Research Article

Land Price Distortion, Financial Development, and Regional Innovation

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As an important tool for local governments to implement regional development policies, the allocation of land resource plays an important role in promoting regional innovation and development. Based on the microdata of land transfer in 287 cities in China from 2007 to 2017, this study examines the relationship between land price distortion, regional financial development, and regional innovation ability. The results show that land price distortion promotes the improvement of regional innovation ability. There is a significant time-lag effect because it is mainly realized by increasing the fiscal revenue of local governments and providing implicit subsidies to enterprises. The larger the financial scale is, the better the financial structure is and the higher the financial efficiency will further strengthen such a positive effect. Further analysis shows that the impact of land price distortion on improving regional innovation ability is significantly different between central or western regions and the eastern regions. This study provides empirical evidence for promoting regional innovation ability by land price distortion, which is conducive to a better understanding of the importance of reasonable land resource allocation and financial market development in the process of high-quality economic development, providing a useful insight into China’s future reform of land market and financial market.

1. Introduction

In the process of China’s urbanization and industrialization in recent years, land resources have played an important role. As an essential production factor, land resource is an important tool for local governments to implement regional development policies. Reasonable allocation of land resource can attract external investment, increase fiscal revenue and public expenditure, and then realize the purpose of promoting urbanization and industrialization. However, as the main way of land resource allocation at present, the land market has been operating in a state of low efficiency. One of the main features is that the pricing mechanism of land resource has been distorted for a long time. That is, within the same city, the prices of commercial land, residential land, and industrial land have been seriously deviating. As China’s development mode is gradually changing from the traditional factor-driven mode to the innovation-driven mode, how the distortion of land price affects regional innovation ability is an important topic related to the transformation of China’s economic growth momentum and the stimulation of regional innovation potential.

According to existing studies, the reason for the distortion of land price is that local governments make full use of the power of land acquisition and transfer granted by the Land Management Law and implement differential pricing strategies for different types of land [1]. On the one hand, the motivation of “land finance,” also called “tudicaizheng” in Chinese, urges local governments to make up for the decline of fiscal revenue (which was caused by the reform of tax sharing system) by selling residential lands at a high price to obtain land transfer fees. On the other hand, motivated by
promotion chances, local governments tend to sell industrial lands at a low price to attract industrial investment in order to develop the local economy and establish political achievements in a short five-year political tenure. The joint effects of land finance motivation and investment attraction motivation of governments finally lead to land price distortion.

No matter what the motivation of the local government is, land transferring is proved to have an important impact on regional innovation ability. Under the motivation of "land finance," the land transfer behaviour of local governments has objectively accelerated the urbanization process in China, and the financial revenue brought by it is conducive to promoting the improvement of infrastructure [2, 3], which will have a positive effect on the ability of regional innovation. However, at the same time, land finance behaviour also brings a series of negative effects, such as boosting the housing prices to rise too fast [4], inducing land illegal and corruption cases [5, 6], and crowding out enterprise innovation elements and destroying institutional environment [7], thus hindering regional innovation. Under the motivation of investment attraction, the industrial capital that was attracted will have positive effects on regional innovation [8]. However, at the same time, in order to realize the rapid economic growth during their political tenure, local officials may lower the quality of investment and trigger "race-to-bottom" competition, which sometimes inhibits regional innovation [9]. At present, the existing studies mainly consider the impact of land transfer behaviour under the single government motivation on regional innovation ability, but there is almost no empirical study on the impact of urban land price distortion on regional innovation ability by combining the two motivations. Therefore, this paper combines the two motivations into the analysis of regional innovation, which can give us a more comprehensive view of the impact of land price distortion. Our study argues that the distortion of land price will actually provide two types of subsidies to enterprises, both explicit and implicit, thus improving regional innovation ability.

In addition, as the main player of technological innovation, enterprise’s R&D input is crucial for the improvement of regional innovation ability. Since the R&D activities require stable and large amounts of capital as support, financial market plays an important role in this process which should not be ignored [10–12]. Some scholars have argued that when local governments provide subsidies to enterprises, a certification effect will be released [13–18]. Developed financial markets can make use of such signal to reduce information asymmetry more effectively, thus reducing external financing constraints of enterprises and finally promoting regional innovation. Therefore, this paper holds the view that while land price distortion brings substantial subsidies to enterprises, regional financial market development will directly affect the effectiveness and diversity of external financing channels of enterprises in this process and then plays a positive role in moderating the effect of land price distortion to enhance regional innovation ability.

In order to clarify whether land price distortion promotes regional innovation, this paper uses the panel data of 287 prefecture-level cities from 2007 to 2017 to explore the influence of land price distortion on regional innovation ability. Furthermore, this paper also includes the effects of regional financial market development in the analysis of the impacts of land resource on regional innovation, explores the moderating effects of local financial market development in this process, and provides empirical evidence for it.

