

Article

Effect of Land Marketization on the High-Quality Development of Industry in Guangdong Province, China

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Abstract: This study developed a theoretical framework on the relationship between land marketization and industrial high-quality development (HQD) to guide the formulation of policies for advancing new industrialization and high-level manufacturing capabilities. An evaluation system was constructed that can assess regional industrial HQD in seven dimensions: innovation, efficiency, structural optimization, financial risk control, openness, social welfare, and greenness. Based on data related to urban primary land markets and different industries in Guangdong province, China, from 2007 to 2021, the effect of land marketization on industrial HQD was explored using the evaluation models of land marketization and industrial HQD, the Theil index, a panel data model, and the difference generalized method of moments. The findings revealed that land marketization and industrial HQD have increased gradually in Guangdong. In the Pearl River Delta (PRD), both factors have increased rapidly, albeit with low levels of land marketization and high levels of industrial HQD. Notably, the province-wide scores for financial risk control and openness have declined. In the PRD, scores for efficient and financial risk control have consistently been lower than those outside the PRD. Positive relationships were discovered between land marketization and various aspects of industrial HQD, including industrial innovation, efficiency, structural optimization, greenness, and social welfare. Conversely, land marketization was found to have negative relationships with financial risk control and openness. Compared with that in the non-PRD, land marketization in the PRD was more conducive to industrial HQD, innovation, efficiency, structural optimization, and openness but less conducive to greenness, social welfare, and financial risk control. This research concluded that land marketization can promote industrial HQD through rising land prices and an open and fair environment for land market trading. The results of this study enrich the theoretical knowledge of the effects of industrial HQD in China; thus, they can be used as a reference in the formulation of industrial HQD policies related to market-oriented reform and land allocation in China.

Keywords: land marketization; high-quality development (HQD); land price; business environment



Citation: Jin, W.; Zhang, Q.; Liu, T. Effect of Land Marketization on the High-Quality Development of Industry in Guangdong Province, China. *Land* **2024**, *13*, 1400. <https://doi.org/10.3390/land13091400>

Academic Editor: Dingde Xu

Received: 5 August 2024

Revised: 28 August 2024

Accepted: 29 August 2024

Published: 30 August 2024



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1. Introduction

With the rise of China's economy and the enhancement of its scientific and technological capabilities, the areas of competition and cooperation between countries have expanded beyond economics and trade to include technological innovation, international cooperation, and geopolitics. Industry serves as the foundation of national competition; thus, stabilizing industrial economic operations and promoting high-quality development (HQD) in industry are crucial for ensuring a country's international competitiveness. Land is one of the fundamental factors in industrial production, and market-oriented land reforms can enhance resource allocation efficiency and total factor productivity [1]. Although China does have a market-oriented land allocation mechanism, problems persist in the Chinese land market, such as delayed market-oriented development, low resource allocation efficiency, and mismatches between supply and demand [2]. Addressing how the land

market's operational mechanisms can be improved to promote HQD and release economic development potential remains a critical topic for discussion in China.

The term HQD was introduced by Chinese leaders in 2017. Although a consensus on its precise definition is still lacking among scholars, the term is broadly understood to encompass meeting the public's growing demands for a better life, reflecting new development ideas, prioritizing innovation, ensuring coordination as an intrinsic attribute, promoting greenness as a requirement for economic development, advocating openness as an inevitable path, and sharing as the fundamental goal [3,4]. Industrial HQD refers to a development mode focused on enhancing the quality and efficiency of economic growth through the implementation of innovation-driven, green, and optimized approaches; the upgrading of industrial structures; and the fostering of openness in development activities [5]. Research on HQD in Europe and the United States generally focuses on not only the speed of economic growth but also the quality of economic growth, including factors such as innovation, sustainability, and social well-being. Such research is informed by theoretical frameworks such as sustainable development theory and innovation-driven development theory. The primary indicators used to evaluate development quality are the Human Development Index and the Global Competitiveness Index [6,7]. Industrial HQD is closely related to concepts such as sustainable development, industrial transformation and upgrading, and the green economy. Academics have mainly adopted single indicators and comprehensive indicator systems to evaluate regional industrial HQD. The single indicators include labor productivity [8,9], green productivity [10], and total factor productivity [11,12]. Moreover, comprehensive indicator systems that have been employed evaluate the five pillars of HQD—innovation, collaboration, sharing, openness, and greenness—along with production efficiency, superior quality, and industrial structure [13,14]. One study developed a comprehensive system incorporating ecological benefits, environmental benefits, economic benefits, resource and energy efficiency, and circular economy principles to assess industrial HQD [15]. Overall, no unified indicator system exists for assessing HQD. HQD is usually assessed using economic indicators (e.g., per capita gross domestic product, proportion of tertiary industry, and openness) [15,16], innovation indicators (e.g., scientific research investment and per capita patents) [13,14], environmental indicators (e.g., pollutant emissions and green total factor productivity, which refer to a comprehensive indicator that measures the quality and efficiency of economic growth while taking into account environmental resource constraints and ecological costs) [15,17], ecological indicators (e.g., green coverage of built-up areas and forest coverage rate) [15,18], and livelihood indicators (e.g., per capita income and social security) [19,20].

Discussions on the effects of HQD in industry often focus on technological innovation, institutional regulation, industrial agglomeration, and financial development. Technological innovation involves replacing traditional production processes with advanced technologies through digital empowerment, thereby enhancing energy efficiency and profitability and achieving HQD in manufacturing [21]. Institutional regulation emphasizes the direct or indirect role of government in promoting green industrial technology and industrial structural adjustments [22]. The effectiveness of industrial agglomeration in promoting industrial transformation depends on environmental regulations and market competition [23]. Through suitable policies and financial products, financial development can address the limitations of traditional financial services, alleviate financing constraints, support technological innovation, enable the upgrading and transformation of traditional industries, and drive green manufacturing [24]. These effects are interconnected and emphasize the promotion of regional industrial HQD through technological innovation. A close theoretical link exists between land marketization and industrial HQD, which is mainly reflected in aspects such as resource allocation efficiency, innovation drive, industrial structure optimization, and sustainable economic development. First, land marketization enables land resources to be allocated through market mechanisms, thus allowing land resources to be diverted to efficient and competitive industrial sectors [25]. This approach reduces the wastage of land resources, increases the overall resource allocation efficiency,

and provides a solid foundation for industrial HQD. Second, a fair and just land market trading environment helps enterprises spend more capital on technological innovation and product development. Moreover, such an environment promotes the creation of technology- and knowledge-intensive industries [26,27]. Third, land marketization promotes the optimization and upgrading of industrial structures. Furthermore, it promotes synergistic cooperation between upstream and downstream enterprises in the industrial supply chain, thus facilitating the creation of an industrial cluster effect and enhancing the overall competitiveness of industry [28]. Finally, land marketization can encourage enterprises to place greater focus on land conservation, intensive land use, ecological protection, and environmental protection, thus promoting the development of green manufacturing and the circular economy [25]. To sum up, existing research on land marketization has only explored its effect on single dimensions of industrial development.

In summary, scholars have extensively evaluated regional industrial HQD and examined its effects. However, comprehensive evaluations of industrial HQD have often focused on provincial regions in China, with prefecture-level cities being neglected because of limitations in data availability. Moreover, comprehensive systems for evaluating industrial HQD rarely incorporate financial risk control and contribution to the social welfare of enterprises. Furthermore, the effects of industrial HQD have seldom been analyzed from the perspective of land marketization. Since the opening up of the Chinese economy in 1978, Guangdong province has rapidly developed a modern industrial system, becoming a crucial global industrial base and a leader in China's industrial development. The economic scale and industrial structure of Guangdong province are similar to those of China overall, and the province's industrial development path and model offer valuable insights for other regions in China. Guangdong plays a crucial role in the achievement of industrial HQD in China. In addition, Guangdong is at the forefront of land marketization reform and has a relatively well-developed land market and land management system. Therefore, examining the relationship between land marketization and industrial HQD in Guangdong is crucial for understanding overall economic trends and policy effects in China, making Guangdong an ideal case study for examining the relationship between land marketization and industrial HQD in China. This study investigated the temporal changes and regional differences in land marketization and industrial HQD across 21 prefecture-level cities in Guangdong from 2007 to 2021 and then analyzed the effects of land marketization on industrial HQD. The findings of this study are expected to (1) enrich research regarding the effects of industrial HQD and indicator systems for evaluating this HQD, (2) reveal the positive and negative effects of land marketization on industrial HQD, and (3) provide a reference for promoting new industrialization measures and constructing a robust manufacturing sector in China and other developing countries.

2. Research Hypotheses

In industrial HQD, technological innovation should be the core driving force of development, and the focus should be on high-end and green manufacturing. Industrial HQD should adhere to the principles of quality, efficiency, and financial risk control; enable the effective leveraging of international capital and markets; and generate wealth and employment opportunities for society.

Land is a fundamental resource in industrial production, and market-oriented land reforms have facilitated China's rapid urbanization and industrialization. Land marketization reform has enhanced the role of market mechanisms in the allocation of land resources, with land value being increasingly reflected by market operations (Figure 1). When land is allocated for free or at a subsidized rate, its price does not reflect its scarcity. In this scenario, producers can secure profits by virtue of the suppressed land cost; thus, they often lack the motivation to maximize production efficiency [29]. Land marketization can regulate the relationship between land supply and land demand, thereby guiding the efficient allocation and utilization of land resources and promoting the optimization and upgrading of industrial structures. Specifically, to increase profits and reduce costs

when the price of land is rising, producers would be motivated to develop new technology, organizational structures, and products, thus contributing to industrial upgrading [25,30]. For example, by optimizing the input structure of production factors, enterprises can increase their investment in technological innovation and improve their production efficiency. Studies have demonstrated that under intense market competition and rising production costs, enterprises can only rely on technological innovation to avoid falling behind in the market [27]. Technological innovation not only transforms traditional industrial production and business models but also promotes cross-sectoral integration and the rapid development of new industries [31]. Furthermore, it reduces pollution emissions, enabling sustainable ecological development. Although technological progress might reduce labor input in certain sectors, it typically increases labor demand in other sectors or at new operational levels [26]. Other studies have argued that technological advancements enhance the competitiveness and production efficiency of enterprises, thereby expanding their scale, resulting in enterprises requiring more labor to support higher production demand [32]. Moreover, in response to rising production costs, some enterprises opt to relocate their investments to less-developed areas where land costs are relatively low [28]. Therefore, the growth of high-end and environmentally friendly industries can displace the resources and market space of declining industries, leading to the transformation and upgrading of regional industrial structures and, ultimately, the promotion of industrial HQD.

