How do industrial land price variations affect industrial diffusion? Evidence from a spatial analysis of China

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A B S T R A C T

Unreasonable industrial land price in China not only lead to a waste of resources and inefficient land use, but also seriously restrict the industrial optimizing configuration and layout. Different land price strategy is an important way to control and guide industrial development. It is unclear whether the industrial diffusion scale of different cities in China is attributable to the land price variations. Based on the calculation of industrial land price variation (*ILPV*) and industrial diffusion scale index (*IDSI*), this paper investigates their spatial distribution and characteristics. There is obvious regional difference in the lowest standard of industrial land transfer price (*LP*) and *ILPV*. The industrial diffusion scale index of eight industries have a spatial positive correlation in different cities. By using the spatial data of 2015, this study examines the spatial effect on the industrial land price variations of industrial diffusion scale and its determinants by the Geographical Weighted Regression (GWR) model. The empirical results prove that the *ILPV* has a remarkably negative effect on the industrial diffusion scale in the four kinds of industries and it has obvious spatial correlation on the industrial diffusion scale. Except for the trade freedom, other control variables have little influence on the industrial diffusion scale.

1. Introduction

The economic growth has been largely attributed to industrial development in China since 1978. Total industrial output value increases from 160.7 billion yuan in 1978–9.039 trillion yuan in 2015. The industrial sector of GDP accounts for approximately 40% of the total GDP in China in 2015. Rapid industrialization largely depends on an unfailing supply of industrial land use. Therefore, industrial land use becomes one of the most dominant forms of land use in China (Zhang et al., 2017). As the "world factory", China requires much industrial land (Zhang, 2006). Industrial land is an important input factor in industrial production. Therefore, industrial land prices are considered as the key driving force behind industrial development. Reasonable price policy is conducive to the rational allocation of the industry, which has great significance to realize the sustainable development of industry and optimize the allocation of land resources (Xie et al., 2016). In recent years, compared with the price of commercial land and residential land, industrial land price is not an overall improvement, indicating that the marketization degree of industrial use land is low as a whole.

With the expansion of industrial land, industrial configuration type and structure in each region have significant changes accordingly. The land cost of the eastern coastal developed areas gradually increased. Land and labor supply in the majority of the central, western regions and less developed coastal areas are relatively abundant, increasing a large number of new industrial land for the further development and expansion of the industry. The government intervention in industrial land market has proven essential for attracting investment and concentrating resources on the industrial development. However, "low land price" policy for the industrial land market and excessive intervention of the local government in the industrial land transfer result in unreasonable utilization of industrial land in different regions. It not only lead to a waste of land resources, but also decrease land use efficiency (Wu et al., 2014). Most low value-added industries transfer from the eastern region to the central and western regions by low industrial land price policy and further lead to industrial diffusion. At the same time, this has seriously restricted the industrial optimizing configuration and layout. Therefore, it is essential to study the impact of the industrial land price on industrial diffusion and establish a cooperative pricing mechanism (Wu et al., 2014).

Chinese industrial land price policy has experienced several stages in the transition from planned economy to market economy. The government adjusts industrial layout and industrial structure through

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industrial land policy, which has a profound impact on the industrial diffusion and industrial development. The industrial land policy in China has experienced four stages, including government assignment, agreement transfer, bidding, auction and listing of industrial land. In the planned economy period, China began a comprehensive economic construction and a large number of city construction lands were used in industrial construction. The assignment of industrial land use for free played an important role in the rapid recovery of industrial production after the founding of the PRC and in the establishment of industrial structure dominated by heavy industry. However, after the reform and opening up, duo to the entry of foreign investment and the increase of the land demand for economic construction, the government carried out the paid use of industrial land. Though the cost of land was far lower than its actual value, this marked the beginning of paid use of land. In 1990s, with the rapidly development of the industrialization, the contradiction between the supply and demand of land resources gradually increased (Dong, 2004). The government had adopted a low land price strategy intervention of land transfer policies, which stimulated the rapid expansion of industrial land (Qin et al., 2005). However, due to the lack of market regulation and low land price, the "imperfect mechanism" produced a series of problems and caused a great deal of harm (Chen, 2010), such as abandoned and idle industrial land (Ling, 2006), inefficient use (Choy et al., 2013), low levels of construction investment (Ling, 2006) and extensive land use (Wu, 2007). On the one hand, with GDP being the core of the appraisal system, the local governments provided more industrial land for industrial development in order to pursuit the GDP. On the other hand, there was also a competition between cities and regions, which leaded to the local governments reducing the price to attract more industrial enterprises. To tackle these problems, the government formulated "Lowest Standard of Industrial Land Transfer" and carried out the bidding, auction and listing system in 2006, which strengthened the regulation and management of industrial land use. In 2009, to give full play to the role of land policy in macro-control, the government adjusted the policy that part of the projects can reduce 30%–50% based on the standard. Of course, in order to promote the industrial structure upgrading, eliminate backward industries, the local governments also continuously improved the industrial land price standard in the eastern coastal region recent years. All the measures played an important role in establishing the reasonable price system of industrial land transfer, controlling the low cost of land use and creating a good environment for the development of the industry.