2. Literature Review

2.1. Land Price Distortion and Its Causes.

"The Provisional Regulations on Assignment and Transfer of the Right to the Use of State-owned Lands in Urban Areas," issued in 1990, has granted prefecture-level and county-level governments the monopoly right in the primary market of state-owned lands. Therefore, the allocation of land resource has become an important tool for local governments to implement regional development policies or industrial policies [19], and they can promote urban development through carrying out various urban renewal projects [20]. However, as the most important resource allocation mechanism, the market for land transfer has been operating inefficiently in recent years. The most important manifestation is that the land prices are highly distorted; that is, in the same city, the price ratio between residential lands and industrial land has been deviating from the normal level for a long time and has kept expanding. Existing literature holds the view that the distortion of land price is caused by the local government’s differentiated pricing strategies for different land types and different land transfer behaviours [1], while the differentiated land transfer strategies are caused by the local government’s "land finance" motivation and investment attraction motivation. Under the land finance motivation, local governments tend to make up for the decline of fiscal revenue (which was caused by the tax sharing system) by selling residential lands at high prices to obtain land transfer fees. Meanwhile, in order to promote economic development and establish political achievements of local officials, local governments sell industrial lands at low prices to attract investment. The excessively high commercial or residential land prices and low industrial land prices together lead to land price distortion, which will have significant impacts on national economic development.

2.2. Land Price Distortion and Regional Innovation.

Enterprises’ innovation not only relies on internal factors like successful marketing-R&D integration and knowledge exchange within enterprises [21] but also depends on external resource input. Since land transferring is an essential behaviour of resource allocation, which greatly affects the production and business activities of enterprises, it will inevitably have indirect impacts on regional innovation activities. Currently, there are different opinions about the influences of land transferring on regional innovation activities under the land finance motivation. Some scholars’ conclusions show that land finance will inhibit regional
innovation because the improvement of urban infrastructure will bring significant capitalization effects, encouraging regional real estate bubbles [22]; for instance, Wen et al. have found that the construction of urban rail transit significantly uplifts the land price [23]. Miao and Wang have demonstrated that the existence of a regional real estate bubble will attract investment from nonreal estate enterprises and then discourage their innovation investment. Therefore, the behaviour of land finance has a potential inhibiting effect on regional innovation ability [7]. However, some scholars argue the opposite. For instance, fiscal revenue created by transferring residential and commercial lands can significantly promote the regional innovation ability because local governments can make use of such fiscal revenue to increase local science and education expenditure. This reduces the cost gap of investment attraction activities, thus promoting the improvement of regional innovation ability [24]. Through existing literature, our paper finds that the positive interaction between land finance and urban construction seems to provide favourable conditions for improving regional innovation ability. However, it is worth noting that although these studies provide evidence for the influences of land finance behaviour on regional innovation ability, they do not pay enough attention to the coefficients of another kind of motivation, the effects of investment attraction motivation.

Existing literature has identified the tools with which local government officials attract investment, such as tax incentives, adjusting the structure of government expenditure, improving infrastructure, and relaxing environmental regulatory standards. Driven by the motive of investment attraction, local governments can also attract industrial investment by selling industrial lands in large quantities [1], thus driving economic development and establishing political achievements to gain advantages in promotion competition [25]. On the one hand, investment attraction policies will have a positive impact on the local innovation ability. For example, government subsidies and tax incentives will have an incentive effect on enterprises’ innovation activities [26, 27]. On the other hand, the results of investment attraction will also have a direct positive impact on local technological innovation [8]. However, according to the research of Romer and Jones, innovation capital and talents are the most important factors affecting regional innovation ability [28, 29]. Therefore, the industrial lands sold by local governments at low prices for the purpose of investment attraction actually provide implicit subsidies to local enterprises, which may encourage enterprises’ R&D activities. However, under the motivation of investment attraction, local governments will compete to lower the land prices in order to expand the scale of investment attraction. Such excessive transfer of industrial lands has also been confirmed by many scholars, including corruption, environmental pollution, and destruction of the institutional environment [30, 31], and these influences are undoubtedly negative to regional innovation ability.

Although these two kinds of land transferring behaviour and their influences on regional innovation ability have been fully recognized, discussing one of the two kinds of transferring behaviour separately is not enough to explain the effects of price distortion on regional innovation ability. As the two types of transferring behaviour together lead to the distortion of the land price and deeply affect China’s economic development, it is reasonable to guess that not only do these two kinds of differentiated land transferring behaviours lead to the distortion of land price, but also their potential mechanism will undoubtedly have significant impacts on the regional innovation ability. Our paper hopes to make some marginal contribution from this perspective.

2.3. Financial Market Development and Regional Innovation. The improvement of regional innovation ability is complex progress [32], which is not only affected by land resource but also affected by local financial market development. An efficient financial market can effectively alleviate the financing constraints faced by enterprises and plays a guiding role in the resource allocation process of a country or region. Therefore, the development of the local financial market will also have significant impacts on regional innovation ability, and it is necessary to include it in our analysis.