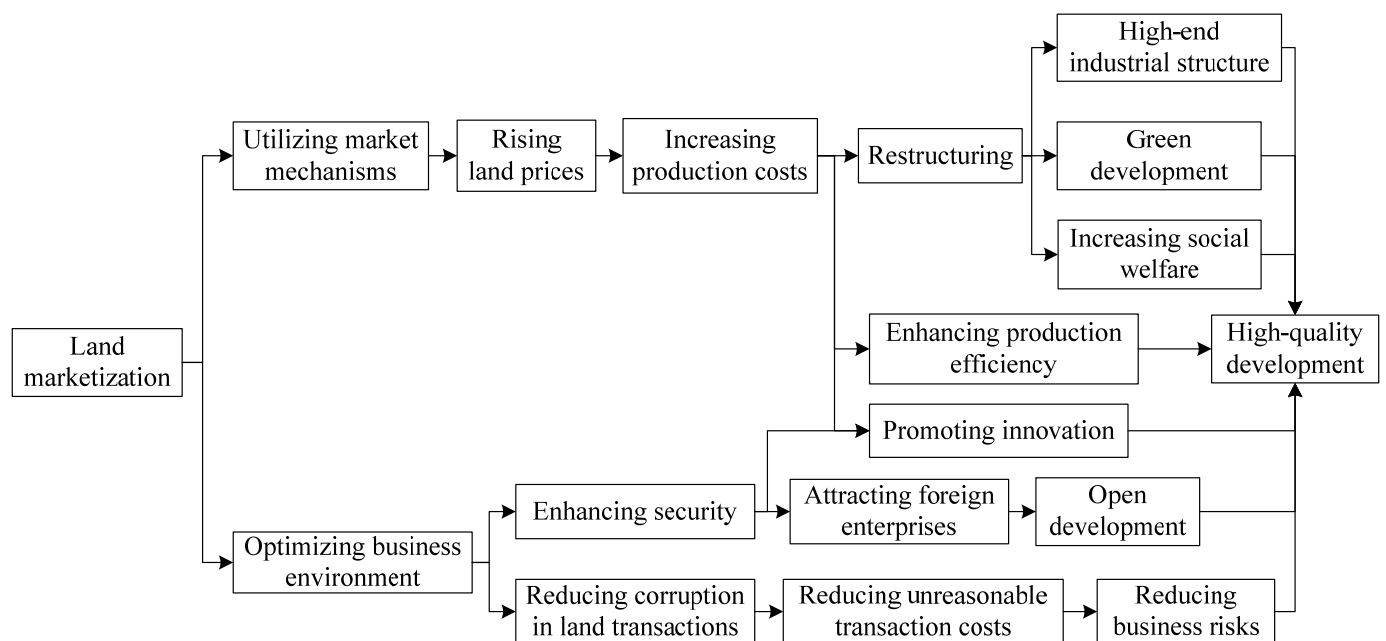


Figure 1. Analytical framework for the effects of land marketization on industrial HQD.

Land marketization also implies that land market operations adhere to standard legal principles. Enhanced land marketization contributes to the creation of an open and fair market trading environment, thus optimizing the business environment and reducing the intervention of local officials [33,34]. A market environment without fair competition inhibits technological innovation by enterprises. In contrast, in market environments with fair competition, the pressure of competition motivates entrepreneurs to launch new products, conduct research and development (R&D) related to new technologies, enter into new markets, and explore new and innovative processes and production activities to obtain greater profits [35]. An open and transparent land market can help curb corruption in land transactions, reduce unreasonable transaction costs, and mitigate business risks, thereby promoting the enterprises' development. A study indicated that market-oriented land transfers can reduce the costs and inefficiencies associated with rent-seeking corruption, thus enhancing the productivity of industrial enterprises [36]. One study revealed that the land output elas-

ticity in China's development parks is higher for industries located on transferred land than for industries located on allocated land [37]. From the perspective of enterprises, increased land marketization leads to institutionalized and impersonal market competition rules, gradually replacing relationship-based and personalized transaction rules because land resources are primarily allocated to entrepreneurs through market mechanisms [38]. An open and fair land market also fosters a level playing field for entrepreneurial innovation activities. The market principle of survival of the fittest incentivizes entrepreneurs to invest resources into innovative, productive activities to gain a competitive advantage [35]. Moreover, optimizing the business environment enhances the sense of security for enterprises, attracting international investment and promoting export-based economic development. A high-quality business environment helps attract international partners and promote transnational cooperation projects [39]. International cooperation and exchange can bring opportunities for technology transfer, resource sharing, and market expansion, which in turn accelerate the technological transformation and upgrading of enterprises and improve their market competitiveness [40]. Studies have found that US multinational corporations are more willing to operate in areas with strong intellectual property protection, minimal government intervention in business operations, low corruption, and effective contract enforcement than in areas without these characteristics [13].

On the basis of the aforementioned discussion, this study formulated the following hypotheses:

Hypothesis 1: *Land marketization development is conducive to industrial HQD.*

Hypothesis 2: *Land marketization development stimulates land prices and thereby forces industrial HQD.*

Hypothesis 3: *Land marketization development is beneficial for optimizing the business environment, thereby promoting industrial HQD.*

3. Methodology and Data Sources

3.1. Measurement of Land Marketization

China's urban land market comprises primary and secondary markets. Primary land markets involve relationships between the government and land users, with the government providing land-use rights for state-owned land to land users through various methods, including allocations, transfers, and leases. By contrast, secondary land markets involve transactions between holders of land-use rights, encompassing practices such as leasing and mortgaging. Secondary land markets are relatively well-developed [41]. Given the focus of the present study, the secondary land market was excluded from the calculation of urban land marketization levels in Guangdong. Allocated land refers to state-owned land assigned to a land user by a government at or above the county level. Land users acquire such land after the payment of compensation, resettlement, and other fees or free of charge, with no time limit existing on land use. The supply area of allocated land considerably varies across different years, affecting data stability. Leasing, as a form of paid use of state-owned land, supplements land transfers. However, the volume of leased land is small in primary land markets. Four methods of land transfer exist in primary land market in China: agreement, listing, bidding, and auction (Table 1). Agreement involves direct negotiation between a prospective transferee and a government representative for developing land in return for payment [42]. This method lacks transparency and competitive mechanisms, potentially fostering corruption. The quotation time in listing is longer than that in agreement, allowing investors to make rational decisions and thereby avoiding price inflation due to irrational competition and promoting fair competition. Bidding is an incomplete competition mode in which strict development conditions are set for the transferred land, encouraging bidders to actively study the land development plan and offering the transferor a choice. Auctioning involves a competitive mechanism with

centralized on-site quotations, thus eliminating subjective factors and better-reflecting land supply and demand through transfer prices. In the present study, the level of urban land marketization was calculated for each prefecture-level city in Guangdong from 2007 to 2021. The calculation involved summing the product of the land supply area under each land transfer method and a corresponding weight. The weights were determined by inviting experienced experts in the field of land management research to conduct multiple rounds of comprehensive scoring for the four land transfer methods in terms of their competition, transparency, and revenue from the land transfer price. The methods were scored from 0 to 1, and scoring was continued until the deviation of the scores from their mean value did not exceed a predetermined threshold. After this threshold was reached, the average score provided for each method was used as its weight. The weights determined for agreement, listing, bidding, and auction were 0.10, 0.25, 0.30, and 0.35, respectively.

$$LM_{it} = (x_{it} \times w_1 + y_{it} \times w_2 + z_{it} \times w_3 + p_{it} \times w_4) / (x_{it} + y_{it} + z_{it} + p_{it}) \quad (1)$$

where x , y , z , and p denote the land areas transferred through agreement, listing, bidding, and auction, respectively, and w_1 , w_2 , w_3 , and w_4 are the corresponding weights.

Table 1. Comparison of the four land transfer methods in primary land market.

Land Transfer Method	Characteristics
Agreement	(1) Non-market-oriented method of land transfer with no competitors (2) Strong government control over land (3) Restricts land price and development
Listing	(1) Transparent process (2) Extended listing period that allows for multiple offers, thus promoting rational decision-making and competition among investors (3) Highest bidder wins, with no limit on the number of bidders
Bidding	(1) Incomplete competition (2) High transparency, fairness, and objectivity (3) Comprehensive evaluation process
Auction	(1) Full competitiveness (2) Purchase price determines the buyer (3) Involves multiple rounds of bidding

3.2. Indicators and Method for Measuring Industrial HQD

This study established a comprehensive index system for evaluating regional industrial HQD in terms of seven factors: innovation, efficiency, structural optimization, financial risk control, openness, social welfare, and greenness (Table 2).

Technological innovation plays a crucial role in enhancing productivity, reducing costs, improving product quality, and generating new business opportunities for enterprises [43]. Such innovation requires substantial capital and human resource investments to drive high-quality technological research and development, which enhances economic vitality and competitiveness [44]. We evaluated industrial innovation by using indicators such as the ratio of research and development expenditure to industrial value added, the per capita number of granted patents, and the proportion of individuals engaged in scientific and technological activities relative to the resident population.

Table 2. Index system for evaluating industrial HQD level.

Indicator	Symbol	Description	Positive or Negative	Weight
Innovation	IN	(1) Expenditure on research and development as a share of industrial value added (%)	Positive	0.0469
		(2) Number of authorized patents per capita	Positive	0.1531
		(3) Number of people engaged in scientific and technological activities as a percentage of the resident population (%)	Positive	0.1152
Efficiency	EF	(4) Contribution of total assets (%)	Positive	0.0344
		(5) Product sales rate (%)	Positive	0.0067
		(6) Total labor productivity (yuan/person)	Positive	0.0417
		(7) Cost–expense margin (%)	Positive	0.0157
Structural optimization	ST	(8) New product sales revenue as a percentage of main operating revenue (%)	Positive	0.0544
		(9) Share of industrial value added by high-end manufacturing (%)	Positive	0.0490
Financial risk control	RI	(10) Debt-to-asset ratio (%)	Negative	0.0352
		(11) Current asset turnover (times)	Positive	0.0608
Openness	OP	(12) Proportion of enterprises with foreign investment to the total number of enterprises (%)	Positive	0.1078
		(13) Proportion of total imports and exports with foreign investment to gross domestic product (%)	Positive	0.1202
Social welfare	SO	(14) Total profits and taxes of industrial enterprises (in terms of 100 million yuan)	Positive	0.1327
		(15) Average number of employees in industrial enterprises	Positive	0.0097
Greenness	GR	(16) Industrial particulate matter emissions per unit of industrial added value (tons/100 million yuan)	Negative	0.0058
		(17) Industrial sulfur dioxide emissions per unit of industrial added value (tons/100 million yuan)	Negative	0.0034
		(18) Energy consumption per unit of industrial added value (ton of standard coal/10,000 yuan)	Negative	0.0071

Efficiency refers to the achievement of high output with minimal resource consumption, which provides a competitive advantage in market [45]. Higher development efficiency typically translates into higher profitability, which is characterized by higher profit margins and better asset utilization [46]. We evaluated efficiency in industrial development by using indicators such as the total asset contribution rate, product sales rate, labor productivity per employee, and cost–expense margin.

