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The Policy Effect, Spatial Heterogeneity, and Spillover Effect of Land System Pilots

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Abstract: As an important way to innovate the pattern of land reform, the land system pilots serve as the crucial driving force in promoting rural economic development under the background of rural revitalization. Based on the panel data of 10 pilots along the Yellow River basin, this paper chose 111 near and distant neighboring regions from 2009 to 2018. This paper tested the spillover effects and regional heterogeneity characteristics of the land system pilots using the propensity score matching-difference-in-differences (PSM-DID) method and regression discontinuity design (RDD). The results are as follows: first, the land system pilots have a significant and general impact on regional economic development; second, the establishment of the land system pilots has different impacts on the economic development of near and distant neighboring regions, which shows obvious policy-effect spillovers; and third, the land system pilots have the strongest stimulating effect on the economic development of the middle reaches of the Yellow River basin, as well as the weakest stimulating effect on upstream regional economic development, which shows the significant spatial heterogeneity of policy effects. The results of the research study are of great significance for the exploration of regionally differentiated system-supply pilots under the background of rural revitalization. Additionally, this study has important implications for further land system improvements and rural economic developments.

Keywords: land reform policy; economic development; PSM-DID method; regression discontinuity design

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1. Introduction

Land is a cross-cutting theme in the global development agenda and is fundamental to the survival of farmers. Rural land is a major issue of China's social and economic development, and also the key to addressing issues relating to "agriculture, rural areas and farmers". The sustainability of land utilization is a key issue in the process of a nation's development in terms of economic power and land conservation [1–3]. Research on the relationship between land use change and land policies has received increased attention in recent years. Many studies have focused on the economic reform and development of land-use policies and markets, and on the operation of land-leasing systems [4]. Some issues related to the land systems and land policies, such as the land allocation system and its relationship to cultivated land protection [5], the land requisition system reform, and conflicts between the land allocation system [6], have been discussed. In 1960, land system reform took place in Latin America, with 19 Latin American countries passing land system legislation and 12 countries implementing a land system between 1960 and 1964 [7]. This land system was carried out through the sale of less productive land, with landowners retaining their most productive agricultural farmland [8]. In the 1990s, Tanzania started significant land-ownership reforms in various fields such as economic growth and environmental sustainability. In 1995, land resource management plans were developed in terms of land security and land market reform [9]. Since the early 1990s, the

Malian government has initiated a series of reforms of the rural land system, such as Code Domanial et Foncier, Loi d′ Orientation Agricole, and Charte Pastorale, with the aim of reconciling the customary system with the logic of state-centered legislation [10]. In 2002, the Land Tenure Code was amended in line with the decentralization policy initiated and implemented by the Malian government at the end of the 1990s [11]. China began to explore the reform of the three rural land systems in 1999 (Figure 1) and some regions were initially selected as pilot regions. In 2001, pilots of land expropriation reform were carried out in Chengdu and Wuhan, and pilots of collective commercial construction land transfer reform were carried out both in Wuhu city in Anhui Province and the Shunde district in Guangdong Province. In 2013, the Third Plenary Session of the 18th Central Committee of the CPC proposed to carry out pilot work in 33 pilot areas. In 2014, the Opinions on Rural Land Expropriation, Marketization of Collective Commercial Construction Land, and the Reform of the Homestead System was adopted [12], and the reform of the land system was officially launched. In 2015, 33 pilots in China were established for the reform of the three land systems, including 15 regions that carried out the pilot reform of the rural homestead, such as Lu county in Sichuan and Jinzhai county in Anhui. Fifteen regions carried out the pilot marketization of collective commercial construction land, such as Daxing district in Beijing and Songjiang district in Shanghai. Additionally, three regions carried out the pilot reform of rural land expropriation, such as Yucheng county in Shandong, Dingzhou city in Hebei, and Horinger county in the Inner Mongolia Autonomous Region. During 2017 and 2018, the Standing Committee of the National People's Congress (NPC) extended the pilot program twice.

In the above practical pilot work, the feasibility and effectiveness of the land system pilot innovation were tested. First, regarding the "pilot system", the gradually established unified construction land market system in urban and rural areas provides key support for the new amendment of the land management law in 2019. Second, regarding the "pilot effect", with the promotion of the pilot work, innovative institutional reform policy has effectively improved the rural land problem. However, there are still some problems regarding land system pilots in the practical work. In terms of the specific pilot areas, the progress of each pilot area varies and the adaptability of each land system pilot is also different. At the same time, the policy itself also has some problems. Therefore, in pilot promotion, simply borrowing or imitating the successful experience of a pilot will not make the best use of the "pilot". While focusing on the direct effect of land pilot system reform, special attention should also be paid to the spillover effect of the pilot system on policy innovation. The implementation of the pilot system can provide experience and opportunities for the wider promotion and related policy innovation.