As for the impacts of the financial market on innovation activities, existing studies mainly discuss two aspects: on the one hand, the development of the financial market can alleviate information asymmetry and guide allocation of resources reasonably. Chowdhury and Maung found that the development of the financial market can alleviate information asymmetry in R&D investment and then improve output efficiency [11]. Maskus, Neumann, and Seidel studied the influence of domestic and international financial market development on industrial R&D expenditures by taking 22 manufacturing industries in 18 OECD countries from 1990 to 2003 as research objects. The results show that various financing channels of domestic financial market development have a positive effect on industrial R&D expenditures [10]. On the other hand, the development of regional financial market can reduce financing costs by alleviating financing constraints caused by credit bias. Rajan and Zingales, Demirguc-Kunt, and Maksimovic found that financial development has a positive impact on enterprises’ financing channels, thus promoting the growth of industries and enterprises which are dependent on external financing [33, 34]. Claessens and Laeven proposed that the development of the financial market of a country affects the channels for enterprises to obtain external financing and determines the resources available for investment, thus affecting the growth of enterprises. The demand for houses or lands ascends as the total credit allocation increases within the region, which will further boost the expectations of local lands, and this will no doubt help improve enterprises’ ability to get bank loans or other liabilities while mortgaging lands as collateral. According to the conclusion of existing research, the development of regional financial development can help ease the financing constraints of enterprises and meet the capital needs of enterprises to carry out R&D activities, thus playing a moderating role in the process of land price distortion affecting regional innovation ability.
Our paper tries to make some contributions from this perspective.

Another potential explanation is that higher financial market development implicates an easier way for local governments to get financing. As local governments seek to expand infrastructure investment, a huge number of urban construction investment companies are established during the past twenty years whose duty is to help local governments finance from capital markets, including loan market and bond market, since the central government has prohibited local governments from financing from banks directly. By transferring lands to urban construction investment companies and mortgaging lands to banks as collateral, local governments can get bank loans through these companies and invest in infrastructure construction, which will help improve cities’ innovation ability.

To sum up, the existing literature only considers the influences of land transferring behaviour under a certain motivation of local governments on regional innovation ability but fails to recognize the joint effects of two motivations on regional innovation ability. In addition, existing studies often separate the relationship between financial development, land price, and regional innovation, but there is an inseparable relationship between the land resource and regional financial markets. At present, there is no literature systematically analyzing such a relationship. Therefore, the innovation of our paper is to clarify the inner correlation between land price distortion, regional financial development, and regional innovation ability.

3. Theoretical Framework and Hypothesis

According to the analysis of the existing studies, we find that the distortion of land price is actually caused by the local government’s land finance motivation and investment attraction motivation. However, due to the availability of data, most studies only focus on the total income of land transferring but fail to distinguish income generated from different types of land. Since local governments have different transferring strategies for different types of lands, we believe that the total income from land transferring actually covers two different government behaviours. As Tao found, local governments tend to sell commercial and residential lands at high prices and sell industrial lands at low prices [1]. The former generates what we call “land finance” revenue, while the latter contributes little to fiscal revenue due to the low or even “zero” price of industrial lands. In addition, existing studies usually explain the impacts of local governments’ land finance behaviour on regional innovation ability from the perspective of “expenditure bias,” but as local governments’ total revenue increases, governments’ expenditure on other subjects should not decrease. However, some existing studies also found positive relationships between land finance and governments’ public capital investment. By increasing the city’s capital stock, the infrastructure is improved, and the cities are expanded. As the revenue created by land finance increases, local governments tend to finance more from bank loans or bond markets because they believe they have the ability to repay such huge amounts of debts. By doing so, the cities are expanded, and infrastructures are constructed, which have incurred population inflow. Thus, at least in less developed cities, regional innovation abilities are improved.

As for the impacts of land prices on regional innovation under the motivation of investment attraction, this paper argues that it is necessary to take financing constraints of enterprises in R&D activities into account, as selling industrial lands at low prices have provided an effective tool for enterprises to alleviate their financing constraints. In the early stage of project investment, local governments can control the factor market and lower the price of industrial lands to attract enterprises to settle in, thus reducing their costs. In the process of project implementation, enterprises can mortgage the lands to the bank at market prices higher than the purchasing costs to obtain loans. After the completion of the project, the enterprise can transfer the land use right at a market price far higher than the acquisition cost. The huge intermediate price difference creates a huge additional income for the enterprise, forming a huge substantial subsidy for the enterprise investment. As we know, enterprises are the channels and carriers for the agglomeration of production factors. The establishment of new enterprises or the expansion of existing enterprises will further promote the growth of urban population, capital level, information and knowledge, and other factors. So if local governments allocate more resources, especially land resources, to enterprises, the enterprise cluster will thus be formed, and regional innovation ability will be further improved.

Although there is a considerable amount of literature studying the impact of government subsidies on enterprise innovation, such studies only study the impacts of direct government R&D subsidies on enterprise. There is still a lack of systematic evidence on the impact of implicit subsidies caused by land price distortion on regional innovation. By distorting land prices, local governments sell industrial lands at a low price to enterprises, which may help ease the financial constraints on enterprises’ innovation activities. On the other hand, local governments transferring lands at a low price to enterprises also encourage the enterprise cluster, thus increasing enterprises’ R&D investment and enhancing regional innovation ability.