Structural optimization not only enables the achievement of HQD but also drives sustained economic and social progress. It allows the optimization of resource allocation, the achievement of technological progress, and the enhancement of economic efficiency, thus facilitating economic development and the realization of HQD and sustainable development goals [47]. Structural optimization involves increasing the proportion of high-value segments such as research and development, design, branding, and marketing, thereby boosting total factor productivity and promoting a shift from economic growth to HQD [3]. We evaluated structural optimization in terms of new product sales revenue as a percentage of main operating revenue and the share of industrial value added by high-end manufacturing.

Effective financial risk management is a crucial safeguard and driving force for achieving HQD. Strengthening financial risk control can increase a company’s financial strength,

improve its solvency and profitability, enhance its market position and brand influence, and reduce obstacles and damage caused by risk events in the economic development process, thereby promoting HQD [48,49]. We used indicators such as the debt-to-asset ratio and current asset turnover to evaluate financial risk management.

In the context of globalization, the key to achieving industrial HQD lies in openness. High-level openness provides the driving force for constructing a high-standard market economy system, ensures stable and secure supply chain guarantees for creating a new development pattern, and allows access to high-quality global resources for independent innovation [47,50]. Openness focuses on leveraging international capital and markets to enhance the export competitiveness of manufacturing industry [51]. We evaluated openness in terms of the ratio of enterprises with foreign investment to the total number of enterprises and the ratio of total imports and exports with foreign investment to gross domestic product.

The creation of social welfare is not only a part of corporate social responsibility but also a crucial factor for achieving HQD in enterprises. By actively fulfilling their social responsibilities, enterprises can enhance their competitiveness and sustainable development capabilities, thus obtaining economic and social benefits [52]. The social welfare creation of industrial HQD was evaluated in terms of job creation and tax revenues.

Greenness emphasizes the achievement of environmental protection by reducing pollution, mitigating ecological damage, and safeguarding biodiversity [53]. By actively promoting green development, enterprises can achieve a balance between economic, social, and environmental benefits, thereby realizing long-term sustainable development goals [54]. We evaluated greenness by using indicators such as industrial particulate matter emissions per unit of industrial value added, industrial sulfur dioxide emissions per unit of industrial value added, and energy consumption per unit of industrial value added.

To incorporate both positive and negative indicators, the initial data were normalized using the range method. Subsequently, index weights were determined using the entropy method. This method calculates weights based on the discrete degree of the data itself, which reduces the influence of subjective judgment on the evaluation results and improves the objectivity and fairness of the evaluation. Each city's industrial HQD level in each year was estimated using the following equation:

$$HQD_{it} = \sum_{k=1}^{k=11} \theta_k x_k \quad (2)$$

where θ_k is the weight of the k th index, and x_k is the normalized value of the k th index.

3.3. Theil Index and Its Decomposition

Theil index was employed to analyze regional differences in urban land marketization and industrial HQD in Guangdong. In contrast to other imbalance indices, Theil index can assess the contributions of within- and between-group imbalances to total disparity. Moreover, the index is decomposable and can be employed to analyze the intrinsic causes of imbalance changes [55].

The between-group component of Theil index measures the differences or inequality between different groups, which is calculated as follows:

$$T_b = \sum_{p=1}^2 \left(\frac{k_p}{k} \times \frac{\bar{S}_p}{\bar{S}} \times \ln \left(\frac{\bar{S}_p}{\bar{S}} \right) \right) \quad (3)$$

The within-group component of Theil index measures the differences or inequality within a certain group, which is calculated as follows:

$$T_w = \sum_{p=1}^2 \left(\frac{k_p}{k} \times \frac{\bar{S}_p}{\bar{S}} \times T_p \right) \quad (4)$$

$$T_p = \frac{1}{k_p} \sum_{q=1}^{k_p} \left(\frac{S_{pq}}{\bar{S}_p} \times \ln \left(\frac{S_{pq}}{\bar{S}_p} \right) \right) \quad (5)$$

Theil index is defined as the weighted average of the between- and within-group components, expressed as follows:

$$T = T_w + T_B \quad (6)$$

where T denotes the Theil index of land marketization in Guangdong. A smaller Theil index value indicates less regional disparity in land marketization. The terms T_b and T_w denote the between- and within-group components of the Theil index, respectively; k represents the number of cities; S_q refers to the land marketization in city q ; $\bar{S}$ denotes the average land marketization in Guangdong; $\bar{S}_p$ refers to the average land marketization in region p [in this study, PRD or non-PRD]; T_p represents the Theil index of land marketization in region p ; k_p refers to the number of cities in region p ; and S_{pq} denotes the land marketization in city q in region p . The higher the T_w value, the greater the disparity in land marketization levels within region p . Moreover, the higher the T_b value, the greater the disparity in land marketization levels between regions p and r . The ratio of within-group component to the Theil index represents the contribution of within-group imbalance to this index. Similarly, the ratio of between-group components to the Theil index represents the contribution of between-group imbalance to this index. Theil index can be decomposed to gain insights into the variation in the level of land marketization or industrial HQD between different regions or within a region. Thus, this index is a powerful tool for analyzing inequalities in the level of land marketization or industrial HQD.

3.4. Econometric Model

Firstly, this study formulated the following panel data model to examine the effects of land marketization on industrial HQD in Guangdong (Figure 2):

$$\ln(HQD_{it}) = \alpha + \beta_1 \ln(LM_{it}) + \beta_j \ln(con_{it}) + \varepsilon_{it} \quad (7)$$

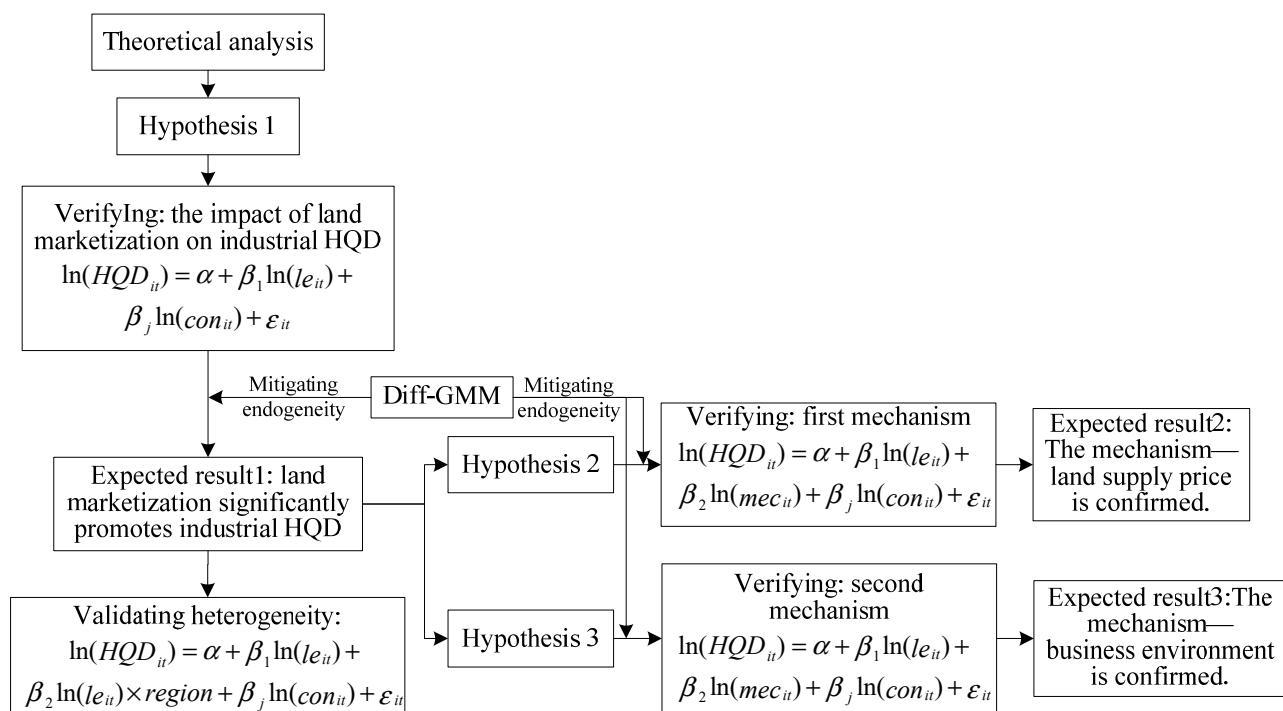


Figure 2. Models used for hypothesis testing in this study.

Secondly, to explore the effect of regional heterogeneity in land marketization on industrial HQD, a term for the interaction between land marketization and a dummy variable was added to the model expressed in Equation (7), thus yielding Equation (8). The model expressed in Equation (8) has high explanatory power and accuracy, and it effectively reveals the influence of land marketization level on industrial HQD in different regions. The insights obtained using the aforementioned model can be employed to formulate more specific policies or interventions for industrial development.

$$\ln(HQD_{it}) = \alpha + \beta_1 \ln(LM_{it}) + \beta_2 \ln(LM_{it}) \times region + \beta_j \ln(con_{it}) + \varepsilon_{it} \quad (8)$$

Thirdly, to evaluate whether land price and business environment act as mediating variables in the relationship between land marketization and industrial HQD, two mechanism variables were incorporated into the model expressed in Equation (8): industrial land price (*PR*) and the business environment index (*EV*) [56]. The modified model is expressed in Equation (9). This model reveals the pathways through which land marketization affects HQD in Guangdong.

$$\ln(HQD_{it}) = \alpha + \beta_1 \ln(LM_{it}) + \beta_2 \ln(mec_{it}) + \beta_j \ln(con_{it}) + \varepsilon_{it} \quad (9)$$

where HQD_{it} denotes the industrial HQD level of city i in year t ; LM represents the level of land marketization; region values of 0 and 1 correspond to the non-PRD and PRD, respectively; mec refers to the mechanism variables; con denotes the control variables; β is an estimated coefficient; α represents the intercept term; and ε refers to a random perturbation term. The control variables in this study included the levels of financial development (*FD*), industrial concentration (*CI*), and informatization (*FI*). The level of financial development is expressed in terms of the ratio of employees working in Chinese-funded financial institutions to the total number of employees in all sectors. Moreover, the level of industrial concentration is represented by location quotient. Finally, the level of informatization is expressed in terms of the ratio of employees working in the information transmission, computer service, and software industries to the total number of employees in all sectors.

