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Can the Difference of the Transfer Trice of Industrial Land "Bidding, Auctions and Listings" Promote the Transformation and Upgrading of Regional Industries?

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Abstract: The purpose of this study is to explore the impact of the difference in the transfer price of industrial land on the regional industrial transformation and upgrading under the "bid and auction" system. Research methods: panel data fixed effect model. Research results: Improving the differentiation of industrial land transfer price is conducive to regional industrial transformation and upgrading, and this conclusion has passed a variety of robustness tests. Research conclusions: First, formulate and improve the promotion of industrial land transfer price differentiation strategy. The second is to establish and improve the enterprise entry and exit mechanism to improve the efficiency of industrial land resource allocation. The third is to further improve the secondary market trading system of industrial land, and actively explore the circulation mechanism of stock industrial land to ensure the reasonable flow and efficient use of industrial land resources.

Keywords: Industrial Land; Transfer Price; Differentiation; Industrial Transformation and Upgrading.

1. Introduction

Industrial land serves as a fundamental spatial form for regional economic development and industrial transformation and upgrading, playing a crucial role in aggregating innovative resources, nurturing emerging industries, and propelling urban construction. Following the reform and opening-up, the central and local governments gradually shifted the evaluation criteria for officials to economic performance during their tenure, establishing a political promotion tournament primarily based on ranking key economic indicators [1]. Local government officials became more likely to be promoted with the improvement of local economic performance. Under China's unique land allocation system, local governments hold a special status as the owners, suppliers, and monopolists of state-owned construction land [2]. The non-market characteristics of land supply are very evident, and local governments have absolute power to intervene in and control the land market [3]. Consequently, by intervening in and controlling the land market, local governments attract corporate investment and stimulate economic growth through the low-priced allocation of industrial land, thereby increasing their chances of career advancement[4]. As rational economic agents, the more intense the inter-regional competition for investment, the more motivated local governments are to allocate the rights to use industrial land at extremely low prices[5], leading to a spiral decline in industrial land prices[6]. By controlling the allocation of land resources, local governments have achieved rapid economic growth in the short term, adopting a "development through land" model that has made China one of the fastest-growing economies in the world[7]. The extremely low prices of industrial land have attracted a large number of enterprises to invest in factories, not only increasing the current economic growth rate and expanding the economic scale but also creating job opportunities and cultivating local tax sources, making it a significant driving force behind China's distinctive industrialization.

However, this "development through land" model has also brought adverse effects on the high-quality economic development. On one hand, the local governments' practice of transferring industrial land at extremely low prices can easily lead to excessive investment by enterprises[8], which in turn results in overheating of investment and overcapacity, reducing the return on industrial investment and the stability of the macroeconomy, and exerting immense pressure on infrastructure and the local ecological environment[9]. This "competition at the bottom line of investment quality" solidifies the structure of mid-to-low-end industries and suppresses the diversified development of industries[3]. On the other hand, the distortion of industrial land prices caused by the low transfer of industrial land is the root cause that restricts the transfer of traditional industries and exacerbates the resurgence of capacity[10], lowering the domestic value-added and quality of exports of manufacturing enterprises[11], and is not conducive to enterprises improving green total factor productivity[12]. Low industrial land prices promote the agglomeration of low-quality industries and result in environmental pollution[13]. With the slowdown in the growth rate of urbanization in China, local governments have a stronger motivation to select the types of industries for land use[14], and their land supply practices are gradually shifting from "indiscriminate land supply" to "differentiated land supply", with the level of differentiation in the transfer prices of industrial land continuously increasing. Only by reasonably allocating land resources, especially industrial land, abandoning the "indiscriminate low-price land supply", can we address issues such as the shortage of land supply for emerging industries, the inefficient use of existing industrial land, and the financialization tendency of industrial land. This is of significant practical importance for adapting to the new stage of economic development, meeting the new requirements of national policies, and playing an important role of industrial land in the transformation and upgrading of industries, thereby accelerating the industrial transformation and upgrading.