The evaluation of the effect of land system pilots on regional economic development can test the effect of policy implementation and also provide a basis for improving policy implementation. Currently, many domestic and foreign literature on land system can be summarized into the following three categories according to the difference of research focus. The first category concerns the research on the influencing factors of land system reform. Tian believed that the reform of the land system is obviously influenced by market transactions [13]. The realization of property rights and interests of farmers in housing and homestead was constrained, and the income and wealth gap between urban and rural residents was becoming increasingly obvious. The system led to low efficiency of land use. Tang et al. constructed a mathematical model to analyze the factors affecting the collective commercial construction land and found that the government's behavior and choice significantly affected the collective commercial construction land [14]. Bao et al. conducted a practical survey on the characteristics of farmers and features of land property rights, as well as other variables, and the results showed that the market-entry price of land was significantly affected by the characteristics of land property rights and geographical location [15]. Wang et al. analyzed 179 practical cases and found that socio-economic factors had the greatest impact on the market-entry price of land, followed by transportation factors, while public facilities had the least impact on the market-entry price of land [16].

Li et al. studied farmers' wishes before and after land expropriation and found that farmers' wishes changed after land expropriation. Their dissatisfaction with the current expropriation system stems from the huge gap between psychological expectations and actual results [17]. Wang et al. studied the impact of culture on farmers' willingness to transfer under the current land system and showed that cultural, economic, and individual factors were the three main factors influencing farmers' willingness to transfer land, with religious belief as a significant negative impact on farmers' willingness, while language, family, and folk culture had a significant positive association with farmers' intention to transfer land [18]. Zhang et al. found that the age of the head of the household, the entry of village cadres, non-agricultural working hours, the scale of the family labor force, the difficulty of obtaining land transfer information, the land type, and the property right intervention are deep-seated factors affecting the willingness of land transfer. Land ownership and pension security has an impact on land transfer [19]. Zuka studied land reform in Malawi and found that it continued to face strong resistance from traditional institutional custodians and gatherings [20]. Wubneh's study of land issues in the Ethiopian region found that the existing land management framework lacks mechanisms to reconcile the needs of the urbanization process with the needs of rural land conservation [21]. Haregeweyn et al. showed through research on Guangdong Province that the satisfaction of land expropriation is not just affected by the compensation standard but is also improved by the publication of procedural fairness and rules. By respecting the individual rights and interests of farmers, and by allocating more compensation to farmers, the satisfaction of land expropriation will be much improved [22].

The second category concerns the research on the relationship between the adjustment of the land system and the welfare of farmers. Huang et al. from the perspective of farmers' non-agricultural employment and non-agricultural entrepreneurship, showed that the system of land right confirmation promoted farmers' non-agricultural employment but had no significant effect on farmers' non-agricultural entrepreneurship [23]. Li et al. measured the welfare of farmers before and after land expropriation, and found that land expropriation drove the welfare of farmers, although there were regional differences in the driving effect on the welfare of farmers [24]. Wang et al. tested the impact of land system reform on urbanization using the PSM-DID method and the results showed that the land system reform significantly improved the urbanization ability of suburban farmers [25]. Ansari et al. made a comparative analysis of the impact of land right confirmation and land transfer on farmers' income and concluded that land right confirmation significantly increased the per capita income and salary income of the farmers, while land transfer had no significant effect on the improvement of household income [26]. Morgan-Davies et al. systematically analyzed the mechanism of land expropriation on labor allocation and found that land expropriation increased both the personal disposable income and per capita consumption expenditure of farmers, thus improving the overall welfare of farmers [27]. Zhang et al. analyzed the impact of rural land transfer on family income by using the survey data of 1080 farmers in Jiangsu Province and found that the total income of families participating in land transfer was lower than that of self-sufficient families [28]. Shang Guan et al. investigated the impact of different homestead replacement models on farmers' welfare using family data from three different regions and found that each model had different effects on farmers' family economic status, living conditions, social security status, social capital status, and farmers' satisfaction [29]. Liang et al. and Xue et al. found, through research, that due to the limited education level and lack of popularization of urban work skill-training, many farmers had become the most affected group in land expropriation, where in the employment opportunities of farmers had been reduced and it has difficult to recover livelihoods in the urban environment [30,31]. Chen et al. based on 162 valid questionnaires in the suburbs of Wuhan city, found that more than 80% of landless farmers faced unemployment and relied on unstable temporary employment, resulting in the deterioration of the financial situation of landless farmers [32–35].