When causal relationships between variables are analyzed using panel data models, the existence of fixed or random effects can be assumed. A fixed-effects model assumes that individual effects are constant and related to changes in explanatory variables. By contrast, a random-effects model assumes that individual effects are random and independent of explanatory variables. The Hausman test was used to determine whether a fixed-effects model or random-effects model was more suitable in this study. This test involves comparing the estimation results of a fixed-effects model with those of a random-effects model and investigating whether explanatory variables are correlated with individual effects. If the results of the test are significant, the fixed-effects model should be used; however, if these results are nonsignificant, a random-effects model should be used. In addition, although completely avoiding endogeneity-related problems in econometric regression models is difficult, these problems can be addressed and controlled using appropriate techniques and methods. This study employed the difference generalized method of moments (GMM), which offers flexibility and advantages in controlling autocorrelation and endogeneity, to mitigate the effect of endogeneity-related problems on the model estimation results. The results obtained with the difference GMM were evaluated using the Sargan test, with significance greater than 0.1 indicating that the choice of instrument variables in the model was valid. Moreover, the results obtained using the difference GMM were reliable if they achieved the threshold significance level in the Arellano–Bond AR(1) test but not in the Arellano–Bond AR(2) test. Figure 2 displays the models used in this study for hypothesis testing.

3.5. Data Sources

Data regarding land transfer, which were used to determine the level of land marketization, were primarily obtained from announcements of land supply results made by the China Land Market Network (<https://www.landchina.com/> accessed on 1 December 2023). Mandated by a document issued on 31 May 2006 by the former Ministry of Land and Resources [“Specification for Bidding, Auction, Listing State-Owned Land Use Rights (Trial)”], municipal and county governments in China are required to publish supply information for each land parcel on the website of the China Land Market Network. Therefore, the present study selected land transfer data from 2007 to 2021, which comprised 154,863 transaction records. Of these records, 223, 5130, 34,527, and 114,983 were related to bidding, auction, listing, and agreement, respectively. The price of acquired industrial land was calculated based on revenue generated from land transfers and the corresponding land area. In accordance with related research [57], the business environment index was determined in terms of government financial expenditures on public services, that is, the proportion of local public budget expenditure to gross domestic product. Other socioeconomic data were primarily obtained from the Guangdong Statistical Yearbook. To explore the regional disparities in the effect of land marketization on industrial HQD in Guangdong, this study divided the entire province into two main regions based on their industrial and technological development (Figure 3): the PRD (including Guangzhou, Shenzhen, Zhuhai, Foshan, Huizhou, Dongguan, Zhongshan, Jiangmen, and Zhaoqing) and the non-PRD (including Chaozhou, Shantou, Jieyang, Shanwei, Meizhou, Zhanjiang, Maoming, Yangjiang, Yunfu, Qingyuan, Heyuan, and Shaoguan).

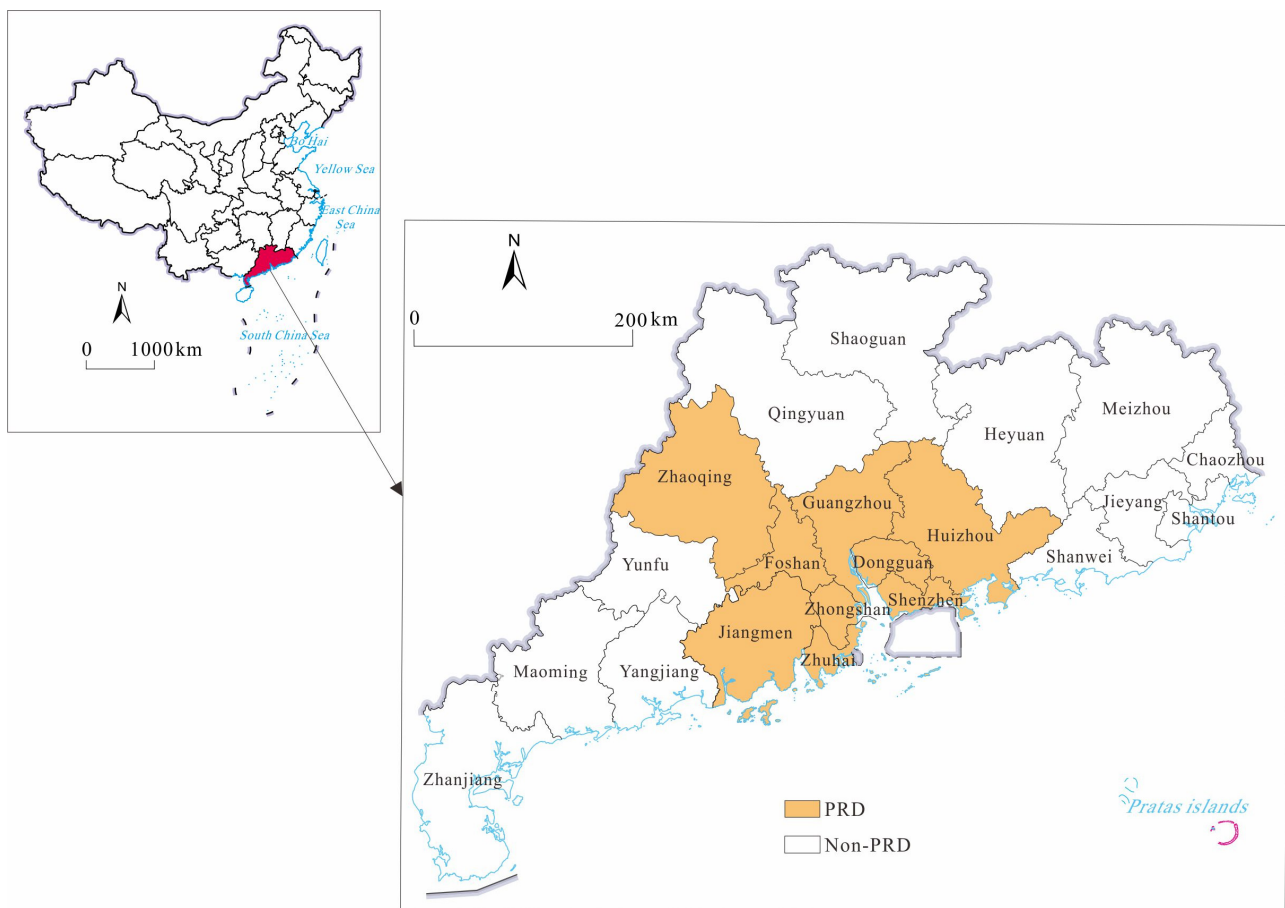


Figure 3. Pearl River Delta (PRD) and non-PRD in Guangdong.

4. Temporal Changes and Spatial Heterogeneity in Land Marketization and Industrial HQD

4.1. Land Marketization

From 2007 to 2021, the temporal changes in urban land marketization across 21 prefecture-level cities in Guangdong generally exhibited a fluctuating growth pattern characterized by two distinct phases: a period of fluctuating increase from 2007 to 2010 and a period of steady growth from 2011 to 2021 (Figure 4). Compared with 2007, the average land marketization level in these cities in 2021 had increased by 0.0709; thus, the land marketization level exhibited slow growth from 2007 to 2021, with the growth primarily driven by large-scale land transfer through agreements and listings. From 2007 to 2021 in Guangdong, the proportion of land area transferred through agreements and listings decreased by 6.55%, the auctioned land area increased by 7.81%, and the bid area decreased by 1.26% (Figure 5). During this time, 77.14% of the total land area and 94.23% of the industrial land area were transferred through agreements and listings. In 2007, the cities with high levels of land marketization were concentrated in economically less-developed regions outside the PRD, whereas the cities with low levels of land marketization were concentrated in the PRD and eastern Guangdong (Figure 6). However, by 2021, the cities with high levels of land marketization were concentrated in western and eastern Guangdong, whereas the cities with low levels of land marketization were still concentrated in the PRD. Regarding regional disparities, the temporal changes in land marketization levels in the PRD and non-PRD mirrored the trends observed in Guangdong overall, with a more pronounced increase in land marketization evident in the PRD. From 2007 to 2021, the Theil index for urban land marketization in Guangdong decreased from 0.03922 to 0.01054 (73.13% decrease), indicating considerable narrowing of regional disparities in urban land marketization in Guangdong and a gradual movement toward synergistic development (Figure 7). The contribution of within-group imbalance to the Theil index increased slightly overall over the aforementioned period, with this contribution considerably exceeding that of between-group imbalance. This result suggested that the regional disparities in urban land marketization in Guangdong primarily originated from a within-group imbalance in the PRD and non-PRD. Notably, the urban land marketization level in the PRD was lower than that in the non-PRD. In 2021, agreements and listings together accounted for 94.34% and 95.55% of the total land and industrial land transferred in the PRD, respectively, with both percentages exceeding the corresponding values for non-PRD. The lower level of land marketization in the PRD was possibly caused by irregular market behaviors in land transfers aimed at attracting investments during rapid industrialization.

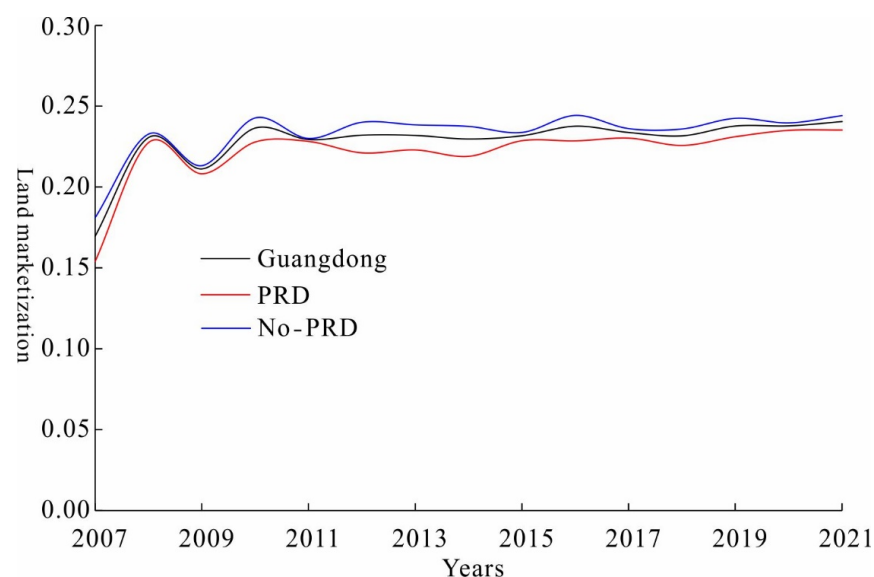


Figure 4. Land marketization in Guangdong from 2007 to 2021.