Besides, most innovation demands are generated in the process of industrial production, and industrial production provides an important interaction place for the dissemination of new knowledge and the use of new technology, so there is an inseparable relationship between industrial base and urban innovation. The stronger the industrial base, the more likely it is to provide carrier and support for innovation activities and the more conducive to promoting urban innovation. In the early stage of industrialization and urbanization, China’s commercial and residential land use mode of “generating wealth from land” helped local governments quickly accumulate huge wealth needed by urbanization and ensured the infrastructure construction of industrial production. The “land to attract capital” method of industrial land utilization helps the government to attract a large amount of manufacturing capital in a short time.
Together, they can greatly promote the formation of urban industrial base and guarantee the basic industrial carrier needed for innovation activities.

If the above mechanism does exist, there should be a lag effect. Based on the above theoretical analysis, this paper proposes the following hypothesis:

H1a: The distortion of land prices can significantly improve the ability of regional innovation, which has a lag effect (direct effect).

Although the explicit subsidies provided by local governments can directly alleviate the financing constraints of enterprises to some extent, they are nothing compared to the large R&D inputs of enterprises. Therefore, another important function of government subsidies lies in the certification effect, that is, the government’s recognition of a certain R&D project. This would actually boost investors’ expectations about the success rate of the project, making companies more likely to obtain external financing. As mentioned above, one of the functions of financial markets is to alleviate information asymmetry. So when local governments sell residential lands at high prices and use the revenue to subsidize local enterprises, the developed financial market will be able to reduce the information asymmetry more effectively through this kind of “certification effect” and identify high-quality research and development projects, improving the possibility of subsidized enterprises’ access to external finance and strengthening the positive effects of land price distortion.

In addition, industrial lands purchased from governments allowed enterprises to obtain bank loans by mortgaging the land. In fact, commercial bank loans are still the main financing source for China’s enterprises at present, and mortgage loans are the main type of credit. The low price of industrial lands will inevitably reduce the value of collateral. As a result, in the central and western regions where enterprises rely heavily on land mortgage loans, the decline of collateral value will undoubtedly increase the financing difficulty of enterprises. Another major function of financial markets is to broaden the financing channels, so when local governments sell industrial lands to enterprises at low prices, a more developed financial market can reduce enterprise’s dependence on mortgage loan, easing external financing difficulties of enterprises and further enhancing the positive effects of land price distortion. Therefore, hypothesis 2 is proposed in our paper:

H2a: The promotion of regional financial development level can strengthen the promotion effect of land price distortion on regional innovation level.

Generally speaking, the relation between variables studied in this paper is shown in Figure 1.

4. Empirical Strategy and Variables

4.1. Baseline Regression. According to the above analysis, under land finance motivation and investment attraction motivation, local governments obtain fiscal revenue by selling residential land at high prices and selling industrial lands at low prices to enterprises to attract investment. This paper uses the following econometric model to reflect the impact of land price distortion on regional innovation:

\[
\ln \text{inpatents}_i = \beta_0 + \beta_1 \text{distort}_{i,t} + \gamma \text{control}_i + \mu_i + \lambda_t + \epsilon_{it}.
\]

(1)

Considering the influences of land price distortion on regional innovation ability may have a time-lag effect, we further include the lagged term of land price distortion into the model:

\[
\ln \text{inpatents}_{i,t} = \beta_0 + \beta_1 \text{distort}_{i,t-1} + \gamma \text{control}_i + \mu_i + \lambda_t + \epsilon_{it},
\]

\[
\ln \text{inpatents}_{i,t} = \beta_0 + \beta_1 \text{distort}_{i,t} + \beta_2 \text{distort}_{i,t-1} + \gamma \text{control}_i + \mu_i + \lambda_t + \epsilon_{it}.
\]

(2)

In the above models, \( \ln \text{inpatents}_i \) is the variable to measure regional innovation ability, which represents the natural logarithm of the number of patent grants per 10,000 people in \( i \) city in \( t \) year. The improvement of innovation ability requires enterprises to go through a series of processes, including R&D inputs, outputs, and transformation into economic value. Some of the existing studies mainly use R&D input or patent application data to measure the innovation ability of the enterprise. However, since R&D inputs do not certainly produce outputs, the amount of R&D inputs or patent application can only unilaterally reflect the subjective intention of regional market players to conduct R&D and innovation activities, while the number of patents granted reflects the regional innovation output after official audit. Therefore, based on the comprehensive measurement of authority and availability of data, we suggest that the number of patents granted can objectively reflect the innovation ability of a region. The key explanatory variable in this paper is the distortion degree of land prices. Existing studies mainly measure the distortion degree with industrial land prices, but this method only analyzes the distortion phenomenon from the perspective of industrial lands, without taking into account the price of residential lands. Instead of being limited to a single type of land, this paper uses the ratio of the average land price of residential land \( P_r \) and the price of industrial land \( P_i \) to measure land price distortion. If the degree of land price distortion can promote the development of regional innovation ability, then the value of \( \beta_1 \) should be significantly positive.

control_i is a collection of control variables. In addition, annual dummy variables are used in the model to reflect the time fixed effect \( \mu_i \) so as to control the influence of the macroenvironment changes on the overall innovation ability. The individual fixed effect \( \lambda_t \) of cities is also used to control the unobserved differences between cities.