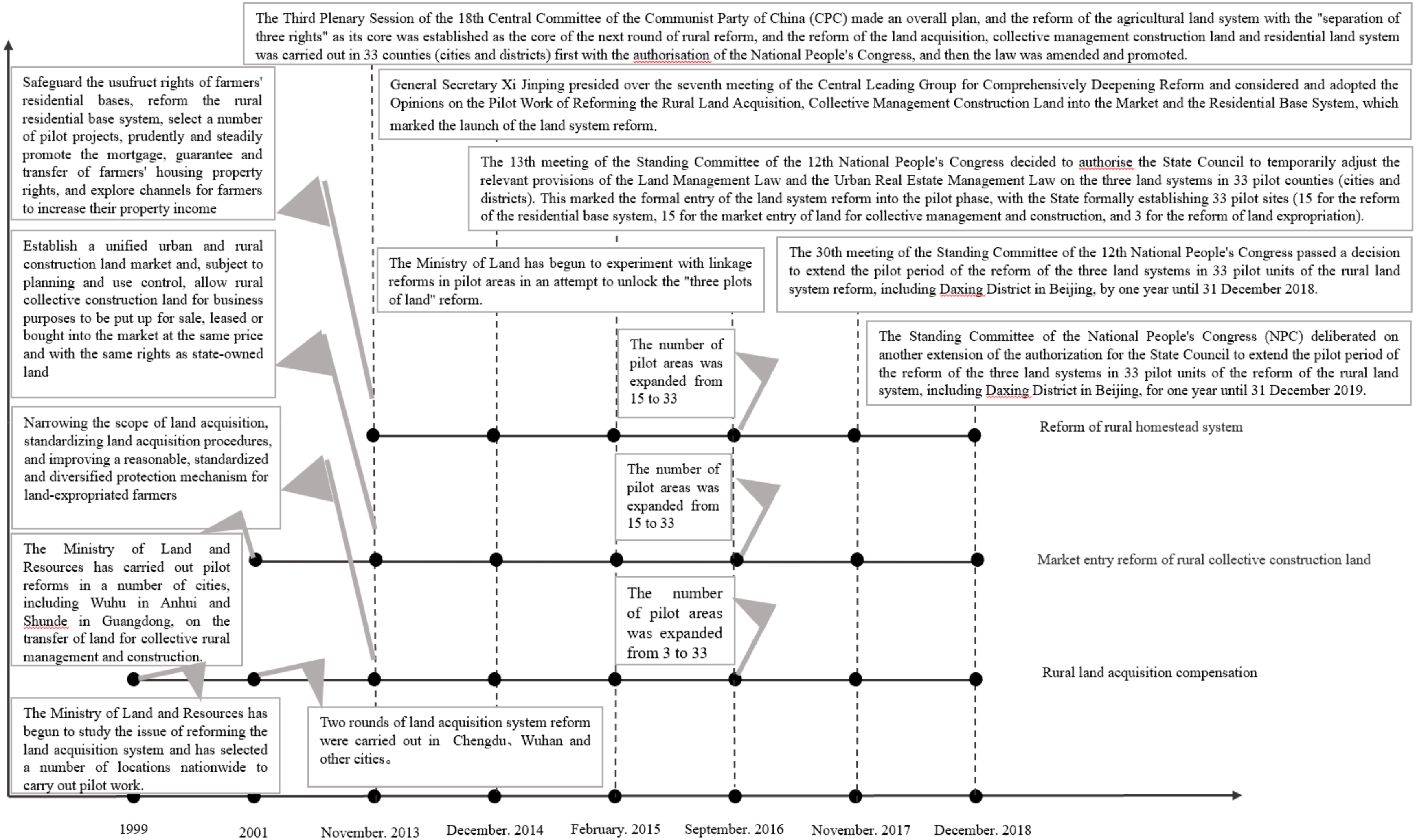

Figure 1. Roadmap analysis of the pilot land system reform.

The third category concerns the research on the effectiveness of land system reform. Currently, scholars believe that the three-rights separation system of land is faced with some difficulties; for example, the practical demand fails to adapt to the policy; the land ownership is difficult to manifest; and there is a lack of legal protection and market mechanisms, among other difficulties. Albertus et al. analyzed the effect of the land system reform in Peru and found that the land system reform impeded the flow of its rural population, led to human capital development and changes in the relationship between supply and demand of education, and aggravated the poverty of farmers [36]. Lipscomb et al. analyzed the land system reform in the Amazon region and found that the land system reform increased farmers' enthusiasm to invest in land and expand land in the region, which significantly slowed the speed of deforestation [37]. Zhong et al. analyzed the panel data of 31 provinces in China and found that differentiated land policies promoted regional economic development [38]. Khan et al. believed that the improvement of the land system and the market-oriented allocation of land added a new impetus to the development of rural areas and promoted the generation of both land dividends and economic growth [39]. Kan analyzed the impact of homestead transfers on farmers and found that through homestead transfer, farmers can rent or sell idle houses and homesteads, realizing the value of land resources, increasing farmers' transfer ability, and enhancing farmers' confidence in transformation [19].

This paper falls in the third category of research, mainly discussing the driving effect of land system pilots on regional economic development. The PSM-DID method and regression discontinuity design (RDD) were used to test the implementation effect of land system pilots in the near and distant neighbors along the upstream, midstream, and downstream of the Yellow River basin of the pilot area, which enriches domestic research on the validation of the effectiveness of the land system using cross-section data; alleviates the reverse causality between the land system pilots and the regional economic development; weakens the endogeneity problem; and produces more reliable results. In addition, given the impact of land system pilots on regional economic development, this paper focuses on the differences between the impacts of the land system pilots on regional economic development under different regional resources, urbanization levels, industries, and other conditions, which enriches the domestic research pertaining to the impact of land system pilots on regional economic development.