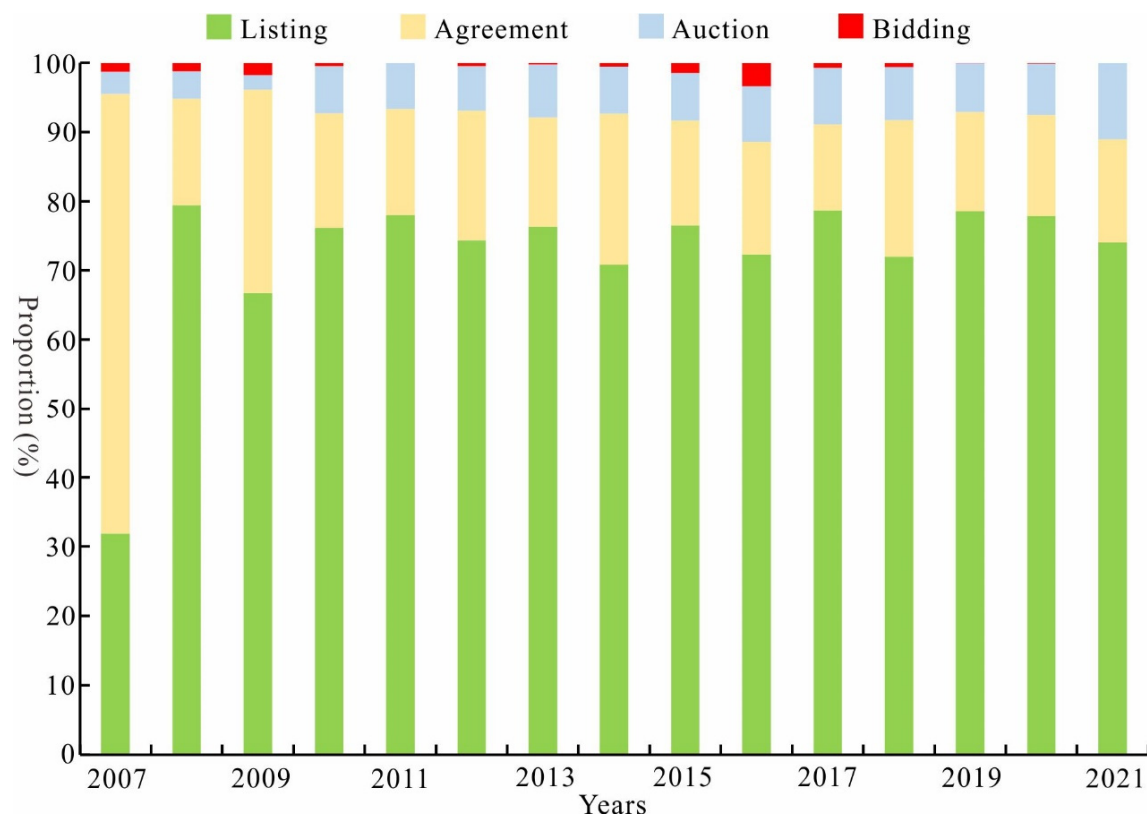
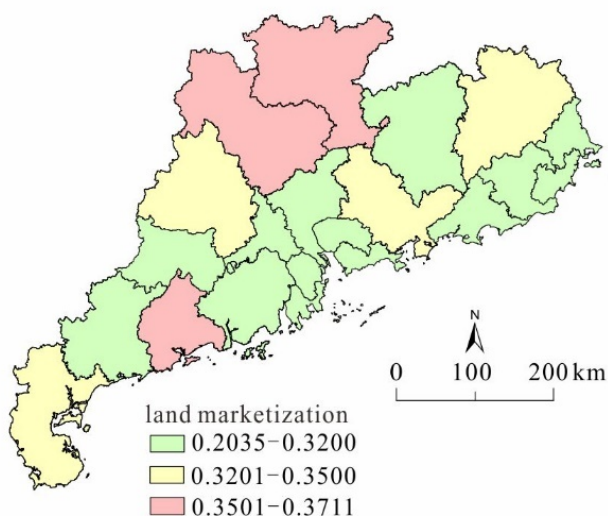


Figure 5. Proportion of land transferred through different methods in Guangdong from 2007 to 2021.

a. 2007



b. 2021

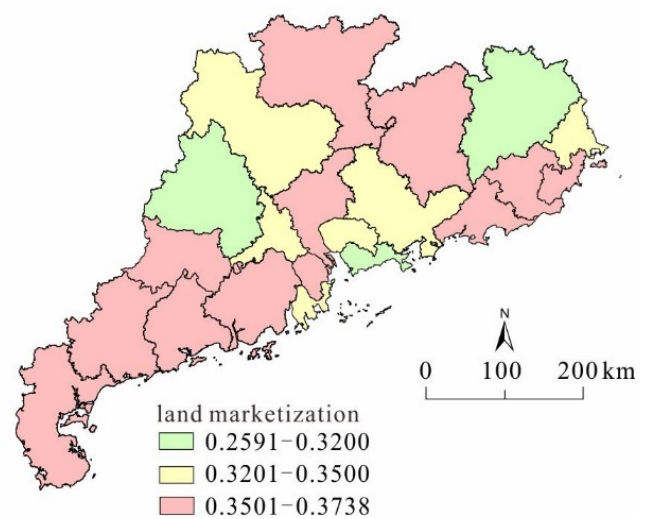


Figure 6. Spatial distribution of land marketization levels in Guangdong in 2007 and 2021.

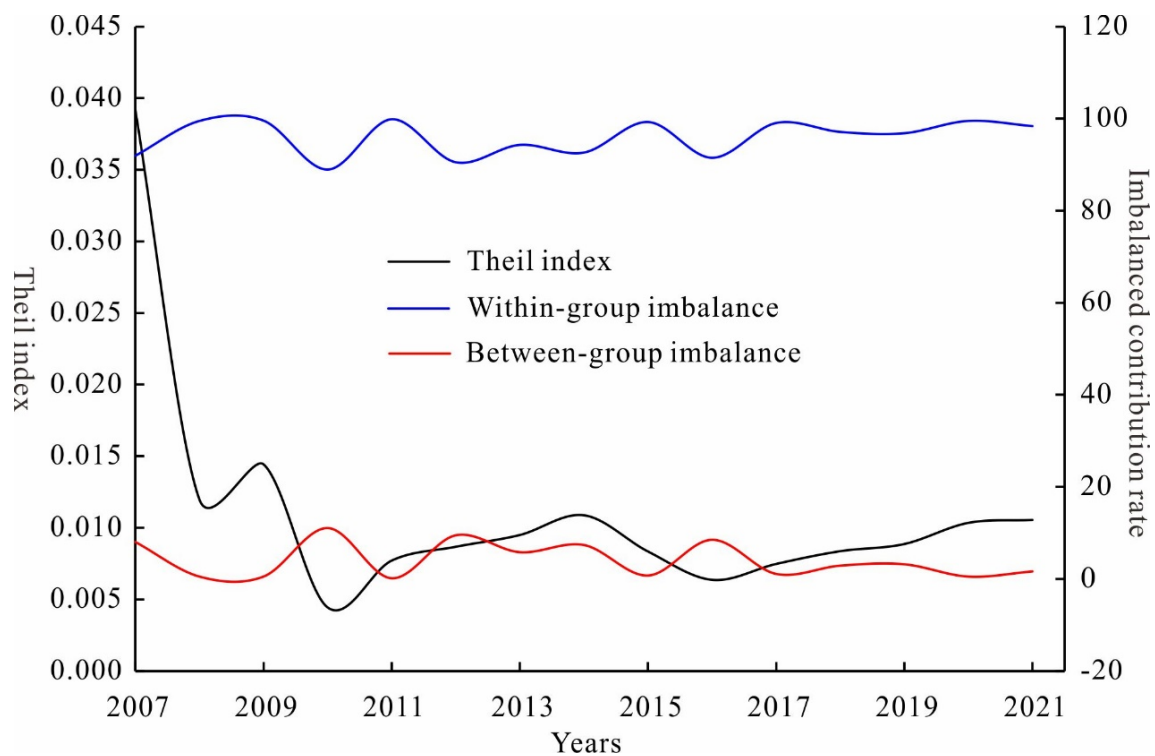


Figure 7. Theil index of land marketization in Guangdong from 2007 to 2021.

4.2. Industrial HQD

The level of industrial HQD in Guangdong, a region primarily oriented toward exports, decreased from 2007 to 2009 because of the global financial crisis. Subsequently, under the effects of central government initiatives aimed at transforming and upgrading the manufacturing industry, industrial HQD steadily increased from 2010 to 2021 (Figure 8). Compared with 2007, the average industrial HQD value across the 21 considered prefecture-level cities in Guangdong had increased by 0.0675 in 2021, with the rate of increase being low. In 2007, cities with high levels of industrial HQD were concentrated in the PRD, with this concentration becoming more intense by 2021 (Figure 9). In terms of regional disparities, the temporal evolution of industrial HQD in the PRD and non-PRD generally mirrored that in Guangdong overall, with the PRD consistently exhibiting a more pronounced increase in industrial HQD level than did the non-PRD. The Theil index for industrial HQD in Guangdong increased from 0.16513 in 2007 to 0.20416 in 2021 (23.64% increase), indicating a widening of regional disparities in industrial HQD (Figure 10). The contribution of between-group imbalance to the Theil index generally increased from 2007 to 2021, becoming considerably higher than that of within-group imbalance. This result indicated that the regional disparities in industrial HQD in Guangdong primarily originated from the differences between the PRD and non-PRD.

The average scores of industrial innovation, efficiency, structural optimization, social welfare, and greenness for the 21 prefecture-level cities in Guangdong generally exhibited a fluctuating growth trend from 2007 to 2021. Specifically, industrial innovation had a high growth rate, highlighting an increasing emphasis on scientific and technological innovation within Guangdong's industrial development. This shift has led to the accelerated creation of wealth and employment opportunities for society as well as a noticeable transformation of the industrial structure toward high-end and environmentally friendly practices. However, efficiency increased slowly, indicating that modest growth occurred in economic benefits achieved through industrial development. The average scores for financial risk control and openness exhibited a fluctuating downward trend from 2007 to 2021. Notably, the decline in openness was most pronounced, indicating that the proportion of foreign investment in

Guangdong's industrial economy has been decreasing amid a growing dominance of the internal economy, particularly the private sector. This trend reflects increasing operational pressures on industrial enterprises and a generally deteriorating financial environment in the region.