Consequently, this study utilizes the data of industrial land transferred through bidding, auction, and listing methods from the China Land Market Network spanning from 2010 to 2019, employing a panel data fixed effects model to analyze the impact of differentiated prices in the transfer of industrial land on regional industrial transformation and upgrading. The research findings indicate that an increase in the level of differentiation in industrial land transfer prices is conducive to the transformation and upgrading of industries in a region, and this promotional effect is influenced by factors such as the level of regional economic development. The potential innovation of this study lies in its meticulous collection of land supply data from the China Land Market Network, focusing on the differentiation level of industrial land transfer prices from the perspective of government regulation. By constructing a discreteness indicator to describe the extent of differentiation, the study clearly analyzes the impact of differentiated industrial land transfer prices under the "bidding, auction, and listing" system on regional industrial transformation and upgrading, thereby enriching the research on industrial land prices.

2. Theoretical Analysis

Under the current land system, the land element is controlled by governments at various levels and serves as an important bargaining chip for local governments to attract investment and generate fiscal revenue [15]. Within the promotion mechanism that primarily assesses economic growth indicators, local governments intervene and control the land market to promote investment attraction in order to achieve rapid short-term economic growth. Since the secondary industry, represented by manufacturing, can promote employment and create a significant amount of GDP in the short term, manufacturing has become the main target for local governments to attract investment, and they have a strong motive to lower industrial land prices to attract investment [16]. Consequently, local governments continuously reduce the price of industrial land to attract investment, even to the point of offering it below cost or at zero price, leading to a severe undervaluation of industrial land prices. The "competition at the bottom line of investment quality" by local governments lowers the entry threshold for industrial enterprises. On one hand, this encourages enterprises to prefer obtaining more land resources, resulting in a large amount of land being idle and wasteful, reducing the efficiency of industrial land use and distorting the allocation of land resources. On the other hand, a significant amount of backward capacity that develops in an extensive manner is allowed to survive, delaying the proactive exit of outdated capacity from the market, reducing the enterprises' drive for innovation and updating of machinery and equipment, and the transformation of production technology [17-19], thus slowing down industrial transformation and upgrading and affecting high-quality economic development. Additionally, the behavior of local governments indiscriminately offering industrial land at low prices can also lead to rent-seeking by officials and land violations, severely affecting the normal functioning of the market mechanism [20-21].

Therefore, altering the indiscriminate practice of local governments to sell industrial land at low prices, and establishing a differentiated pricing system for the allocation of industrial land, can create a "threshold effect" that screens for high-value-added enterprises. This, in turn, acts as a barrier for inefficient industrial enterprises that are detrimental to high-quality economic development, objectively promoting the migration of both high and low-efficiency industries within and between regions. This process carves out more space for high-end industries in central areas, enhancing the utilization of land resources and fostering their conservation and intensive use [18]. On one hand, by differentiating the prices of industrial land allocation, local governments increase the land costs for general enterprises, thereby encouraging them to transform their production processes and seek innovation, which strengthens the local capacity for technological innovation. The rise in land costs also compels new entrants to increase their initial capital investment, pushing them to improve their operational levels through factor substitution, equipment upgrades, and technological advancements. This concentrates the limited industrial land resources on higher-quality industrial projects, facilitating industrial agglomeration within cities and creating conditions for information exchange and other interactions among businesses. On the other hand, the differentiated pricing of industrial land allocation plays a "screening effect," which is conducive to achieving high-quality investment attraction. When local governments allocate industrial land to target industries, it helps attract high-value-added enterprises that align with the local industrial development plan, while guiding low-value-added industries to regions with more favorable land prices. This is beneficial for optimizing the regional industrial spatial layout and promoting the transformation and upgrading of local industries. Therefore, this paper posits the research hypothesis that the higher the level of differentiated pricing for industrial land allocation, the more favorable it is for the transformation and upgrading of regional industries.