2. Overview of the Study Area and Model Specification

2.1. Overview of the Study Area

The Yellow River basin plays a very important role in China's economic and social development, wherein the grain and meat production as well as the energy storage account for about 33.3% and 50% of the totals in China, respectively. It is the main producing area of grain and meat, and is an important industrial base of energy and chemical industry in China. Since the 18th National Congress of the Communist Party of China (CPC), General Secretary Xi Jinping has visited the Yellow River basin many times and the important position of the Yellow River basin in China's economic and social development was emphasized, thus ensuring high-quality development along the Yellow River basin as a major national strategy. In this paper, 10 pilot areas along the Yellow River basin and 111 near and distant neighboring regions are mainly taken as research objects to test the implementation effect of land system reform policy (Figure 2).

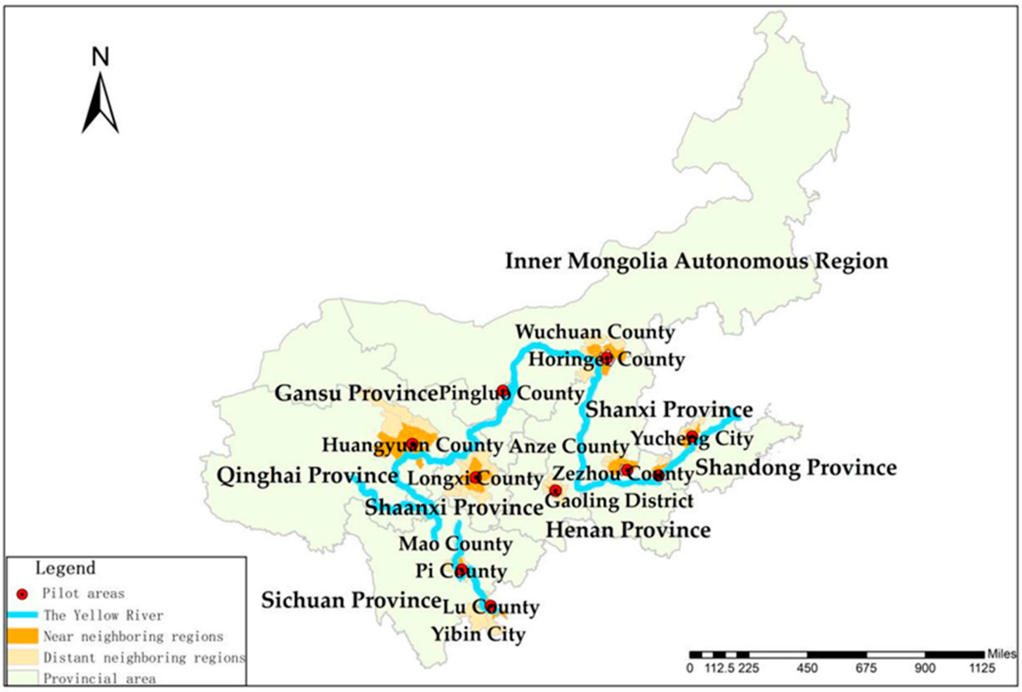

Figure 2. Pilot reform of the land system along the Yellow River basin and its neighboring and far-neighboring areas.

2.2. Model Specification

The common methods of policy effect-testing include instrumental variable methods, difference methods, sensitive analysis, and RDD. The difference methods and RDD are the most similar to random experiment, are considered as quasi-natural experiment designs, and can be used to overcome the endogenous problem in parameter estimation. The purpose of this paper is to study the degree of impact of land system pilots on local economic development. The pilot establishment of land system pilots is regarded as a quasi-natural experiment. Given that the conditions cannot be satisfied, such as regarding unobservability and time effect inconsistency in different regions, direction estimation was employed to avoid the possible sample selection bias problem. Therefore, PSM-DID as proposed by Heckman et al. and RDD as proposed by Thistlethwaite and Campbell were used in this paper to measure the implementation effect of land system pilots. In this study, the introduction of the opinion provides an opportunity to use PSM-DID and RDD. The Yellow River basin in terms of the policy is a natural test site for quasi-random experiments. In reference to relevant studies [40–42], firstly, PSM was used to match the treatment group and control group, and the control group that was most similar to the treatment group was selected to increase the comparability of the samples. Secondly, DID was used to analyze the driving effect of the policy implementation on the near and distant neighbors along the Yellow River basin. Finally, the exact RDD was used to analyze the driving effect of the policy implementation on the regional economic development in the upstream, midstream, and downstream areas of the Yellow River basin.

In this paper, Formula (1) was constructed to test the net effect of the pilot establishment of land system pilots on local economic development:

$$y_{it} = \beta_0 + \beta_1 D_{it} \times T_{it} + \sum \alpha_{it} X_{it} + \varepsilon_{it} \quad (1)$$

Among the variables, Y_{it} is the economic output, which represents the per capita GDP of the I-th region and the T-th year; X_{it} is the control variable that affects the economic development of the pilot areas, including the regional industrial structure, population, and the education level; the cross term $D_{it} \times T_{it}$ represents the dummy variable of the area along the Yellow River basin after the implementation of the policy; β_1 is the main parameter to be estimated, indicating the impact of the policy implementation on local economic development; and ε_{it} is a random perturbed variable.

