%	5.84%

Below are detailed equations of checks [7] and [8]:

[7] Partially elastic floor space supply to population density:

$$\phi_{ju} = \bar{\phi}_{ju} \times (D_{ju})^{\gamma_\phi} \tag{A38}$$

where D_{ju} is the same urban density definition as in the agglomeration equation, and γ_ϕ is the elasticity. We try a range of γ_ϕ up to 0.10, and the effects of removing the inland-favoring distortions get stronger with larger γ_ϕ.

[8] Congestion effects besides floor space constraints to population density:

$$\tau^s_{in,ju} = \bar{\tau}^s_{in,ju} \times (D_{ju})^{\gamma_\tau} \tag{A39}$$

where D_{ju} is the same urban density definition as in the agglomeration equation, and γ_τ is the elasticity. We try a range of γ_τ up to 0.15 as in Allen and Donaldson (2020).

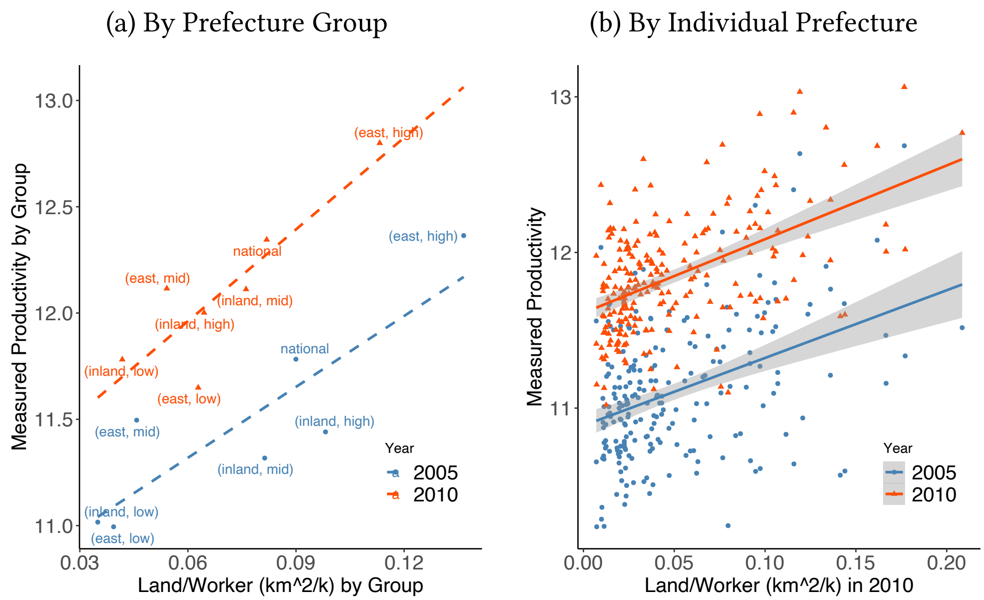
D Supplements to Constrained Optimal Land Allocation

D.1 Main Results of Constrained Optimal Land Allocation

We further explore the constrained optimal land allocation policy when *the total land supply must be maintained at a constant level*, given that the central government of China is very restrictive on the total amount of construction land available. In this counterfactual world, we make three assumptions. First, the central government distributes construction land supply to equalize the marginal product of land across all regions. Second, the distortion between residential and production floor space prices is eliminated. Third, the allocation policy never hits the natural limits of each area, which holds in the counterfactual equilibrium. These conditions are unattainable in practical terms. However, this counterfactual scenario is constructed to serve as a benchmark for the constrained-efficient land allocation. By comparing actual outcomes to this idealized baseline, we can quantify the overall magnitude of spatial misallocation within China's economy and how much the inland-favoring land policy contributed to it.