3. Econometric Modeling and Variable Selection

3.1. Reference Model

The level of regional industrial transformation and upgrading is influenced not only by the characteristics of industrial land prices but also by factors such as the level of economic development and the degree of openness to foreign trade. To quantitatively analyze the impact of differentiated industrial land allocation prices under the "bidding, auctioning, and listing" system on regional industrial transformation and upgrading, this paper employs a fixed effects model for econometric regression analysis. The baseline regression equation is formulated as follows:

$$promotion_{c\,t} = \alpha_0 + \alpha_1\ lndispersion_{c\,t} + \gamma X_{c\,t} + \theta_t + \varphi_c + \varepsilon_{c\,t} \quad (1)$$

In equation (1), the dependent variable., promotionc, t, represents the level of industrial transformation and upgrading in city c during the year t. The inexplained variable, $lndispersion_{c,t}$, denotes the logarithm of the dispersion level of industrial land allocation prices in city c under the "bidding, auctioning, and listing" system in year t. The set of control variables, $X_{c,t}$, encompasses factors such as the level of fixed asset investment and fiscal revenue that can influence the regional industrial transformation and upgrading. The term θ_t represents the time fixed effects, φ_c signifies the city fixed effects, and $\varepsilon_{c,t}$ is the stochastic error term.

3.2. Variable Definition

3.2.1. Explained Variable -- Regional Industrial Transformation and Upgrading

In this paper, the level of regional industrial transformation and upgrading is measured by the industrial structure level coefficient. The specific calculation formula is as follows:

$$\text{promotion}_{c,t} = \sum_{m=1}^{3} y_{c,t,m} \times m, m=1,2,3,$$

Within this context, $y_{c,t,m}$ denotes the percentage share of the m-th industry in the gross regional product of city c in year t.

3.2.2. The Core Explanatory Variable--Differentiated Level of Industrial Land Allocation Prices

The dispersion of industrial land prices reflects the level of variation in the transfer prices of different plots, with a higher dispersion indicating a greater propensity of local governments to adopt differentiated land pricing strategies. Given that there are absolute differences in the transfer prices of industrial land across various regions, to facilitate inter-regional comparisons, this paper constructs a land price dispersion index, termed 'dispersion', to reflect the level of differentiated industrial land allocation prices. The construction is detailed as follows:

$$\text{dispersion}_{c,t} = \frac{\sqrt{\sum_{k=1}^{n}(p_{k,c,t} - \overline{p_{c,t}})^2}}{\frac{n}{p_{c,t}}} \quad (2)$$

In equation (2), $p_{k,c,t}$ represents the average transfer price of the k-th plot of land in city c during year t, while $\overline{p}_{c,t}$ denotes the average transfer price of industrial land in city c during year t, calculated by dividing the total price aggregated at the city level by the total area. The variable n signifies the number of industrial land plots transferred in city c during year t. To mitigate the interference of extreme outliers, this paper applies a 2.5% tail trimming to the data on both ends, and simultaneously excludes city samples where the number of industrial land plots transferred through the "bidding, auctioning, and listing" method is less than or equal to 10 per year. This ensures that the price dispersion can more accurately reflect the level of differentiated industrial land allocation prices, and further, the natural logarithm of this measure is taken to obtain $\text{dispersion}_{c,t}$.

3.3. Control Variables

Referring to existing literature, the other main factors influencing regional industrial transformation and upgrading are as follows: (1) Level of Economic Development, this is represented by the natural logarithm of per capita GDP (in yuan) calculated at the constant prices of 2010; (2) Level of Fixed Asset Investment, denoted by the ratio of fixed asset investment to GDP; (3) Technological Innovation, indicated by the number of invention patents (in ten thousand pieces); (4) Infrastructure, measured by the road area per capita (in square meters per person); (5) Population Density, expressed as the population density (in thousands of people per square kilometer); (6) Fiscal Revenue, represented by the percentage of general budget revenue in GDP. The data mentioned above are sourced from the China Land Market Website, China Statistical Yearbook, China Urban Statistical Yearbook, China Urban Construction Statistical Yearbook, China Social and Economic Big Data Research Platform, and the Wind Database.