By constructing Formula (2), we tested the spatial differences between the near and distant neighbors of the land system pilot in the pilot areas:

$$y_{it} = \beta_0 + \beta_2 D_{it}{}' \times T_{it} + \sum \alpha_{it} X_{it} + \varepsilon_{it} \quad (2)$$

Here, the interaction term $D_{it}{}' \times T_{it}$ is the dummy variable for the near and distant neighbors of the pilot areas after the implementation of the policy. If they are in the pilot areas, $D_{it}{}' = 1$; if they are in the near and distant neighbors of the pilot areas, $D_{it}{}' = 0$; and β_2 refers to the impact of the implementation of the policy on the economic development of the near and distant neighbors in the pilot areas.

In this paper, each region along the Yellow River basin is taken as a research object and 2015 is taken as the breakpoint time of the land system pilot. As is shown in Formula (3), t_0 represents the time of implementation of the land system pilot in the study area. If the time is before the implementation of the policy, the D_{it} value is 0; if the time is after the implementation of the policy, the D_{it} value is 1.

$$D_{it} = \begin{cases} 0, \ t < t_0 \\ 1, \ t \geq t_0 \end{cases} \quad (3)$$

The probability of the land system pilot, implemented by the research object around 2015 in this paper, rose abruptly from 0 to 1, meeting the precise breakpoint regression conditions. Therefore, the sharp regression discontinuity design was used to construct the pilot model of the land system, as is shown in Formula (4):

$$y_{it} = \beta_3 D_{it} + \beta_4 (t - t_0) + \beta_5 (t - t_0) D_{it} + \beta_6 X_{it} + \varepsilon_{it} \quad (4)$$

In Formula (4), the coefficient β_3 represents the measurement of the explained index at the breakpoint of the land system pilot; the variable $(t - t_0)$ means to standardize the time variable so that $(t - t_0)$ becomes the land system pilot breakpoint; and coefficient β_4 represents the driving effect of time variable t on the explained variable.

2.3. Data Sources

Based on the availability of data, the time span from 2009 to 2018 was selected and the data-missing areas were eliminated. Finally, 9 provinces were obtained. In considering 2015 as the policy impact point, 10 pilot areas along the Yellow River basin and 111 near and distant neighboring areas of the pilot areas in 2015 were selected. The data of this paper derives from the 2009 to 2018 China county statistical yearbook, Shanxi statistical yearbook, Qinghai statistical yearbook, Inner Mongolia Autonomous Region statistical yearbook, Shaanxi statistical yearbook (and Xi'an statistical yearbook), Gansu Development Yearbook, Sichuan statistical yearbook, Shandong statistical yearbook, Henan statistical yearbook, Ningxia statistics yearbook, and the statistical bulletin of national, economic, and social development of various regions from 2009 to 2018. In addition, in order to eliminate the impact of inflation, the year 2009 and 2012 were taken as the base periods using the GDP deflator to process other indicators and logarithmical processes for all indicators were performed using state 15.1 software to process the data.

2.4. Variable Selection

First, we discuss the explained variable (Table 1). The evaluation indicators on the institutional reform policy regarding regional economic development are regional GDP, the number of invention patents, regional GDP, and regional GDP per capita. The per capita GDP can accurately and truly reflect the potential for sustainable economic and social development in China, as is the per capita income and living standard of residents.

In addition, in taking into account the difference of population and the availability of statistical data, as well as in combining the studies of relevant scholars [43–46], lnpergdp was used to present the logarithm of per capita GDP.

Table 1. Variable definitions.

Variable Categories	The Variable Name	Variable Symbol	Variable Definitions
Explained variable	Regional economic development	lnpergdp	Logarithm of gross regional product per capita
Core explanatory variable	Individual dummy variable	D_{it}	In 2015 and after, the pilot area is 1; before 2015, the pilot area is 0
	Time dummy	T_{it}	The pilot policy year was 0 before 2015 and 1 after 2015
	The policy effect	$D_{it} \times T_{it}$	The driving effect of land system reform pilot establishment on regional economic development was studied
Control variables	Gross output value of farming, forestry, animal husbandry, and fishery	Gro	Logarithm of the gross output value of farming, forestry, animal husbandry, and fishery
	GDP of the secondary industry	Sec	Logarithm of the GDP of the secondary industry
	population	Pop	Logarithm of the total population of an area
	Education level	Edu	Logarithm of the number of higher education enrollees per 10,000 people
	Total agricultural machinery power	Agr	Logarithm of the total agricultural machinery power

Second is the core explanatory variable. In this paper, interaction item $D_{it} \times T_{it}$, D_{it} is taken as the core explanatory variable, where D_{it} is the policy dummy variable. If the sample area is a pilot area in 2015 or later, the value is 1 and otherwise is 0. T_{it} is the time dummy variable and the year before 2015 is set to 0, while the year after 2015 is set to 1. The coefficient β of interaction term $D_{it} \times T_{it}$ is the estimated value of DID, representing the net impact of the pilot establishment of the land system pilot on the economic development of the study area. When t $\geq$ 2015, $D_{it} \times T_{it}$ = 1; otherwise, it is 0.