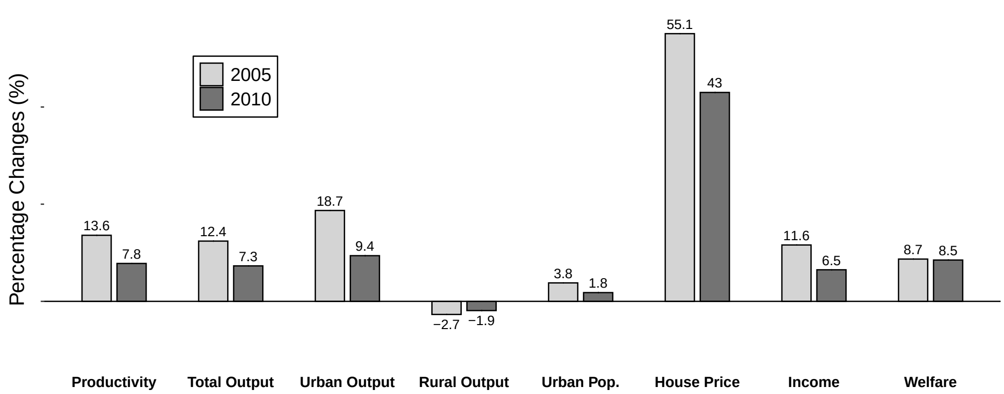
All Distributional Land Frictions There are three layers of land friction in the current equilibrium: national (total land quota friction), cross-prefecture, and within-prefecture (distributional land frictions). Natural limits and national food security concerns constrain national construction land supply through the total land quota, which we will discuss in the next section. National security needs primarily include food security, also known as the "Farmland Red Line," which has been well-studied in Yu (2019). The central government of China is very restrictive on the total amount of construction land available. Here, we focus on the cross-prefecture and within-prefecture distortions to show the constrained optimal allocations. Given all other frictions are fixed, cross-prefecture distortions exist as long as $S_{ju} \neq S_{ju}^{opt}$ for any prefecture ju, where S_{ju}^{opt} denotes the optimal allocation and $\sum S_{ju} = \sum S_{ju}^{opt}$. Meanwhile, within-prefecture distortions exist as long as $\eta_j \neq 1$, indicating that the marginal returns to residential and production floor space are unequal. Additional results of land distribution are listed below in Section D.2.

Figure D1: Constrained Optimal Correlation between Productivity and Land Tightness



Notes: This figure plots the correlation between productivity and land tightness in the model with optimal policy. Plot (a) shows the correlation by prefecture group as in the tables above. Plot (b) shows the correlation by individual prefecture. Plot (b) excludes six extreme values for visual clarity; please refer to Appendix D for the plot with the whole sample. The correlation is stronger when the extreme values are included. The optimal policy reverses the negative correlations between productivity and land per thousand workers in Table 4 and distributes more land to more productive prefectures.

Figure D2: Aggregate Effects of Constrained Optimal Land Allocation



Notes: This figure shows the aggregate effects of the constrained optimal land allocation policy on the Chinese economy in 2005 and 2010. Grey columns represent changes in 2005. Black columns represent changes in 2010. In both years, we find substantial changes in national productivity, total output, urban output, urban population, house prices, incomes, and welfare.

Production Optimal Policy Given these definitions of land frictions, we derive an optimal national productivity policy based on the national total construction land supply. Optimality requires no cross-prefecture distortions in production demand and no within-prefecture distortions between production and residential demands, that is (1) $\partial Y_{ju}/\partial S_{ju}^M = \partial Y_{iu}/\partial S_{iu}^M$, ($q_{ju} = q_{iu}$), for any i, j, and (2) $\eta_j = 1$, ($q_{ju} = Q_{ju}$), for any j. Indeed, these optimal conditions are rarely met in reality. However, it serves as a helpful baseline for efficient allocation comparison.

Constrained Optimal Results We show how far the current equilibrium allocation is from the hypothetical optimal allocation. We focus on two results: (1) the relationship between land tightness and productivity, and (2) the aggregate effects. Additional results are in Appendix D. We first show the correlation between productivity and land tightness in Figure D1. This optimal policy scenario yields two notable observations. First, a pronounced positive correlation emerges between productivity and land tightness, starkly contrasting with the strong negative relationship observed under the current equilibrium. This suggests that more developed eastern prefectures exhibit higher productivity with less stringent land constraints. Second, as productivity generally improves over time, land tightness is slightly alleviated. We then delve into the aggregate outcomes in Figure D2. Eliminating all land frictions results in substantial productivity, urban output, income, and welfare gains. Productivity in 2005 and 2010 increased by 13.6% and 7.8%, respectively, while total output rose by 12.4% and 7.3%. The minor improvement in 2010 suggests a reduction in frictions over time, likely attributable to economic reforms (Tombe and Zhu, 2019). The welfare effects are not that large since the policy does not target national welfare maximization but production maximization.