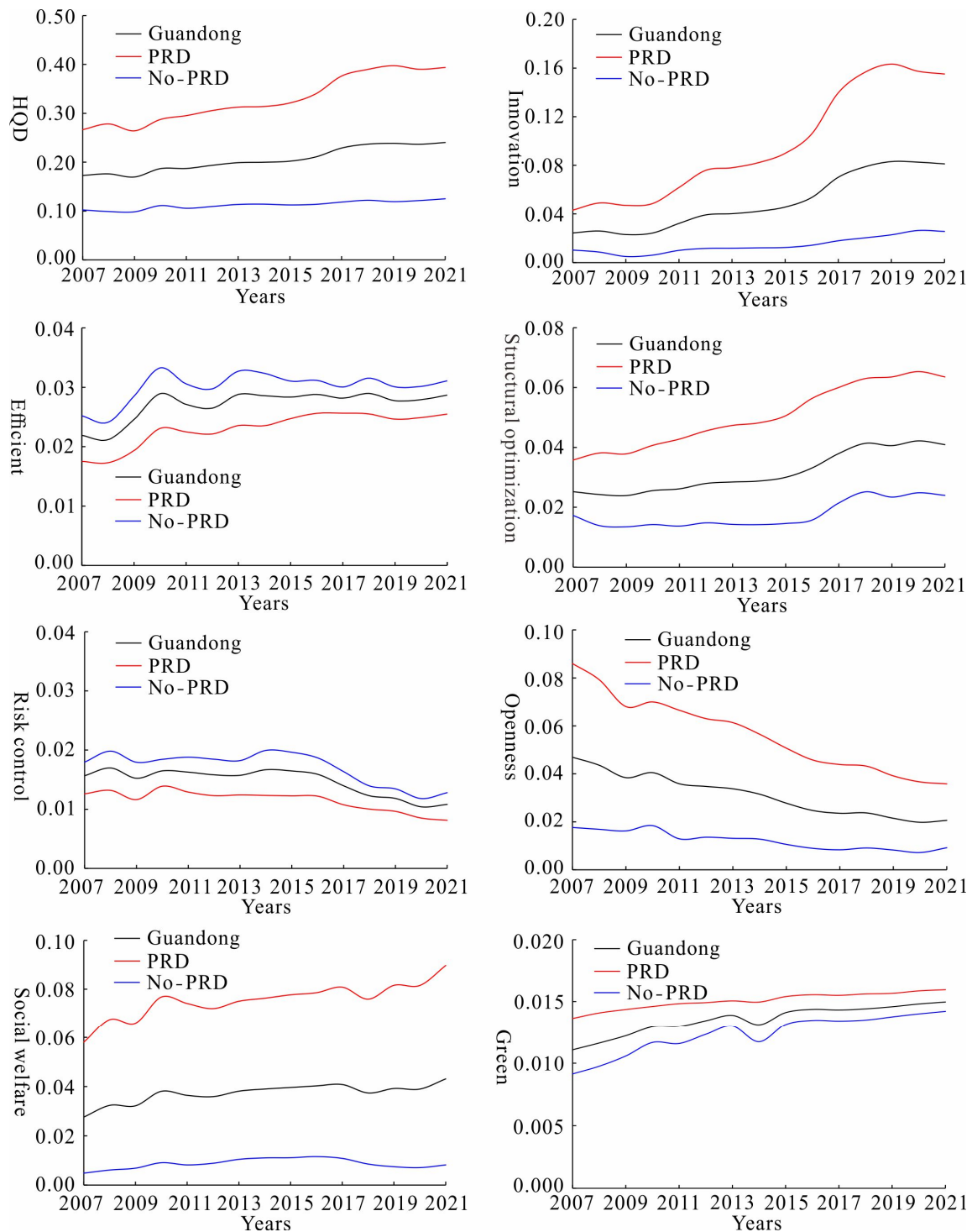


Figure 8. Industrial high-quality development (HQD) in Guangdong from 2007 to 2021.

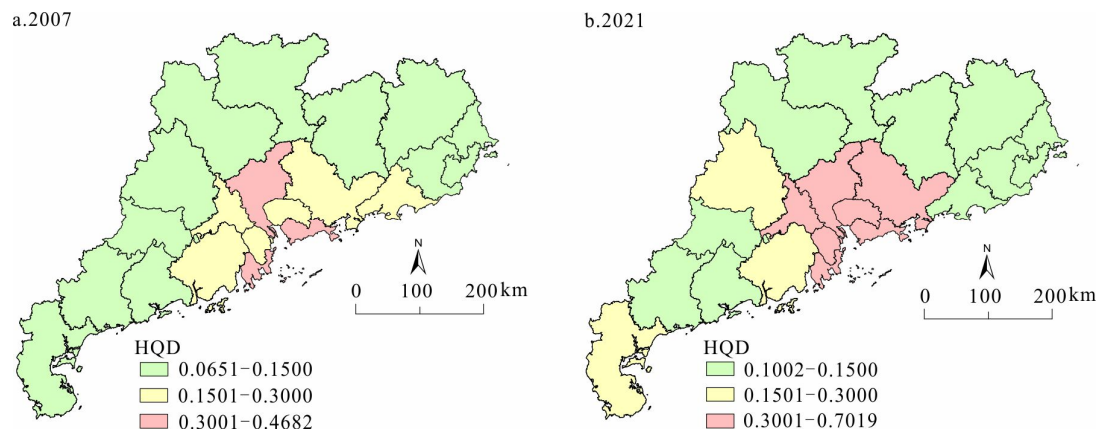


Figure 9. Spatial distributions of industrial HQD in Guangdong in 2007 and 2021.

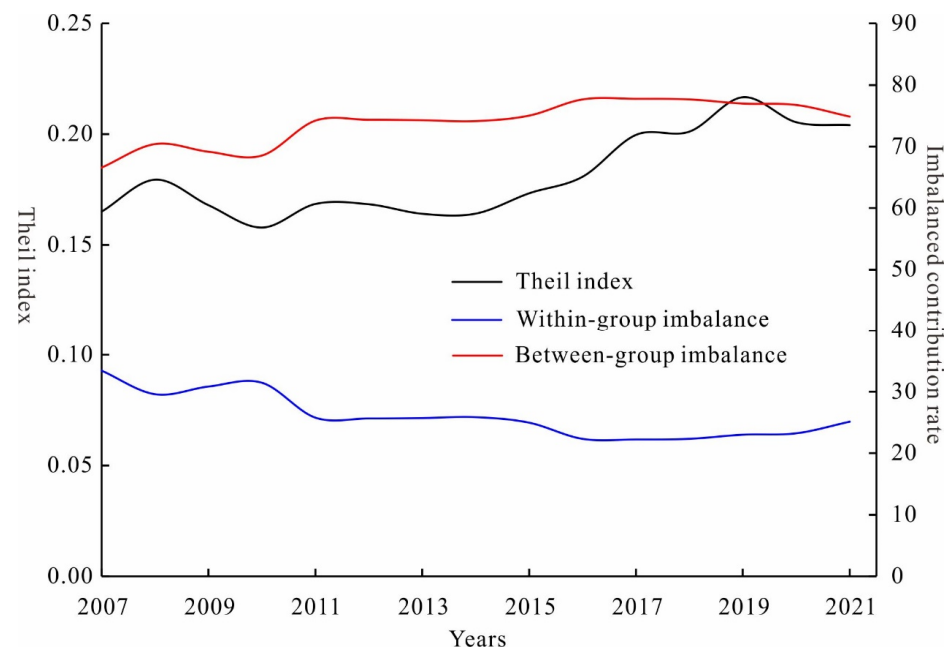


Figure 10. Theil index of industrial HQD in Guangdong from 2007 to 2021.

The temporal changes in the scores of the aforementioned seven dimensions of industrial HQD in the PRD and non-PRD generally mirrored those in the entire province of Guangdong; however, considerable spatial heterogeneity existed in these scores between the two regions. Specifically, the PRD consistently outperformed the non-PRD in terms of industrial innovation, structural optimization, social welfare, greenness, and openness, with the greatest difference being in social welfare. From 2007 to 2021, the differences in the scores of industrial innovation, structural optimization, and social welfare between the two regions increased, whereas the differences in the scores of greenness and openness decreased. The scores for efficiency and financial risk control were lower in the PRD than in the non-PRD, with the differences in these scores between the two regions decreasing over time.

5. Empirical Testing and Analysis

5.1. Overall Effect of Land Marketization on Industrial HQD

To enhance the robustness of regression analysis, this study incrementally incorporated control variables into the regression equation. The estimation results obtained with Models 1–4 in Table 3 revealed that land marketization had significantly positive coefficients. This

finding indicated that the effect of land marketization on industrial HQD in Guangdong was generally robust, with land marketization significantly enhancing the industrial HQD in Guangdong. To mitigate potential endogeneity bias, this study further explored the effect of land marketization on the industrial HQD in Guangdong by using the difference GMM. The results obtained with Model 5 indicated that the first-order lag term of land marketization level was positive and significant, with first-order autocorrelation observed in the disturbance term but no second-order autocorrelation; thus, these results validated the use of the difference GMM. The results of the Sargan test confirmed that the hypothesis “all instrumental variables are valid” could not be rejected at the 5% significance level; the estimated coefficient of land marketization remained significantly positive. In the results obtained with Model 6, although the estimated coefficient for the main effect term “land marketization” was negative and failed the significance test, the estimated coefficient of the interaction term was 0.1965 and significant. This finding indicated that the contribution of land marketization to industrial HQD was greater in the PRD than in the non-PRD. The results obtained with Model 7 (difference GMM) further corroborated the regional heterogeneity in the effect of land marketization on industrial HQD.

Table 3. Results obtained in analysis of the effect of land marketization on industrial HQD.

Independent Variables	Model 1 (FE)	Model 2 (FE)	Model 3 (FE)	Model 4 (FE)	Model 5 (GMM)	Model 6 (FE)	Model 7 (GMM)
$\ln(LM)$	0.2540 *** (4.70)	0.2251 *** (4.21)	0.2175 *** (4.18)	0.2095 *** (4.05)	0.0859 * (1.68)	−0.0691 (−0.44)	−0.2217 (−1.27)
$\ln(FD)$		0.3020 *** (3.61)	0.2510 *** (3.05)	0.2676 *** (3.27)	0.0153 (0.19)	0.2695 *** (3.31)	0.0195 (0.26)
$\ln(CI)$			0.1813 *** (4.23)	0.1975 *** (4.59)	0.0976 ** (2.34)	0.2027 *** (4.72)	0.1018 ** (2.59)
$\ln(FI)$				0.0671 ** (2.38)	0.0230 (1.25)	0.0638 ** (2.27)	0.0184 (0.98)
$\ln(LM)t - 1$					0.7786 *** (15.57)		0.7952 *** (15.06)
$\ln(LM) \times \text{region}$						0.1965 * (1.90)	0.2549 * (1.67)
overall R2		0.2758	0.3894	0.4265		0.1323	
F	233.96	129.67	107.39	109.18		43.83	
Arellano–Bond test for AR(1)					−3.12 ***		−3.00 ***
Arellano–Bond test for AR(2)					0.85		0.88
Sargan test					261.72		180.49
Hausman	10.25 ***	41.79 ***	88.39 ***	45.99 ***		41.74 ***	

Note: Sargan test of overidentifying restrictions: $\chi^2(239) = 261.72$, $\text{Prob} > \chi^2 = 0.150$. Sargan test of overidentifying restrictions: $\chi^2(172) = 180.49$, $\text{Prob} > \chi^2 = 0.313$. *, **, and *** represent significance at the 10%, 5%, and 1% levels, respectively. The values in parentheses are t values.