Third is the control variable. Although the DID and RDD weaken the endogenous problem caused by the sample selection, the error problem caused by missing variables has not been solved. Referring to present studies, the following variables were selected to reduce the errors caused by missing variables: the gross output value of farming, forestry, animal husbandry, and fishery, as well as the total agricultural mechanization power. The content of the land system reform mainly focuses on rural land issues, which may affect the agricultural production efficiency of farm households. Therefore, referring to the research of Xie et al. [47], this paper chose the logarithmic values of gross agricultural, forestry, animal husbandry, and fishery products, and the total agricultural mechanization power, notated as Gro and Agr. Secondly, the GDP of the secondary industry was considered. Differences in industrial structure are an important cause of differences in regional economic growth and regional industrialization can test the role of structural factors in regional economic development. The GDP of the secondary industry reflects the industrial structure of each region and the regional industrial structure is one of the important factors that determine whether the regional economy can develop healthily. Referring to the research of Gong et al. [48], we used the GDP of the secondary industry to measure the regional industrial structure differences, notated as Sec. Thirdly, we considered population size. People are the main participants of social production activities. The influence of population factors on economic development has a multifaceted impact: on the one hand, populations produce obstacles to economic development and population growth affects capital accumulation as well as puts pressure on resources and technological development; on the other hand, population provides a driving force for economic development, wherein the demographic dividend provides a strong impetus to economic development and population development produces economies of scale. Referring to the study by scholars Yang et al. [49], this paper chose to express the logarithm of the regional population size, notated as Pop. Fourthly, we considered the level of education. According to the theory of human capital, education plays a leading, overall, and fundamental role in economic development, and plays a very important role in promoting economic development, as knowledge spillover has a certain enhancing effect on the economic level. Therefore, referring to the research of Mamuneas [50], the number of students with higher education per 10,000 people was used to measure the educational level of a region and is recorded as Edu.

3. Empirical Analysis

3.1. Average Effect of Pilot Establishment on Economic Development

The premise of using the DID method is that the treatment group and control group have the same trend, that is, the parallel trend assumption must be satisfied. In this paper, the economic development trend of the treatment group and control group before 2015 was basically the same, satisfying the parallel trend hypothesis, and DID had the applicability.

According to Model (1), the logarithm lnpergdp of the GDP per capita was taken as the explained variable to measure the impact of pilot establishment on regional economic development in the land system pilot. At the same time, Table 2 also reports the regression results without adding control variables for comparison. In Table 2, regardless of whether the control variable is added or not, when lnpergdp is taken as the explained variable, the policy effect of Gansu Province and Henan Province remains significant, while that of Shanxi Province and Qinghai Province is not, and the policy effect of the Inner Mongolia Autonomous Region is significant after the addition of control variables. This indicates that the establishment of the land system pilot has affected the economic development of the areas along the Yellow River basin and has regional heterogeneity.

When considering other factors affecting the pilot land system reform, it is easy to see that for Gansu Province, population size and education level are inversely related to the economic development of the region. The total power of agricultural machinery has no significant impact on the economic development of the region and the larger the total output value of agriculture, forestry, animal husbandry and fishery, the faster the economic development of the region. The main reasons for this is that Gansu is located in the northwest; desertification is serious; the area of arable land is decreasing year by year; and there is a mismatch between population growth and limited arable land, thus the population increases and economic development is hindered. The secondary industry accounts for a relatively small share of the economy. In recent years, local growth has continued to develop various preferential policies to attract large and small enterprises to move in and encourage the development of the secondary industry, thus it is clearly driving the development of the regional economy. In addition, the development of the secondary industry also provides more jobs for the local areas and solves the problem of labor surplus. The agriculture, forestry, animal husbandry, and fishery industry reflect the total scale of production, and as the agriculture, forestry, animal husbandry, and fishery industry become bigger and stronger, it forms a scale effect, thus driving the development of the local economy. The region should therefore continue to optimize the proportion of industrial structure, continue to increase investment in agricultural infrastructure, actively adjust the industrial structure, vigorously develop education, and actively develop human resources as a way to continue to steadily promote the region's economic development.

Table 2. Test results of the economic development effect of the pilot establishment on the sample areas in the land system pilot.