4.2. Moderating Effects. In order to further study the different impacts of land price distortion under the effects of different financial market development, we add the interaction term to the baseline Model (1) and reestimate the following equation:
\[ \ln \text{patents}_{it} = \beta_0 + \beta_1 \text{distort}_{it} + \beta_2 \text{distort}_{it} \ast F_{it} + \beta_3 F_{it} + \gamma \text{controls}_{it} + \mu_i + \lambda_t + \epsilon_{it}. \]  

(3)

In the analysis of moderating effect, \( F_{it} \) is the variable to measure the regional financial market development level. This paper comprehensively measures the level of local financial development from financial development scale (\( \text{fin\_scale} \)), structure (\( \text{fin\_stru} \)), and efficiency (\( \text{fin\_effi} \)). Among them, the financial scale is measured by the ratio of the total deposits and loans of financial institutions to the nominal GDP of the year in each city. The financial structure is measured by the ratio of the loan balance of the financial institutions to the nominal GDP. Financial efficiency is based on the ratio of loan balance to deposit balance of financial institutions. In the case that land price distortion will enhance regional innovation ability, if higher local financial development level will strengthen the positive effects of land price distortion, \( \beta_2 \) should be significantly positive.

4.3. Variables and Descriptive Statistics. The dependent variable in this paper is the ability of regional innovation, which is the natural logarithm of the number of patent grants per 10,000 people per year in the region. The data are obtained from the China Urban Statistical Yearbook of each region. Explanatory variables are divided into three categories. One category is the core explanatory variable, namely, the distortion degree of land prices (\( \text{distort}_{it} \)), which is measured by the ratio of the average price of residential lands to the average price of industrial lands. The land price data are crawled from China Land Market website. On the basis of the Yearbook, this paper adjusts the statistical calibre of residential lands and industrial lands and deals with the missing value of some cities or some years.

Another category is the control variables. On the basis of existing literature, the following control variables are selected in our paper: disposable income per capita (\( \text{di\_per\_capita} \)), which reflects the economic development level of the city. We also control the degree of local government’s dependence on land finance by calculating the ratio of residential land transfer fees to budgetary fiscal revenue (\( \text{dependon} \)). The proportion of general high school students and vocational students to population (\( \text{local\_hr\_pop} \)) is used to control the influence of human capital on regional innovation, savings per capita (\( \text{sav\_person} \)) is used to control the potential of a place, and industrial dust (\( \text{dust} \)) is used to control the impact of the urban environment. The proportion of fiscal expenditure to GDP (\( \text{govern scale} \)) is used to control the impact of government input. Government fiscal pressure (\( \text{fin\_press} \)) is used to control the potential fiscal expenditure behaviour of local governments. Government R&D expenditure (\( \text{lnsci} \)) is used to control R&D investment. Among them, the financial pressure of local governments is measured by the ratio between the amount of fiscal deficit of current year and fiscal budget expenditure, but when fiscal revenue is greater than fiscal expenditure, the value of this variable is 0, indicating that the city has no financial pressure in this year. The data on residential land transfer fees are obtained from the land transfer data from 2008 to 2017 published by China Land Market website.

The third category is the moderating variable, which is the level of local financial market development. We measure the level of financial market development from multiple perspectives, specifically including three indicators of local financial development scale, structure, and efficiency. All the data come from China City Statistical Yearbook.

Descriptive statistical results of variables are shown in Table 1. It can be found that the average price ratio of

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure1.png}
\caption{The relationship between land price distortion, local financial development level, and regional innovation level.}
\end{figure}
residential lands to industrial lands in China is around 9, indicating the serious distortion of the current land prices. At the same time, the distortions vary from place to place, with the ratio of the two types of land in the worst places reaching 70. What is more, the difference in other variables is also significant, which illustrates the seriousness of the current imbalanced development among regions. In order to exclude the influences of such extreme value, we have made 1% tail indentation for all continuous variables before currentimbalanceddevelopmentamongregions.Inorderto also significant, which illustrates the seriousness of the reaching 70. Whatismore,thedifferenceinothervariablesis distortion caused by governments has a positive promoting effect on the regional innovation ability, and this effect will not have a direct impact in the current period but also have a significant lag effect. Therefore, hypothesis 1 is verified.

5.2. Moderating Effect Regression. We introduce the interaction term between the land price distortion and the level of local financial market development in this part. The estimation method and the selection of control variables are consistent with the baseline regression. Among them, we measure the level of local financial market development from three aspects, financial efficiency, financial structure, and financial scale, to ensure the comprehensiveness of the study.