Though a growing body of literature on the industrial land price and the influence mechanism of industrial diffusion, little is known of the relationship between industrial land price variation and industrial diffusion. Land price is an important part of production costs of industrial enterprises, which affects the enterprise location, the industrial layout and industrial diffusion. The industrial land price variation has profound impacts on the industrial development. Different land price strategy is an important way to control and guide the differential development of industry. Besides, the government plays a complex role of making decisions regarding industrial diffusion by its intervention in the industrial land market. So the industrial land price variation can well reflect the land policy and land market price. However, it is still unclear whether the industrial diffusion scale of different cities in China is attributable to the land price variations. There is also a lack of research into the impact of industrial development based on the non-complete market price structure of China's industrial land. Moreover, China has a vast territory, with significant provincial differences in resource endowments and economic development level, the level of industrial development (Zhang et al., 2012). The industrial agglomeration and diffusion has obvious spatial differences of different regions. Meanwhile, there exist industry heterogeneity and spatial heterogeneity along with the distortion of industrial land price. Therefore, according to the price adjustment policies and market price changes, this paper aims to reveal the spatial distribution characteristics of

industrial land price variations and industrial diffusion scale. Using the spatial data of 2015, this study examines the spatial effect on the industrial land price variations of industrial diffusion scale and its determinants by the Geographical Weighted Regression (GWR) model. The policy suggestions are made to provide a reference for the optimization of city industrial land allocation and reasonable industrial layout. It is worth noting that the industrial diffusion can be studied from two angles: roll-in region and roll-out region. This study focuses on the change of industrial structure and the expansion of industrial scale from the angle of roll-in region.

The remainder of this paper is structured as follows: Section 2 presents the literature review of industrial land price and diffusion scale. Section 3 describes the methodology of GWR model and Moran's index; Section 4 presents data sources; results and discussion are given in Section 5; and the conclusions and policy implications are summarized in Section 6.

2. Literature review

Early studies on industrial land price mainly focused on the industrial land space balance (Lind, 1973; Southey, 1974), the theory of industrial localization (Krugman, 1991b), the efficiency of industrial land (Xiong and Luo, 2000) and industrial land speculation (Wang and Huang, 2004). According to the spatial economics theory of regional equilibrium and location marginal revenue, Alonso (1964) proposed the land rent model and further introduce the distribution and spatial structure of the industrial land, residential land and commercial land within the city. In the market competition, the spatial distribution of land in the city depends on all kinds of activities which can pay the rent. Goldberg and Chinloy (1984) investigated the demand for industrial land types and urban land supply and price by a series of system analysis. From the study method, structural equation model (SEM) and geographically weighted regression (GWR) model were widely used to study the industrial land price (Lockwood and Rutherford, 1996; Thompson and Tsolacos, 2002). Recent year, some scholars paid more attention on the internal competition of industry land price (Wu et al., 2014) and land property rights (Lai et al., 2014). Based on the industrial land transfer agreements, the local governments attract investment by the low land price or even zero price in China (Li, 2005a,b; Cao et al., 2005). This could be attributed to the incomplete property rights over collective land (Lai et al., 2014). Wang et al. (2012a,b) explored the relationship between industrial land price and industrial agglomeration in China and found the impact of industrial agglomeration on industrial land price is vary in different regions. Xie et al. (2016) found that industrial land prices have a direct impact on sustainable development of industry use land.

Studies on the industrial diffusion increasingly have attracted the attention of scholars. The industrial agglomeration and diffusion are determined by the centripetal force and the centrifugal force of regional economic development. The centripetal force mainly includes the external economy formed by industrial agglomeration. The centrifugal force is the increase of the production cost, which includes the land cost, labor cost and trade cost in the original production area. The intermediate product model showed that price index effect, market access effect and congestion cost determines spatial distribution regularities of various types of industries (Krugman, 1991a). Martin and Rogers (1995) carried out the Footloose Capital model to partially amend the hypothesis of core-periphery model. They found that the industrial agglomeration and diffusion were influenced by market access effect and congestion cost. Foot loose Entrepreneur (FE) model was proposed by Forslid and Ottaviano (2003), which was a spatial economic model based on the core-periphery model and footloose capital model. Industrial agglomeration and diffusion is explained by the hypothesis that the human capital or entrepreneur can flow freely (Ottaviano, 1996). Krugman and Venables (1995) believed that industrial aggregation and diffusion were the influence of the cost and demand on the enterprises