The results of the difference GMM revealed that the estimated coefficient for financial development level was positive but not significant. However, other model estimates indicated that a significant positive relationship existed between the financial development level and industrial HQD. This finding suggests that a high level of financial development can ensure access to sufficient financial resources, promote technological innovation, encourage resource allocation optimization, improve market efficiency, and facilitate the creation of a favorable policy and market environment for the HQD of enterprises. The estimated coefficients for industrial concentration were significantly positive in all models, indicating that moderate industrial concentration can promote industrial HQD through economies of scale, technological innovation, resource optimization, and market competition. The estimated coefficients for the information technology level were positive but not significant only in the results obtained with the difference GMM; these coefficients were significantly

positive in all other estimation results. This finding suggests that information technology development supports industrial HQD by improving production efficiency, optimizing resource management, enhancing production flexibility, and reducing costs.

5.2. Effect of Land Marketization on the Seven Dimensions of Industrial HQD

The estimation results obtained for the factors influencing the seven dimensions of industrial HQD indicated that the interaction-term model for efficiency failed the Hausman test. Therefore, to ensure the consistency of the analytical results, a fixed-effects model was used to examine the influences of various factors on industrial HQD. The results presented in Table 4 indicate that land marketization had significant positive relationships with industrial innovation, efficiency, social welfare, and greenness. Land marketization resulted in greater improvements in industrial innovation and efficiency but smaller improvements in social welfare and greenness in the PRD than in the non-PRD. However, the effects of land marketization on industrial innovation and social welfare in the PRD did not pass the significance test. This result indicates that as the land marketization level in the PRD has increased, this region has attracted increasing numbers of high-end talent; thus, abundant labor support is available for enhancing the PRD's industrial innovation. Moreover, the PRD has benefitted from a robust industrial base and the establishment of large-scale manufacturing clusters. Under the existence of imperfect environmental regulations, large-scale industrial clusters may contribute to increased total industrial pollutant emissions. Furthermore, as the operating mechanisms in the land market of the PRD have improved, industrial enterprises in this region have begun to adopt advanced technologies to boost productivity and increase returns. However, this transformation and upgrading of enterprises has led to changes in labor demand, with a decrease in demand for low-skilled labor and an increase in demand for high-skilled individuals. Consequently, the number of jobs provided by industrial enterprises in some cities has decreased or remained stable. Statistics indicate that the proportion of employment in the secondary industry in Guangdong changed marginally from 39.4% in 2007 to 36.3% in 2021, with the average annual decrease in this proportion being 0.21%. This minimal change suggests that the positive effect of land marketization on industrial structure optimization has not been significant. However, land marketization development has made a greater contribution to the optimization of industrial structure in the PRD than in the non-PRD. Moreover, land marketization development has significantly hindered financial risk control. The increase in land costs caused by land marketization increases labor and resource costs, which leads to diminishing returns on investment, an increased enterprise debt-to-asset ratio, and a decline in current asset turnover. From 2007 to 2021, the average debt-to-asset ratio of industrial enterprises across the 21 prefecture-level cities increased from 53.11% to 57.09%, which is close to the upper threshold of 60% (Figure 11). The average current asset turnover decreased from 2.97 times to 2.07 times, which is close to the threshold of 2 times. These trends indicate declining profitability and short-term solvency of industrial enterprises, leading to an overall increase in financial risk. In the PRD, the development of land marketization is more detrimental to the financial risk control of industrial firms than in the non-PRD, although this effect is not significant. Furthermore, land marketization has had a significant negative effect on industrial openness. This phenomenon may be attributable to land marketization causing an increase in production costs for industrial enterprises, a decrease in profit margins for foreign-funded industrial enterprises, and the withdrawal of some labor-intensive foreign-funded industrial enterprises from the relevant region. However, land marketization development has been more conducive to enhancing the openness of industrial enterprises in the PRD than in the non-PRD. The PRD's industrial enterprises are mainly technology-intensive enterprises. Studies have indicated that the rising production costs, diminishing location advantages and preferential policies, and improved business environment in the PRD favor technology-intensive industries over labor-intensive ones [58].

Table 4. Results obtained in analysis of effect of land marketization on various dimensions of industrial HQD.

Independent Variables	Dependent Variables													
	ln (IN)		ln (EF)		ln (ST)		ln (RI)		ln (OP)		ln (SO)		ln (GR)	
	Model 1 (FE)	Model 2 (FE)	Model 3 (FE)	Model 4 (FE)	Model 5 (FE)	Model 6 (FE)	Model 7 (FE)	Model 8 (FE)	Model 9 (FE)	Model 10 (FE)	Model 11 (FE)	Model 12 (FE)	Model 13 (FE)	Model 14 (FE)
ln (LM)	0.8560 *** (4.08)	0.6841 (1.08)	0.2476 *** (3.68)	−0.0999 (−0.49)	0.1640 (1.39)	−0.5656 (−1.60)	−0.1370 * (−1.67)	0.1571 (0.64)	−0.6003 *** (−3.09)	−1.1741 ** (−2.00)	0.3308 *** (4.55)	0.4767 ** (2.17)	0.4254 *** (5.84)	1.1327 *** (5.24)
ln (FD)	3.2489 *** (9.79)	3.2501 *** (9.78)	−0.0910 (−0.86)	−0.0887 (−0.84)	1.3753 *** (7.37)	1.3803 *** (7.44)	−0.6418 *** (−4.95)	−0.6438 *** (−4.97)	−1.8511 *** (−6.03)	−1.8472 *** (−6.02)	0.0210 (0.18)	0.0200 (0.17)	0.4826 *** (4.19)	0.4778 *** (4.22)
ln (CI)	−0.3891 ** (−2.23)	−0.3860 ** (−2.20)	0.5340 *** (9.56)	0.5403 *** (9.69)	−0.4337 *** (−4.42)	−0.4203 (−4.30)	0.7082 *** (10.39)	0.7028 *** (10.30)	−0.1141 (−0.71)	−0.1036 (−0.64)	1.1709 *** (19.38)	1.1682 *** (19.28)	0.1474 ** (2.43)	0.1344 ** (2.25)
ln (FI)	0.5019 *** (4.40)	0.4999 *** (4.37)	0.1346 *** (3.69)	0.1307 *** (3.58)	0.1102 * (1.72)	0.1017 (1.59)	−0.1280 *** (−2.87)	−0.1246 *** (−2.79)	−0.3963 *** (−3.76)	−0.4030 *** (−3.81)	0.1426 *** (3.61)	0.1443 *** (3.64)	0.0494 (1.25)	0.0576 (1.48)
ln (LM) × region		0.1212 (0.29)		0.2451 * (1.82)		0.5145 ** (2.18)		−0.2074 (−1.26)		0.4047 *** (1.04)		−0.1029 (−0.70)		−0.4988 *** (−3.47)
overall R ²	0.3859	0.3404	0.0005	0.0832	0.2100	0.0291	0.1347	0.0171	0.1758	0.3159	0.3549	0.4703	0.2091	0.2374
F	24.36	13.77	67.01	58.88	51.59	33.17	42.72	40.16	46.58	29.43	270.78	161.40	8.79	9.08
Hausman	79.88 ***	53.24 ***	8.32 *	2.67	11.52 **	21.98 ***	14.97 ***	14.48 **	60.16 ***	35.91 ***	30.84 ***	22.21 ***	26.58 ***	43.21 ***

Note: *, **, and *** represent significance at the 10%, 5%, and 1% levels, respectively. The values in parentheses are t values.

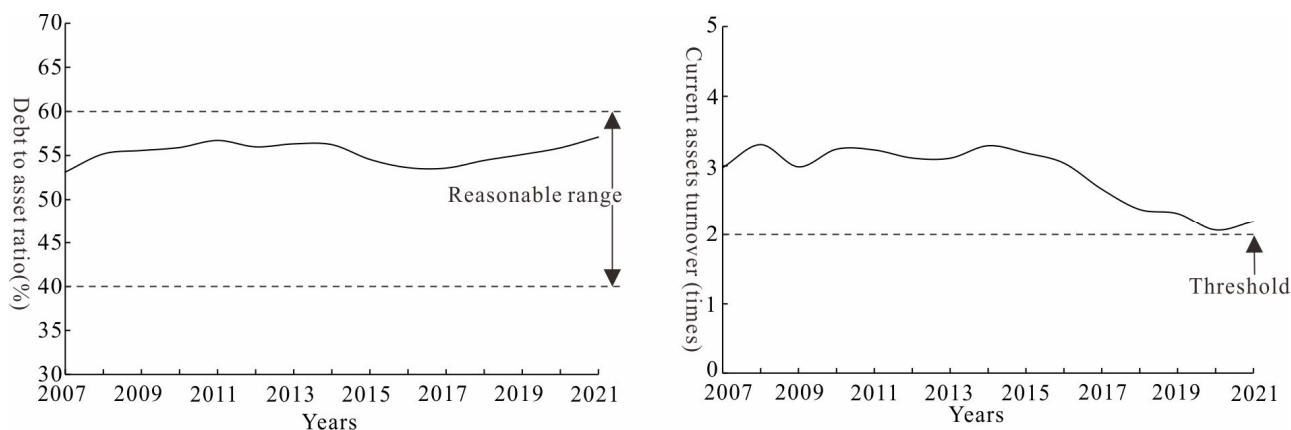


Figure 11. Average debt-to-asset ratios and average current asset turnover of industrial enterprises in Guangdong from 2007 to 2021.

5.3. Mechanisms for the Effect of Land Marketization on Industrial HQD

Land marketization development can significantly promote industrial HQD in Guangdong. However, the mechanism underlying this effect is unclear. To explore this mechanism, two mechanism variables, namely industrial land price and the business environment index, were incorporated into the analysis based on Equation (7). If these variables act as mechanisms in the effect of land marketization development on industrial HQD, their inclusion should reduce the effectiveness of the core explanatory variables; that is, the estimated coefficients of the core explanatory variables should decrease, and the significance of these coefficients should diminish or disappear. Conversely, if the two mechanism variables do not act as mechanisms in the aforementioned effect, the estimated coefficients of the core explanatory variables and the significance of these variables should not change significantly.