The results are shown in Table 3. In all models with interaction terms, the coefficients of interaction terms between financial efficiency, financial structure, and financial scale and the distortion degree of land price are significantly positive at the level of 5%. This indicates that land price distortion has a more significant effect on the improvement of regional innovation levels in the regions with large scale, high efficiency, and well-structured financial markets. That may be because local governments can send a positive signal to investors, namely, the “certification effect,” by providing subsidy support to enterprises through distorting land prices. In the region with a more developed financial market, this signal can more effectively alleviate the external fi-nancing constraints of enterprises. Therefore, hypothesis 2 has also been verified.
5.3. Robustness Test

5.3.1. Replacing the Sample. In our robustness test, the land price data of 103 key cities from 2012 to 2017 published in Yearbook (Lhasa was excluded due to the lack of other data) were used for reestimation. Data source, control variables, model setting, and estimation method are all kept unchanged. Table 4 reports the results after narrowing the number of individuals in the sample and the time span. Results in column (1) and column (2) show that the core explanatory variable regression coefficient is still significantly positive, which means that, in these 103 cities, land price distortion can still play the role of promoting regional innovation ability. However, compared with the baseline regression of 287 cities, although the sign of the regression coefficient of the core explanatory variable remains positive, its absolute value increases. This may be because the enterprises that can be set up in the 103 key cities are usually possessed with strong research and development capabilities or financial support. Therefore, when the land price is distorted, the government’s subsidies for such enterprises can play a more effective role. At the same time, compared with other cities, as the infrastructure environment and industrial chain of these 103 key cities are more complete and the industrial base has been formed, the explicit and implicit subsidies from the government to the enterprises can be transformed into innovation achievements more effectively. This is evidenced by the fact that the absolute value of the regression coefficient of the current term of the core explanatory variable in baseline regression (3) is greater than that of the first-order lag term.

5.3.2. Changing the Estimation Method. In order to avoid model misspecification and endogeneity of missing variables, this paper uses the lagged term of the dependent variable to alleviate this problem. However, the correlation between the first-order lag term and the random error term will lead to biased OLS estimation, so we adopt the estimation method of systematic GMM to deal with the endogeneity problem caused by the lag term of the explained variable. Table 5 reports the estimated results obtained by using the systematic GMM method. The regression coefficients of the core explanatory variables are significant at the 1% level when the lag term is included, and they all pass the residual autocorrelation test and the overidentification test of instrumental variables. This result proved the conclusion that such positive effects are caused by land price distortion of last year. Therefore, it can be considered that the system GMM estimation method alleviates the endogeneity problem, and our result is robust.

5.3.3. Endogeneity Test. In the robustness test section above, we have used the systematic GMM method to solve the endogeneity problem from the estimation method. In terms of model setting, some may argue that the land price distortion caused by the government will affect the financing conditions of enterprises through the intermediary channel of the local financial market, which means the development level of the local financial market will be affected by land price distortion and then affect regional innovation ability. In other words, there might be a mediating effect rather than a moderating effect between these variables. Therefore, the possible mediating effect was tested in this paper. Tables 6–8, respectively, report the test results of mediating effect of three indicators to measure the level of local financial market development. It can be seen that the regression coefficient of the core explanatory variable is not significant, indicating that land price distortion does not have an impact on the local financial development level. Moreover, the three models testing the intermediary effect do not pass the Sobel test, so it can be considered that the intermediary effect does
not exist. Therefore, setting the relationship between land price distortion and the level of local financial market development as a moderating effect is not only in line with the realistic background but also supported by economic theory and empirical results, and it can be considered that there should be no endogeneity bias in model setting in this paper.

5.4. Regional Heterogeneity. Considering the vast territory of China, resource endowment and economic development differ greatly among regions, and the special political and economic system will further amplify the regional differences, which is bound to have different influences on regional innovation by land price distortion. Therefore, this paper classifies 287 cities according to eastern and central and western regions to explore the regional heterogeneity of land price distortion on regional innovation ability.

We divided the samples into two parts, the eastern region and the central and western region, to test the effects of land price distortion under such two conditions, respectively. The empirical results in Table 9 show that there is indeed a difference in the effect of land price distortion on

### Table 4: Baseline regression of 103 key cities.

| Dependent variable: lnppatents | Baseline (1) | Baseline (2) | Baseline (3) |
|--------------------------------|-------------|-------------|-------------|
| distort                       | 0.0160***   | 0.0117***   |             |
|                               | (0.005)     | (0.004)     |             |
| L.distort                     |             |             |             |
|                               | 0.0197***   | 0.0133***   |             |
|                               | (0.005)     | (0.005)     |             |
| Constant                      | 1.0585***   | 1.0507***   |             |
|                               | (0.375)     | (0.372)     |             |
| Observations                  | 477         | 477         |             |
| R-squared                     | 0.470       | 0.475       |             |
| Number of cities              | 103         | 103         |             |

Notes. Robust standard errors in parentheses; *, **, and *** represent the significance level of 10%, 5%, and 1%, respectively.

### Table 5: Estimate results of system GMM method.

| Dependent variable: lnppatents | SYS-GMM (1) | SYS-GMM (2) | SYS-GMM (3) |
|--------------------------------|-------------|-------------|-------------|
| distort                       | 0.0018      |             | 0.0022*     |
|                               | (0.001)     |             | (0.001)     |
| L.inppatents                  |             | 0.9096***   | 0.8681***   |
|                               |             | (0.087)     | (0.065)     |
| L.distort                     |             | 0.0040***   | 0.0034***   |
|                               |             | (0.001)     | (0.001)     |
| Controls                      | Yes         | Yes         | Yes         |
| City                          | Yes         | Yes         | Yes         |
| Year                          | Yes         | Yes         | Yes         |
| Observations                  | 287         | 287         | 287         |
| Number of cities              | 3,017       | 2,733       | 2,733       |
| AR1                           | 0.000       | 0.000       | 0.000       |
| AR2                           | 0.324       | 0.369       | 0.365       |
| Hansen P                      | 0.402       | 0.783       | 0.961       |

Notes. Robust standard errors in parentheses; *, **, and *** represent the significance level of 10%, 5%, and 1%, respectively.