4. Empirical Results and Analysis.

4.1. Descriptive Statistics.

From Table 1, it can be observed that the mean value of the industrial structure hierarchy coefficient is 227.231, which is significantly greater than the standard deviation. However, the difference between the maximum and minimum values is considerable, indicating a very pronounced disparity between some regions. Without taking the logarithm, the average level of differentiated industrial land allocation prices is 0.059, which is numerically smaller than the standard deviation. This suggests that there is also a substantial difference in the level of differentiated industrial land allocation prices among cities.

Table 1. Descriptive statistics of main variables

Variable Name	Sample Size	Mean	Standard Deviation	Minimum Value	Maximum Value
promotion	3634	234.251	13.856	183.12	283.2
dispersion	3634	0.061	0.064	0.005	1.198
lnper_GDP	3634	10.397	0.644	8.328	12.863
invest	3634	1.511	2.442	0.005	32.078
patent_inno	3634	0.063	0.231	0	5.292
road	3634	15.948	7.022	2.25	60.07
pop_density	3634	3.575	2.674	0.285	15.055
gov_revenue	3634	7.37	2.73	1.875	23.797

4.2. Baseline Regression Results.

This paper sequentially introduces control variables and fixed effects for estimation, with the econometric regression results presented in Table 2. The regression results indicate that regardless of whether control variables and fixed effects are considered, the core explanatory variable's estimated coefficient remains significant at the 5% or 1% level, and the estimated coefficient is consistently positive. This implies that a higher level of differentiated industrial land allocation prices under the "bidding, auctioning, and listing" system is more conducive to regional industrial transformation and upgrading. Furthermore, concerning the control variables, the regression results in Table 3, column (4), demonstrate that improvements in the level of economic development, fiscal revenue, and infrastructure all contribute to the regional industrial transformation and upgrading. However, an increase in technological innovation is not favorable for regional industrial transformation and upgrading. The impacts of population density and the level of fixed asset investment on regional industrial transformation and upgrading are not significant.

Table 2. Influence of differentiated price of industrial land transfer on regional industrial upgrading

Variable	(1) promotion	(2) promotion	(3) promotion	(4) promotion
dispersion	1.262*** (0.396)	3.140*** (0.366)	0.289** (0.121)	0.324*** (0.121)
Control Variable	Uncontrolled	Uncontrolled	Uncontrolled	Controlled
Individual Effect	Uncontrolled	Controlled	Controlled	Controlled
Time Effect	Uncontrolled	Uncontrolled	Controlled	Controlled
Obs.	3634	3634	3634	3634
R-squared	0.005	0.183	0.775	0.783

Note: ***, **, and * represent significance at the 1%, 5%, and 10% levels, respectively, with the values in parentheses indicating the standard errors. The same format applies to all subsequent tables

Table 3. Influence of differentiated price of industrial land transfer on regional industrial upgrading

	(1)	(2)	(3)	(4)
	promotion	promotion	promotion	promotion
lndispersion	1.626***	3.040***	0.293**	0.321***
	(0.396)	(0.366)	(0.121)	(0.121)
lnper_GDP				2.335***
				(0.688)
invest				0.112
				(0.083)
patent_inno				-2.171***
				(0.513)
road				0.040**
				(0.020)
pop_density				0.021
				(0.050)
gov_revenue				0.173***
				(0.049)
Time Effect	Uncontrolled	Controlled	Controlled	Controlled
Individual Effect	Uncontrolled	Uncontrolled	Controlled	Controlled
_cons	232.52***	227.508***	216.357***	189.247***
	(1.239)	(1.468)	(0.444)	(6.840)
Obs.	3634	3634	3634	3634
R-squared	0.005	0.183	0.775	0.783

4.3. Robustness Test

In the baseline regression section, this paper has reached the conclusion that the differentiation of industrial land allocation prices under the "bidding, auctioning, and listing" system in China is beneficial for regional industrial transformation and upgrading. To further enhance the reliability and robustness of the research findings, this paper conducts robustness tests from the following two aspects.