D.2 Land Distribution Across Prefectures

Table D1: Constrained Optimal Counterfactual Land Allocation (km^2)

Regions (loc., dev.)	No. of Cities	Reality 2005	Reality 2010	Counterfactual $\widehat{2005}$	Counterfactual $\widehat{2010}$
National	225	22268	28336	22268	28336
(east, high)	21	5838	7272	15270	16531
(east, mid)	51	5875	7832	2794	4447
(east, low)	25	1418	1681	550	797
(inland, high)	2	169	206	120	89
(inland, mid)	50	5131	6578	2554	4714
(inland, low)	76	3837	4767	980	1758

Notes: 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: km. Regions are classified by prefecture location (east or inland) and the level of development (GDP per capita) in 2005, as in Table 5.

Table D2: Constrained Optimal Spatial Distribution of Land Tightness

Regions (loc., dev.)	No. of Cities	Reality 2005	Reality 2010	Counterfactual $\widehat{2005}$	Counterfactual $\widehat{2010}$
National	225	0.093	0.083	0.090	0.082
(east, high)	21	0.077	0.068	0.137	0.113
(east, mid)	51	0.084	0.082	0.046	0.054
(east, low)	25	0.080	0.108	0.039	0.063
(inland, high)	2	0.127	0.130	0.098	0.064
(inland, mid)	50	0.140	0.101	0.081	0.076
(inland, low)	76	0.104	0.086	0.035	0.042

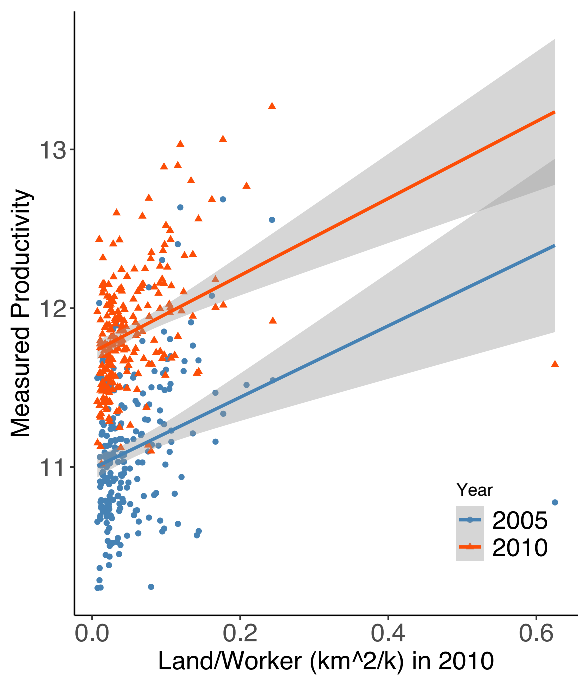
Notes: This table displays a summary of urban land supply relative to workers by city group (weighted by urban population) as well as the counterfactual migration-based land supply in 2005 and 2010 (unit: km^2/k). Regions are classified by the location of the city (east or inland) and the level of development (GDP per capita) in 2005, consistently as in Table 5.

Table D3: Changes in Constrained Optimal Land Allocation

Regions (loc., dev.)	No. of Cities	Changes 2005	2010
National	225	0%	0%
(east, high)	21	162%	127%
(east, mid)	51	-52%	-43%
(east, low)	25	-61%	-53%
(inland, high)	2	-29%	-57%
(inland, mid)	50	-50%	-28%
(inland, low)	76	-74%	-63%

Notes: This table displays changes in counterfactual total urban land supply by group (summations within the group) in 2005 and 2010. Regions are classified by the location of the city (east or inland) and the level of development (GDP per capita) in 2005, consistently as in Table 5.

Figure D3: Correlation between Productivity and Land Tightness By Individual Prefecture of Constrained Optimal Land Allocation (Including Extreme Values)



Notes: This figure plots the correlation between productivity and land abundance in the model at the prefecture level, including the extreme values omitted in the main paper.