	Shanxi Province		**Qinghai Province**		**Inner Mongolia Autonomous Region**		**Shaanxi Province**		**Gansu Province**	
	lnpergdp		**lnpergdp**		**lnpergdp**		**lnpergdp**		**lnpergdp**	
$D_{it} \times T_{it}$	−0.018	−0.043	−0.006	−0.118	−0.843	−1.009	0.001	0.334	−0.118 *	−0.220 *
	(−0.15)	(−0.95)	(−0.04)	(−1.33)	(−0.47)	(−1.51)	(0.00)	(1.17)	(−1.77)	(−1.90)
T_{it}	−0.179	−0.054 ***	−0.075	0.052	−0.048	0.823	−0.058	0.071 *	−0.029	0.057
	(−1.47)	(3.36)	(−0.54)	(−0.64)	(−0.09)	(1.79)	(−0.63)	(1.78)	(−0.51)	(1.20)
D_{it}	0.330 ***	0.086 ***	−0.635 ***	−0.198 ***	1.722	0.583	0.618 ***	−0.056 ***	0.221 ***	0.290 ***
	(3.83)	(3.87)	(−7.29)	(−3.32)	(1.52)	(1.02)	(8.49)	(−3.50)	(5.17)	(3.51)
Gro		−0.016		−0.004		−1.142 ***		0.587 *		0.397 ***
		(−0.93)		(−0.10)		(−3.76)		(1.87)		(4.29)
Sec		0.617 ***		0.545 ***		−0.663 *		0.650 ***		0.273 ***
		(52.58)		(9.55)		(−1.75)		(17.27)		(5.11)
pop		−1.093 ***		−1.176 ***		−7.253 ***		−0.495 ***		−0.685 ***
		(−43.49)		(−6.89)		(−5.65)		(−6.55)		(−7.80)
Edu		0.191 ***		0.103		4.513 ***		−0.055		−0.051
		(7.45)		(0.85)		(5.77)		(−1.21)		(−0.76)
Agr		0.432 ***		0.485 ***		3.399 ***		−0.110 **		0.179
		(10.48)		(4.66)		(4.11)		(−1.98)		(1.58)
Constant	0.707 ***	−8.331 ***	0.678 ***	−8.284 ***	0.587	7.633	0.940 ***	−5.238 ***	0.669 ***	−7.945 ***
	(8.62)	(−22.62)	(8.18)	(−7.90)	(1.57)	(1.60)	(16.17)	(−8.38)	(17.59)	(−6.17)
Samples	120	120	110	110	110	110	180	180	160	160
R^2	0.0417	0.9860	0.0827	0.7750	0.0256	0.4990	0.0621	0.854	0.0182	0.4530
	Sichuan Province (Pi county)		**Sichuan Province (Lu county)**		**Shandong Province**		**Henan Province**		**Ningxia Hui Autonomous Region**	
	lnpergdp		**lnpergdp**		**lnpergdp**		**lnpergdp**		**lnpergdp**	
$D_{it} \times T_{it}$	−0.924	−1.190	0.064	−0.062	0.006	0.010	−0.200 *	−0.180 *	−0.006	−0.004
	(−1.12)	(−1.59)	(0.78)	(−0.94)	(0.12)	(0.43)	(−1.72)	(−1.76)	(−0.10)	(−0.33)
T_{it}	0.422	1.300 **	0.032	0.049 **	−0.142 ***	−0.027 *	0.396 ***	0.120 *	−0.089	0.142
	(0.65)	(2.18)	(0.43)	(2.54)	(−3.08)	(−1.72)	(3.68)	(1.83)	(−1.59)	(0.98)
D_{it}	1.288 ***	0.647 *	−0.378 ***	0.029	−0.013	−0.000	0.666 ***	0.385 ***	−0.081 **	0.106 ***
	(2.82)	(1.84)	(−6.51)	(0.45)	−(0.43)	(−0.02)	(8.66)	(3.65)	(−2.37)	(2.67)
Gro		0.350		0.058 **		−0.562 **		−0.192		0.017
		(0.79)		(2.47)		(−1.96)		(−1.61)		(0.89)
Sec		0.672 ***		0.654 ***		0.595 ***		0.384 ***		0.448 ***
		(3.67)		(20.59)		(23.66)		(3.80)		(15.24)
pop		−1.986 **		−0.671 ***		−0.757 ***		−0.005		−1.108 ***
		(−2.01)		(−20.29)		(−14.64)		(−0.01)		(−9.09)
Edu		3.356 ***		0.124 ***		−0.075		−0.397 ***		0.044 *
		(5.62)		(4.13)		(−1.31)		(−2.73)		(1.74)
Agr		0.266		−0.075 *		0.174 ***		0.946 ***		0.286 ***
		(0.37)		(−1.95)		(3.94)		(3.80)		(9.36)
Constant	−1.987 ***	−15.440 *	0.420 ***	−5.546 ***	1.020 ***	−6.813 ***	−0.139 **	−13.400 ***	1.020 ***	−4.890 ***
	(−4.37)	(−1.92)	(8.97)	(−9.84)	(38.17)	(−19.70)	(−2.22)	(−4.31)	(32.96)	(−11.47)
Samples	180	180	120	120	140	140	80	80	30	30
R^2	0.0051	0.3420	0.0716	0.9530	0.0784	0.8840	0.3173	0.7530	0.2746	0.9770

*, ** and *** indicate significance at the levels of 10%, 5% and 1%, respectively. The number in parentheses is t-values.