4.3.1. Excluding the Data of Industrial Land Allocation under the Key Industries Directory.

To mitigate the potential impact of local governments' strategies aimed at optimizing industrial structures by offering preferential land pricing policies to attract key enterprises, this paper excludes the data of industrial land allocation where the land users belong to key industries targeted by investment promotion (including electronic information, information technology, automobile manufacturing, aerospace, advanced equipment, specialized equipment, new materials, new energy, biomedicine, fine chemicals, new types, energy-saving, environmental protection, high-end, intelligent, technology, modern, biological, pharmaceutical) according to the guidance catalog of key industries. Subsequently, the paper recalculates the dispersion degree of industrial land allocation prices for each region, dispersionA, and takes the natural logarithm of it, lndispersionA. The regression results in column (1) of Table 4 show that the findings obtained after excluding the land allocation data under the key industry investment promotion catalog do not substantially alter the research conclusions of this paper.

4.3.2. Replace the Measurement Indicator of the Dependent Variable.

This paper employs the industrial structure hierarchy coefficient as a proxy variable for regional industrial transformation and upgrading. In addition to the aforementioned measurement indicator, some studies also use the ratio of the output value of the tertiary sector to the secondary sector as a proxy for industrial transformation and upgrading. Therefore, this paper adopts the ratio of the output value of the tertiary sector to the secondary sector as another measurement indicator for industrial transformation and upgrading, denoted as promotionA. The estimated results reported in column (2) of Table 4 show that the estimated coefficient remains significant at the 5% level, and the sign of the coefficient is consistent with the baseline regression results, thereby validating the robustness of this study.

Table 4. Robustness test

variable	(1) promotion	(2) promotionA
lndispersionA	0.232* (0.121)	
lndispersion		0.017** (0.007)
Control Variable	Controlled	Controlled
Individual Effect	Controlled	Controlled
Time Effect	Controlled	Controlled
Obs.	3223	3634
R-squared	0.783	0.592

4.4. Heterogeneity Analysis

4.4.1. Analysis based on Geographic Location Heterogeneity

This paper categorizes the regions into two sub-samples based on geographical location: the eastern region and the central-western region, with the regression results presented in columns (1) and (2) of Table 5. Overall, the eastern region has a higher level of economic and industrial hierarchy, while the central-western region lags behind, indicating underdevelopment and imbalance in regional development. The estimation results reveal that, in general, increasing the level of differentiated industrial land allocation prices can play a positive role in the upgrading of industries in the respective regions, with the eastern region showing a larger absolute value of the estimated coefficient.

4.4.2. Analysis based on Economic Development Level Heterogeneity

This paper divides the sample into cities with high economic development levels (per capita GDP ≥ median) and cities with low economic development levels (per capita GDP < median) based on the median of annual per capita GDP. Subsequent sub-sample regressions were conducted, with the estimated results shown in columns (3) and (4) of Table 5. The estimation results indicate that, regardless of whether in cities with high or low levels of economic development, increasing the level of differentiated industrial land allocation prices significantly promotes regional industrial upgrading. Moreover, in cities with high levels of economic development, the estimated coefficients exhibit higher significance and larger absolute values. This suggests that there are considerable differences in the economic development levels among different cities. By setting differentiated prices for industrial land allocation, each region can leverage the threshold effect of prices to restrict the entry of low-end industries, thereby achieving regional industrial transformation and upgrading.