D.3 Spatial Effects on Economic Development

Table D4: Spatial Effects on Economic Development in 2005

Regions (loc., dev.)	No. of Cities	Constrained Optimal Land Allocation				
		Δ Total Output	Δ Urban Output	Δ Rural Output	Δ Urban Pop.	Δ House Price
National	225	13.6%	18.7%	-2.7%	3.8%	55.1%
(east, high)	21	25.1%	74.8%	5.3%	48.3%	-21.3%
(east, mid)	51	-12.2%	-21.7%	2.3%	-12.5%	102.2%
(east, low)	25	-18.3%	-32.3%	-2.4%	-20.5%	121.5%
(inland, high)	2	-7.4%	-12.7%	3.3%	-7.9%	86.3%
(inland, mid)	50	-9.6%	-21.1%	-3.6%	-14.7%	106.3%
(inland, low)	76	-15.1%	-33.6%	-7.3%	-24.3%	153.5%

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

Table D5: Spatial Effects on Economic Development in 2010

Regions (loc., dev.)	No. of Cities	Constrained Optimal Land Allocation				
		Δ Total Output	Δ Urban Output	Δ Rural Output	Δ Urban Pop.	Δ House Price
National	225	7.8%	9.4%	-1.9%	1.8%	43.0%
(east, high)	21	17.9%	53.0%	11.8%	35.2%	-6.7%
(east, mid)	51	-10.2%	-20.5%	1.8%	-13.9%	70.0%
(east, low)	25	-12.9%	-26.8%	-4.3%	-18.1%	122.6%
(inland, high)	2	-13.2%	-23.5%	2.9%	-13.3%	59.4%
(inland, mid)	50	-3.0%	-7.7%	-3.6%	-5.1%	52.0%
(inland, low)	76	-14.0%	-32.5%	-7.2%	-23.7%	108.5%

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

D.4 Spatial Effects on Migration

Table D6: Constrained Optimal Land Allocation: Spatial Effects on Migration in 2005

Regions (loc., dev.)	No. of Cities	Urban Pop. High-skill	Urban Pop. Low-skill	Rural Pop. High-skill	Rural Pop. Low-skill
National	225	0.0%	4.6%	-12.2%	-4.5%
(east, high)	21	33.3%	51.5%	-0.6%	4.0%
(east, mid)	51	-13.4%	-12.2%	-9.6%	0.4%
(east, low)	25	-19.6%	-21.2%	-17.7%	-2.5%
(inland, high)	2	-4.1%	-8.8%	12.6%	3.3%
(inland, mid)	50	-15.6%	-14.3%	-21.4%	-4.9%
(inland, low)	76	-21.1%	-25.1%	-9.7%	-8.5%

Notes: This table displays a summary of economic development variables by city group (weighted by population) in 2005. Regions are classified by the location of the city (east or inland) and the level of development (GDP per capita) in 2005, consistently as in Table 5.

Table D7: Constrained Optimal Land Allocation: Spatial Effects on Migration in 2010

Regions (loc., dev.)	No. of Cities	Urban Pop. High-skill	Urban Pop. Low-skill	Rural Pop. High-skill	Rural Pop. Low-skill
National	225	0.2%	2.2%	-11.4%	-3.3%
(east, high)	21	28.9%	37.7%	12.7%	11.0%
(east, mid)	51	-13.6%	-13.9%	-9.5%	1.5%
(east, low)	25	-20.0%	-17.4%	-14.0%	-2.9%
(inland, high)	2	-15.1%	-12.8%	-3.5%	3.1%
(inland, mid)	50	-5.6%	-4.7%	-13.4%	-3.8%
(inland, low)	76	-22.6%	-24.0%	-18.9%	-7.9%

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

D.5 Spatial Effects on Income and Welfare

Table D8: Constrained Optimal Land Allocation: Spatial Effects on Income

Regions (loc., dev.)	No. of Cities	Δ Total Income 2005	Δ Total Income 2010	Δ Wage Income 2005	Δ Wage Income 2010	Δ House Income 2005	Δ House Income 2010
National	225	11.6%	6.5%	11.6%	6.5%	11.8%	6.6%
(east, high)	21	32.3%	25.4%	13.1%	7.2%	69.7%	51.0%
(east, mid)	51	-0.9%	-1.3%	2.8%	2.5%	-14.1%	-14.5%
(east, low)	25	7.0%	4.7%	13.0%	9.5%	-17.8%	-18.1%
(inland, high)	2	-1.8%	-5.3%	-1.3%	-2.1%	-3.3%	-15.2%
(inland, mid)	50	7.1%	3.6%	12.2%	6.3%	-13.2%	-6.5%
(inland, low)	76	13.0%	5.1%	19.3%	9.5%	-17.2%	-20.5%

Notes: This table displays a summary of income by city group (summations within the group) in 2005 and 2010. Regions are classified by the location of the prefecture/city (east or inland) and the level of development (GDP per capita) in 2005, as in Table 5.