### Table 6: Results of financial efficiency mediating effect test.

| Connotation of the model dependent variable | Total effect lnppatents | Mediating effect (1) fin_effi | Mediating effect (2) lnppatents |
|---------------------------------------------|-------------------------|-----------------------------|-------------------------------|
| Distort                                     | 0.0044***               | -0.0001                     | 0.0044***                     |
|                                             | (0.002)                 | (0.001)                     | (0.002)                       |
| fin_effi                                    |                          |                             |                               |
|                                             | 0.0599                  |                             |                               |
|                                             | (0.038)                 |                             |                               |
| Controls                                    | Yes                      | Yes                         |                               |
| City                                        | Yes                      | Yes                         |                               |
| Year                                        | Yes                      | Yes                         |                               |
| Observations                                | 3,020                   | 2,733                       | 2,733                         |
| R-squared                                   | 0.079                   | 0.079                       | 0.779                         |
| Number of cities                            | 287                      | 287                         | 287                           |
| Sobel                                       | -0.857                  |                             |                               |

Notes. Robust standard errors in parentheses; *, **, and *** represent the significance level of 10%, 5%, and 1%, respectively.
regional innovation ability between the eastern region and the central and western regions. In the three models, the land price distortion in the eastern region has no significant effect on the regional innovation ability either in the current period or in the lagging period. In the current model and the lagging model, the distortion of land price in the central and western regions has a significant promoting effect on the regional innovation ability.

As for the reason of such results, we think that due to the fact that the revenue of central and western cities is usually less than the eastern region, their off-budget income from transfer payments (now called government-managed funds) not only can be used to provide subsidies for enterprise but also can be used for the construction of infrastructure; therefore, the economic benefits will be more significant than cities in the eastern regions where there is an improved infrastructure environment, a complete industrial chain, and market demand. We also suppose that, with the deepening of economic development and industrialization, urban innovation will gradually change from integrated innovation to original innovation. At this stage, all innovation activities are groping forward, and it is difficult for the government to

| Table 7: Results of financial scale mediating effect test. |
|----------------------------------------------------------|
| Connotation of the model dependent variable | Total effect lnppatents | Mediating effect (1) fin_scale | Mediating effect (2) lnppatents |
|-------------------------------------------------|-------------------------|-----------------------------|-------------------------------|
| Distort                                         | 0.0044*** (0.002)       | -0.0114 (0.011)             | 0.0045*** (0.002)             |
| fin_scale                                       |                         |                             | 0.0015*** (0.000)             |
| Controls                                        | Yes                     | Yes                         | Yes                           |
| City                                            | Yes                     | Yes                         | Yes                           |
| Year                                            | Yes                     | Yes                         | Yes                           |
| Observations                                    | 3,020                   | 3,015                       | 3,011                         |
| R-squared                                       | 0.779                   | 0.018                       | 0.778                         |
| Number of cities                                | 287                     | 287                         | 287                           |
| Sobel                                           |                         |                             | -0.816                        |
| Notes. Robust standard errors in parentheses; *, **, and *** represent the significance level of 10%, 5%, and 1%, respectively. |

| Table 8: Results of financial structure mediating effect test. |
|---------------------------------------------------------------|
| Connotation of the model dependent variable                   | Total effect lnppatents | Mediating effect (1) fin_stru | Mediating effect (2) lnppatents |
|--------------------------------------------------------------|-------------------------|--------------------------------|--------------------------------|
| Distort                                                       | 0.0044*** (0.002)       | -0.0001 (0.001)                | 0.0045*** (0.002)              |
| fin_stru                                                      |                         | 0.0037*** (0.001)              |                                |
| Controls                                                      | Yes                     | Yes                            | Yes                            |
| City                                                          | Yes                     | Yes                            | Yes                            |
| Year                                                          | Yes                     | Yes                            | Yes                            |
| Observations                                                  | 3,020                   | 3,024                          | 3,011                          |
| R-squared                                                     | 0.779                   | 0.079                          | 0.778                          |
| Number of cities                                              | 287                     | 287                            | 287                            |
| Sobel                                                         |                         | -0.774                         |                                |
| Notes. Robust standard errors in parentheses; *, **, and *** represent the significance level of 10%, 5%, and 1%, respectively. |