The coefficients of land marketization that were estimated using Models 1 and 4 in Table 5 were significantly smaller than those estimated using Model 4 in Table 3. Moreover, the coefficients estimated using Models 1 and 4 in Table 5 did not pass the significance test. These results indicate that industrial land price and the business environment index were explanatory mechanisms in the effect of land marketization development on industrial HQD. To address the endogeneity problem, this study employed the difference GMM to estimate whether land marketization influenced industrial HQD through increases in industrial land price or improvements in a business environment. The estimation results obtained using Models 2 and 5 in Table 5 reaffirmed that industrial land price and the business environment index served as mechanisms through which land marketization influenced industrial HQD. In fact, land marketization development can reduce the reliance on administrative allocation and agreement transfer for industrial land. This phenomenon ensures that the market value of land is accurately reflected and suppresses price distortions. Furthermore, under the Chinese central government's stringent control over the conversion of agricultural land into construction land, the supply and demand dynamics for industrial land have tightened, leading to rising industrial land prices. An increase in land prices forces enterprises to improve their factor input structures and labor production efficiency or to eliminate low-end manufacturing and develop high-value-added and environmentally friendly practices. Moreover, land marketization development fosters a transparent and fair land market trading environment, thereby reducing rent-seeking and corrupt activities of local governments and the costs incurred by industrial enterprises. Improvements in the business environment enhance a business' sense of security and stability, enabling it to allocate more resources to innovative production activities, thus promoting improvements in total factor productivity. In addition, an improved business environment attracts high-quality foreign enterprises, which typically have advanced technology and management expertise, thereby driving the transformation and upgrading of Chinese industry. The coefficients estimated for the interaction terms in Models 3 and 6 are significantly positive,

indicating that higher industrial land prices or an improved business environment were more conducive to enhancing industrial HQD in the PRD than in the non-PRD.

Table 5. Results regarding the mechanisms underlying the effect of land market development on industrial HQD.

Independent Variables	Model 1 (FE)	Model 2 (GMM)	Model 3 (FE)	Model 4 (FE)	Model 5 (GMM)	Model 6 (FE)
$\ln(LM)$	0.0613 (1.24)	0.0255 (0.53)	0.0750 (1.53)	0.0537 (1.12)	0.0180 (0.41)	0.0271 (0.60)
$\ln(PR)$	0.1051 *** (8.65)	0.0338 ** (2.52)	−0.0056 (−0.14)			
$\ln(EV)$				0.3387 *** (9.57)	0.1051 *** (4.06)	−0.1665 * (−1.92)
$\ln(FD)$	0.1422 * (1.91)	0.0238 ** (0.29)	0.2120 (2.73)	−0.1506 * (−1.80)	−0.0540 (−0.67)	−0.0203 (−0.25)
$\ln(CI)$	0.1599 *** (4.13)	0.1143 *** (2.80)	0.1680 (4.38)	0.1763 *** (4.68)	0.1076 *** (3.01)	0.1711 *** (4.84)
$\ln(FI)$	0.0190 (0.74)	0.0326 * (1.86)	0.0117 (0.46)	0.0193 (0.77)	0.0297 (1.85)	0.0099 (0.42)
$\ln(LM)t - 1$		0.6967 *** (11.10)			0.6856 *** (13.16)	
$\ln(PR) \times \text{region}$			0.0665 *** (2.81)			
$\ln(EV) \times \text{region}$						0.3746 *** (6.92)
overall R ²	0.6343		0.8476	0.1643		0.6569
F	92.49		33.00	138.59		77.64
Arellano–Bond test for AR(1)		−3.19 ***			−3.25 ***	
Arellano–Bond test for AR(2)		0.97			0.87	
Sargan test		282.36			271.12	
Hausman	81.49 ***		76.65 ***	63.47 ***		26.38 ***

Note: Sargan test of overidentifying restrictions: $\chi^2(247) = 282.36$, Prob > $\chi^2 = 0.061$. Sargan test of overidentifying restrictions: $\chi^2(240) = 271.12$, Prob > $\chi^2 = 0.082$. *, **, and *** represent significance at the 10%, 5%, and 1% levels, respectively. The values in parentheses are t values.

6. Discussion

6.1. Financial Risk Management and Social Responsibility Should Be Emphasized in Industrial HQD

The financial risk control and social responsibility of enterprises must be considered in industrial HQD. In the past five years, some listed companies in China have encountered major financial crises, which have posed massive risks to the economy. In 2008, Lehman Brothers in the United States declared bankruptcy because of severe balance sheet issues and liquidity crises, and this directly triggered severe turmoil in global financial markets and caused a global economic recession [59]. Therefore, financial risk control is crucial for the survival and development of enterprises. Such control not only helps enterprises avoid potential financial crises but also improves their operating efficiency and competitiveness and ensures the stable development of the national economy [48]. Corporate social responsibility constitutes efforts made to support social and environmental sustainability, such as improving social well-being, generating sufficient tax revenue, and creating employment. For example, when Tesla invested in building its factory in Shanghai, the government required the company to pay 2.23 billion RMB in taxes annually starting from the end of 2023. Amazon has established multiple warehouses and distribution centers across the United States. These facilities have not only generated considerable local and national taxes but have also provided numerous job opportunities. The tax revenue has been used by relevant governments to support public services and infrastructure development, which promote economic growth [60]. Currently, China's economy is still facing downward pressure, and

the employment situation is becoming increasingly precarious. Therefore, additional jobs must be created during the process of industrial transformation and development in China.

6.2. Effect of Land Marketization on China's Economic Transformation

In China, bidding and auctions have not been widely adopted by city governments for granting land-use rights [41]. Instead, these governments have often used listing- and agreement-based transfers, which have limited transparency and involve relatively low prices, to attract investment [61]. This approach has been prevalent in urban land market transfers in Guangdong, particularly in the developed PRD. Such land transfer behavior might ultimately lead to the misallocation of land resources, which would result in suboptimal productivity, thereby adversely affecting industrial HQD. The market-based allocation of factors of production is fundamental and essential for market economy development and serves as a key stabilizer for regulating economic and social development [62]. China's ability to sustain economic growth in the future may largely depend on market reforms [2]. In 2020 and 2021, the Chinese central government issued policy documents titled "Opinions on Constructing a More Perfect Institutional Mechanism for the Market-Based Allocation of Factors" and "Action Program for Building a High-Standard Market System," respectively. Both policy documents emphasize the promotion of the market-based allocation of land. Land marketization in China has led to increasing land costs and corporate cash flow pressures, caused the withdrawal of international capital, and hindered outward-oriented industrial development. However, research suggests that in terms of continuously increasing market access, expanding the scope of international capital investment, and creating a favorable business environment, China remains highly attractive to international capital, with the foundation for the industrial utilization of such capital being solid [63].

6.3. Limitations and Future Research

Land marketization in China has alleviated financing constraints and expanded the scale of financing, thereby promoting economic growth and corporate innovation [64]. However, these studies have mainly evaluated land financing in terms of land transfer fees, rents, and other land revenues from the primary land market. This quantitative method of evaluating land financing has certain limitations. First, land financing predominantly occurs in the secondary land market. Second, Chinese industrial enterprises face long return-on-investment cycles, high risks associated with collateral realization, and difficulties in obtaining bank loans. Therefore, future research can identify suitable land financing indicators to explore how land marketization promotes industrial HQD through the enhancement of land financing. Another limitation of this study is that the indicator system developed for evaluating industrial HQD requires improvement. For example, in the evaluation of enterprises' financial risk management, this study did not consider factors such as cash flow ratios, net profit margins, and inventory turnover rates due to the difficulty of obtaining the annual financial reports of listed companies in each city.

6.4. Policy Implications

The findings of this study have the following policy implications. First, to achieve optimized structural reform in the land market, the investment promotion interests of local governments and market laws should be considered, and the amount of land allocated through bidding and auction should be increased. Second, policies should aim to reduce deed tax, stamp duty, and urban land-use tax during land transactions. Reductions in these taxes can decrease production costs for enterprises and enhance their financial risk management capabilities. Third, the financial services available to the manufacturing sector should be increased to provide robust financial support for HQD. Financial development can alleviate the pressures of foreign divestment induced by increasing land prices [65]. Fourth, preferential policies in finance, treasury, and taxation should be formulated to encourage domestic enterprises to participate actively in the international economy.

7. Conclusions

This study explored the temporal evolution of and regional differences in urban land marketization and industrial HQD in Guangdong from 2007 to 2021. It conducted an econometric analysis to examine the effect of land marketization on industrial HQD. The conclusions of this study are as follows.

Urban land marketization is developing slowly in Guangdong, with agreement and listing being the primary methods of land transfer. Although the land marketization level in the non-PRD is higher than that in the PRD, the land marketization level in the PRD region has significantly increased from 2007 to 2021. Industrial HQD has occurred slowly in Guangdong. The PRD exhibits higher levels of industrial HQD than does the non-PRD, and this gap has widened over time. The scores of only industrial financial risk control and openness out of the seven indicators of HQD have declined in Guangdong. The PRD has outperformed the non-PRD in terms of industrial innovation, structural optimization, social welfare, greenness, and openness. The disparities in the scores of industrial innovation, structural optimization, and social welfare between the PRD and non-PRD have increased over time, whereas the disparities in the scores of efficiency, financial risk control, greenness, and openness have decreased over time. The results of this study validate Hypothesis 1, indicating that an increase in land marketization level significantly promotes industrial HQD. This effect was found to be more pronounced in the PRD than in the non-PRD. Moreover, the land marketization level has positive relationships with industrial innovation, structural optimization, efficiency, greenness, and social welfare; however, it has negative effects on enterprise financial risk control and openness. An increase in land marketization level causes greater enhancements in industrial innovation, efficiency, structural optimization, and openness but smaller enhancements in greenness, social welfare, and financial risk control in the PRD than in the non-PRD. Hypotheses 2 and 3 are confirmed. Land marketization influences industrial HQD through increases in land price or improvements in the business environment, with this mechanism being stronger in the PRD than in the non-PRD.

Author Contributions: Conceptualization, W.J. and T.L.; Data Curation, W.J. and Q.Z.; Funding Acquisition, W.J.; Methodology, W.J.; Supervision, T.L.; Writing—Original Draft, W.J. and Q.Z.; Writing—Review and Editing, W.J. and T.L. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by the Guangdong Planning Office of Philosophy and Social Science (grant numbers: GD23XYJ16 and GD23CYJ20) and the Guangdong University of Finance and Economics research project (2024GLPY010).

Data Availability Statement: The raw data supporting the conclusions of this study will be made available by the authors upon reasonable request.

Conflicts of Interest: The authors declare that they have no conflicts of interest.

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