Table D9: Constrained Optimal Land Allocation: Spatial Effects on Welfare

Regions (loc., dev.)	No. of Cities	Welfare	(Urban, High)	(Urban, Low)	(Rural, High)	(Rural, Low)
				Year 2005		
National	225	8.7%	12.5%	-6.3%	7.9%	13.8%
(east, high)	21	32.5%	61.6%	41.6%	22.3%	46.7%
(east, mid)	51	-6.8%	-20.0%	-25.6%	-3.1%	-15.9%
(east, low)	25	1.2%	-22.9%	-25.3%	9.4%	-15.8%
(inland, high)	2	-16.9%	-18.8%	-15.8%	-10.4%	-17.0%
(inland, mid)	50	-1.2%	-13.9%	-24.0%	2.9%	-13.4%
(inland, low)	76	1.9%	-24.0%	-27.8%	8.4%	-14.8%
				Year 2010		
National	225	8.5%	9.4%	-9.0%	14.8%	8.5%
(east, high)	21	18.3%	46.8%	26.1%	22.7%	16.4%
(east, mid)	51	-15.2%	-13.5%	-21.6%	-9.5%	-14.6%
(east, low)	25	-12.0%	-17.6%	-23.3%	4.1%	-12.1%
(inland, high)	2	-15.8%	-18.0%	-22.4%	-7.1%	-13.6%
(inland, mid)	50	-9.8%	-6.8%	-15.5%	5.0%	-11.4%
(inland, low)	76	-9.5%	-21.6%	-26.8%	3.7%	-12.2%

Notes: This table displays a summary of welfare by city group (summations within the group) in 2005. Regions are classified by the location of the prefecture/city (east or inland) and the level of development (GDP per capita) in 2005, consistently as in Table 5.

E Supplements to Removing the Land Quota System

E.1 Spatial Effects on Economic Development

Table E1: Spatial Effects on Economic Development in 2005

Regions (loc., dev.)	No. of Cities	Removing the Land Quota System				
		Δ Total Output	Δ Urban Output	Δ Rural Output	Δ Urban Pop.	Δ House Price
National	225	3.9%	6.3%	-2.3%	2.1%	-13.2%
(east, high)	21	11.8%	12.6%	-2.0%	7.5%	-25.5%
(east, mid)	51	2.1%	4.3%	-1.9%	1.4%	-15.3%
(east, low)	25	-3.0%	-2.8%	-2.8%	-2.8%	-5.6%
(inland, high)	2	-0.5%	-0.7%	-0.3%	-1.0%	-1.2%
(inland, mid)	50	-1.8%	-1.7%	-1.9%	-2.2%	-4.1%
(inland, low)	76	-1.5%	0.2%	-2.2%	-1.1%	-11.4%

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

Table E2: Spatial Effects on Economic Development in 2010

Regions (loc., dev.)	No. of Cities	Removing the Land Quota System				
		Δ Total Output	Δ Urban Output	Δ Rural Output	Δ Urban Pop.	Δ House Price
National	225	7.9%	12.5%	-6.9%	4.1%	-34.4%
(east, high)	21	20.9%	22.1%	-3.7%	12.0%	-43.0%
(east, mid)	51	10.4%	15.8%	-5.5%	7.0%	-43.5%
(east, low)	25	-2.2%	0.7%	-7.4%	-3.2%	-30.0%
(inland, high)	2	-4.5%	-5.5%	-2.1%	-5.5%	-6.6%
(inland, mid)	50	-4.7%	-4.1%	-7.0%	-5.5%	-12.3%
(inland, low)	76	-5.2%	-2.5%	-8.8%	-4.7%	-19.2%

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

E.2 Spatial Effects on Migration

Table E3: Removing the Land Quota System: Spatial Effects on Migration in 2005

Regions (loc., dev.)	No. of Cities	Urban Pop. High-skill	Urban Pop. Low-skill	Rural Pop. High-skill	Rural Pop. Low-skill
National	225	0.0%	2.6%	-6.3%	-2.3%
(east, high)	21	4.3%	8.3%	-5.4%	-2.2%
(east, mid)	51	-0.9%	1.9%	-5.3%	-2.1%
(east, low)	25	-3.6%	-2.6%	-7.8%	-2.5%
(inland, high)	2	-1.4%	-0.9%	-1.4%	-0.2%
(inland, mid)	50	-3.0%	-1.7%	-7.8%	-2.1%
(inland, low)	76	-2.1%	-1.0%	-5.8%	-2.5%

Notes: This table displays a summary of economic development variables by city group (weighted by population) in 2005. Regions are classified by the location of the city (east or inland) and the level of development (GDP per capita) in 2005, consistently as in Table 5.