| Table 9: Regional heterogeneity analysis.                      |
|---------------------------------------------------------------|
| Dependent variable lnppatents                                 | East regions (1) | West regions (2) | East regions (3) | West regions (4) |
|--------------------------------------------------------------|-----------------|-----------------|-----------------|-----------------|
| Distort                                                      | 0.0021 (0.003)  | 0.0053*** (0.002) | 0.0020 (0.002)  | 0.0071*** (0.002) |
| L_distort                                                    |                 |                 |                 |                 |
| Controls                                                     | Yes             | Yes             | Yes             | Yes             |
| City                                                         | Yes             | Yes             | Yes             | Yes             |
| Year                                                         | Yes             | Yes             | Yes             | Yes             |
| Observations                                                 | 1,086           | 1,934           | 985             | 1,751           |
| R-squared                                                    | 0.816           | 0.778           | 0.796           | 0.764           |
| Number of cities                                             | 101             | 186             | 101             | 186             |
| Notes. Robust standard errors in parentheses; *, **, and *** represent the significance level of 10%, 5%, and 1%, respectively. |
predict which direction will produce innovation, so the efficiency of the use of government funds will be reduced. The generation of original innovation results needs to rely more on the prosperity of corporate capital and venture capital. In addition, with the improvement of innovation infrastructure and diversification of innovation funding sources, innovation activities will be less dependent on government funding. In addition, enterprises located in the eastern region tend to have higher R&D capacity, and the fierce market competition will also bring them internal R&D motivation to stand out in the competition, so the distortion of land price is not enough to become the external motivation for enterprises to improve their innovation ability.

6. Conclusions

This study collates the panel data of 287 prefecture-level cities from 2007 to 2017, analyzes the impact of land price distortion on regional innovation ability, and explores the moderating effects of financial development in this process by combining the data on financial market development of prefecture-level cities. The phenomenon of land price distortion is reexamined from its causes and results. The empirical results strongly support the hypothesis proposed by the theoretical analysis and provide empirical evidence that “land price distortion promotes regional innovation.” Different from previous studies, this paper not only studies the impact of land price distortion on regional innovation ability and its potential mechanism from the perspective of land price but also includes the effects of local financial market development into the analysis, which provides a more comprehensive perspective for the study of regional innovation.

Our study found that the distortion of land price is caused by local government’ behaviour of selling commercial and residential lands at high prices and industrial lands at low prices. In fact, it is governments’ land finance motivation and investment attraction motivation that causes land price distortion, which enables governments to use such revenue to increase the investment in R&D subsidies and to make up for the financial gap caused by attracting investment. After controlling R&D input-related variables, we have found that land price distortion has a significant positive effect on regional innovation ability, and such a positive effect is significantly time-lag. After introducing the level of regional financial market development into our study, we find that larger financial scale, better financial structure, and higher financial efficiency will further strengthen the positive effect of land price distortion on the regional innovation ability since the development of regional financial market can not only broaden the financing channels of enterprises but also enable enterprises to obtain external financing through the “certification effect” of government subsidies, thus alleviating the financing constraint problem. In the analysis of regional heterogeneity, we find that in eastern region the positive effect of land price distortion is not as significant as that in the central or western regions. In the process of this study, we have noticed that a huge amount of data can be further used to explore the relationship between land policy and innovation; as a result of this, Social Network Analysis may be a possible method for further research in this field [35].

It is notable that the distortion of land price is actually a rational response of local governments to the institutional pressure featured by regional resource constraints and explicit goals of political performance. In the current stage, relying on the wealth accumulated by land finance and the investment brought by land transferring, the environment of regional innovation is optimized, and the positive effect of land price distortion on regional innovation ability plays a dominant role in this process. But in fact, such excessive and short-term profit-seeking development mode of the governments is becoming serious [9]. In the long run, local governments’ behaviour of “Cherry Picking,” that is, selectively supporting a particular industry or enterprise, and the pursuit of rapid political and economic interests may make the negative impact of land price distortion occupy the dominant position, so in reality, government should not ignore its negative effects in the process of regional development. According to the analysis of causes of land price distortion, compared with the direct regulation of land price, managing the land transferring motivation of local governments is a more fundamental way of governance. On the one hand, since land revenue belongs to the government-managed funds, it does not have sustainability, which means that it is necessary to build new tax to regulate intergovernmental financial distribution relationships and reduce the local government’s dependence on land finance. At the same time, it is also essential to improve the distribution mechanism of government-managed funds so as to ensure that local governments can rationally use the fiscal revenue from land transferring and realize high-quality growth of the regional economy. On the other hand, for the purpose of attracting investment, the low-price transferring of industrial lands may easily lead to the race-to-bottom competition between local governments, expanding the area of industrial land transferring, lowering the industrial land price, and reducing the quality of investment, which will seriously harm the sustainable development of China’s economy in the long run. Therefore, it is urgent to accelerate the reform of the land market, establish a reasonable land transferring system, and give more preferential treatment or subsidies to high-quality investment projects. In addition, on the premise of strictly preventing systemic financial risks, an effective regional financial market is also needed [36]. Local governments should help broaden the financing channels of technology-based enterprises, develop multilevel capital markets, reduce financing constraints of local enterprises, and increase the efficiency of financial resource allocation to release their financial constraints.

Data Availability

The data were collected by an Internet web crawler technology and are available from the corresponding author upon request.
Conflicts of Interest

The authors declare that they have no conflicts of interest.

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