4.4.3. Analysis based on Regional Resource Endowment Heterogeneity.

Table 5. Heterogeneity analysis

	(1) Eastern	(2) Central-Western	(3) High Economic Level	(4) Low Economic Level
	promotion	promotion	promotion	promotion
lndispersion	0.361*	0.364**	0.438***	0.339*
	(0.193)	(0.148)	(0.156)	(0.180)
Control Variable	Controlled	Controlled	Controlled	Controlled
Individual Effect	Controlled	Controlled	Controlled	Controlled
Time Effect	Controlled	Controlled	Controlled	Controlled
Obs.	1383	1901	1645	1639
R-squared	0.763	0.823	0.795	0.785

Table 6. Heterogeneity analysis

	(1) Resource-based City	(2) Non-resource-based City
	promotion	promotion
lndispersion	0.257	0.331**
	(0.200)	(0.152)
Control Variable	Controlled	Controlled
Individual Effect	Controlled	Controlled
Time Effect	Controlled	Controlled
Obs.	1263	2021
R-squared	0.791	0.785

This paper classifies the sample cities into resource-based and non-resource-based cities according to the "National Sustainable Development Plan for Resource-based Cities (2013-2020)" to examine the impact of the level of differentiated industrial land allocation prices on regional industrial upgrading across different city types. The sub-sample regression results are provided in columns (1) and (2) of Table 6. It can be observed that for non-resource-based cities, an increase in the level of differentiated industrial land allocation prices significantly promotes regional industrial upgrading. However, for resource-based cities, the impact of the level of differentiated industrial land allocation prices on regional industrial upgrading is not significant. The possible reason for this result is that the economic growth of non-resource-based cities largely relies on the development of industry, especially manufacturing, and the differentiated

level of industrial land allocation prices meets the objective needs of local industrial upgrading by screening new entrants and industries. In contrast, resource-based cities primarily depend on the extraction and processing of mineral resources to drive economic growth, with a relatively low demand for industrial land and thus are less sensitive to changes in the differentiated level of industrial land allocation prices, and therefore cannot directly affect the local level of industrial upgrading.

5. Research Conclusion and Policy Recommendations

5.1. Research Conclusion

Utilizing industrial land allocation data from the China Land Market Network for the years 2010 to 2019, this paper examines the impact of the differentiated level of industrial land allocation prices under the "bidding, auctioning, and listing" system on regional industrial transformation and upgrading in China. The research findings indicate that increasing the level of differentiated industrial land allocation prices is conducive to promoting regional industrial transformation and upgrading, and this conclusion has been substantiated through various robustness tests. Heterogeneity analysis reveals that: geographically, the impact of the differentiated level of industrial land allocation prices on regional industrial transformation and upgrading is significant in both the eastern and central-western regions, with a stronger effect observed in the eastern region; economically, the differentiated level of industrial land allocation prices significantly promotes industrial transformation and upgrading in both the eastern and western regions, with a more pronounced effect in cities with higher levels of economic development; and in terms of regional resource endowment, in non-resource-based cities, the differentiated level of industrial land allocation prices can significantly drive regional industrial transformation and upgrading, whereas this effect is not significant in resource-based cities.

5.2. Policy Recommendations

Enhancing the efficiency of industrial land resource allocation holds significant practical importance for promoting regional industrial transformation and upgrading, as well as achieving high-quality economic development. The research conclusions of this paper offer certain policy implications: Firstly, it is essential to formulate, refine, and widely implement differentiated strategies for the pricing of industrial land allocation. This can curb the "competition at the bottom" among local governments in attracting investment, explore and implement new models for industrial land allocation such as long-term leasing and industrial "upgrading," and enforce "one location, one price" to leverage the threshold effect of land prices. Secondly, local governments should base their "land-led investment attraction" strategies on the industrial structure and development plans of their respective regions. They should selectively establish entry standards and pricing levels, implement strict review systems for new entrants, and tilt industrial land resources towards technology-intensive and high-tech enterprises to improve the quality of enterprise investments. For enterprises that do not align with the industrial development plan, it is necessary to improve the compensation mechanism for business exits. Thirdly, further improvement of the secondary market trading system for industrial land is needed, actively exploring mechanisms for the transfer of existing industrial land to ensure its rational movement and efficient utilization.

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