Table E4: Removing the Land Quota System: Spatial Effects on Migration in 2010

Regions (loc., dev.)	No. of Cities	Urban Pop. High-skill	Urban Pop. Low-skill	Rural Pop. High-skill	Rural Pop. Low-skill
National	225	0.2%	5.0%	-11.1%	-7.1%
(east, high)	21	6.1%	13.8%	-7.1%	-3.8%
(east, mid)	51	1.9%	8.0%	-11.1%	-5.5%
(east, low)	25	-6.3%	-3.0%	-14.3%	-6.6%
(inland, high)	2	-7.1%	-5.1%	-4.2%	-2.1%
(inland, mid)	50	-5.6%	-5.5%	-10.8%	-7.2%
(inland, low)	76	-4.5%	-4.8%	-12.1%	-9.3%

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

E.3 Spatial Effects on Income and Welfare

Table E5: Removing the Land Quota System: Spatial Effects on Income

Regions (loc., dev.)	No. of Cities	Δ Total Income $\widehat{2005}$	Δ Total Income $\widehat{2010}$	Δ Wage Income $\widehat{2005}$	Δ Wage Income $\widehat{2010}$	Δ House Income $\widehat{2005}$	Δ House Income $\widehat{2010}$
National	225	3.5%	7.4%	3.5%	7.4%	3.5%	7.4%
(east, high)	21	6.4%	13.3%	3.8%	7.9%	11.5%	20.8%
(east, mid)	51	2.7%	8.0%	2.9%	7.5%	2.2%	10.1%
(east, low)	25	2.9%	6.4%	4.4%	8.2%	-2.9%	-2.4%
(inland, high)	2	0.1%	0.6%	0.3%	2.2%	-0.5%	-4.5%
(inland, mid)	50	2.2%	3.6%	3.2%	5.8%	-1.7%	-4.9%
(inland, low)	76	3.1%	6.0%	4.1%	7.9%	-1.3%	-5.6%

Notes: This table displays a summary of income by city group (summations within the group) in 2005 and 2010. Regions are classified by the location of the prefecture/city (east or inland) and the level of development (GDP per capita) in 2005, as in Table 5.

Table E6: Removing the Land Quota System: Spatial Effects on Welfare

Regions (loc., dev.)	No. of Cities	Welfare	(Urban, High)	(Urban, Low)	(Rural, High)	(Rural, Low)
		Year 2005				
National	225	9.2%	10.0%	6.9%	9.2%	9.6%
(east, high)	21	12.9%	17.0%	12.4%	10.8%	16.4%
(east, mid)	51	8.3%	8.0%	7.3%	8.9%	5.4%
(east, low)	25	4.7%	3.0%	1.6%	5.6%	2.8%
(inland, high)	2	0.4%	0.9%	0.3%	2.0%	0.3%
(inland, mid)	50	6.4%	2.9%	1.3%	7.7%	1.9%
(inland, low)	76	8.3%	5.0%	4.6%	9.9%	3.3%
		Year 2010				
National	225	15.1%	21.4%	17.2%	17.2%	14.1%
(east, high)	21	16.5%	32.3%	30.1%	19.3%	15.1%
(east, mid)	51	20.5%	26.3%	24.1%	26.9%	17.7%
(east, low)	25	13.3%	14.2%	8.8%	23.2%	12.1%
(inland, high)	2	2.1%	3.7%	0.8%	5.4%	1.9%
(inland, mid)	50	5.8%	4.1%	2.9%	13.4%	5.7%
(inland, low)	76	8.8%	6.8%	6.5%	10.2%	8.6%

Notes: This table displays a summary of welfare by city group (summations within the group) in 2005. Regions are classified by the location of the prefecture/city (east or inland) and the level of development (GDP per capita) in 2005, consistently as in Table 5.

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