Table 2 shows that in the economic development of the study area of Henan Province, the level of education inhibits economic development in the reverse direction, the impact of the gross secondary industry on economic development is positively driven, the size of the population has little impact on economic development, and the total mechanization of agriculture promotes the economic development of the region. The main reason for this is the asymmetry between its industrial structure and the employment structure of its population. Henan Province is a large agricultural and population province, and its agriculture, forestry, animal husbandry, and fishery industries are well developed. In addition, with advancements of science and technology, the intervention of machinery has accelerated the development of the primary industry. In addition, Henan Province is dominated by secondary and tertiary industries. The development of secondary and tertiary industries has solved the employment problem of many laborers in the region and has driven the regional economic development. The impact of the population size factor, although not significant, has a negative impact, indicating that the region's demographic dividend has passed and cannot rely on increasing population to drive regional economic development. For Henan Province, it is still necessary to continue to orient to the actual situation of each region; to make use of their respective comparative advantages according to local conditions, while strengthening joint collaboration to improve the efficiency of resource allocation; to achieve overall coordinated development with the unbalanced development of the industrial structure of local areas; and to choose an economic growth model that prioritizes employment growth to achieve full employment. In addition, by strengthening investment in human capital and funding for education, the economy will enter a new period of rapid development.

For Shanxi Province, Qinghai Province, the Inner Mongolia Autonomous Region, Shaanxi Province, Sichuan Province (Pi county), Sichuan Province (Lu county), Shandong Province, and Ningxia Hui Autonomous Region, the pilot establishment of the land system pilot did not significantly promote local economic development, which may be associated with the following two reasons: first, the land market is not completely developed and the entry price is uncertain, thus making the problems of land expropriation and compensation market-entry difficult to carry out after the pilot establishment; second, due to the information asymmetry, the land market price is unpredictable and the government departments cannot obtain accurate information, making it difficult to control the land market in a timely and effective way.

3.2. Average Effect of the Pilot Establishment on the Economic Development of the near and Distant Neighbor Areas

Combined with Model (2), the logarithmic lnpergdp of the studied region's GDP is used as the explained variable to measure the impact of the land system reform pilot on the economic development of the near and distant neighborhood areas.

In Tables 3 and 4, when the logarithm of per capita regional GDP is taken as the explained variable, the regression results of the interaction item $D_{it} \times T_{it}$,with no additional control variables, are consistent with the above, therefore, only regression results with the addition of control variables are shown. It can be seen from the regression results in Tables 3 and 4 that the establishment of the pilot program in Henan Province significantly affected the economic development of its distant neighbor. For the near neighbors, after adding the control variables, the pilot establishment in the Inner Mongolia Autonomous Region affected the economic development at the significance level of 10%. In addition, in Shanxi Province, Qinghai Province, Shaanxi Province, and in other areas along the Yellow River basin, the pilot establishment had no obvious influence on the policy of its near and distant neighbors. From the above analysis results, it can be seen that there are spatial differences in the degree of impacts of the pilot establishment of the land system on the economic development of the near and distant neighbors.

3.3. Driving Effect of the Land System Pilot on the Economic Development of the Upper, Middle, and Lower Reaches of the Yellow River basin

The design basis of the RDD is that if there is an obvious breakpoint in the explained variable in the pilot area in 2015, then the reason for the breakpoint may be related to the implementation of the land system pilot. Therefore, 2015 was taken as the time breakpoint and the parameters were estimated according to the precise breakpoint regression equation constructed in Formula (4) to analyze the driving effect of the land system pilot on the economic development along the Yellow River basin.

As is shown in Table 5, in the upper reaches of the Yellow River basin, the policy effect is not significant regardless of whether the covariates were added or not, that is, the driving effect of the land system pilot on the regional economic development along the upper reaches of the Yellow River basin was not obvious. Along the middle and lower reaches of the Yellow River basin, the regional economic changes at the breakpoint 2015 have an obvious "jump"; the land system pilot for the driving effects of regional economic development at the middle and lower reaches were 0.431 at 5% significance level and

0.219 at 1% significance level, respectively; the driving effects of the land system pilot on the economic development at the middle and lower reaches of the region were 0.410 and 0.233, respectively, and both were significant at the level of 10%, indicating that the estimated results are robust and the land system pilot steadily promotes the economic development of the middle and lower reaches of the region.

Table 3. Test of the effect of the pilot establishment on the economic development of distant areas in the pilot land system.

	Shanxi	Qinghai	Inner Mongolia	Shaanxi	Gansu	Sichuan (Pi County)	Sichuan (Lu County)	Shandong	Henan	Ningxia
	lnpergdp	lnpergdp	lnpergdp	lnpergdp	lnpergdp	lnpergdp	lnpergdp	lnpergdp	lnpergdp	lnpergdp
$D_{it} \times T_{it}$	−0.050	−0.054	−0.770	0.353	−0.151	−1.496	0.095	0.023	0.055 **	−0.015
	(−1.07)	(−1.35)	(−0.73)	(1.22)	(−1.07)	(−1.53)	(1.05)	(0.82)	(1.96)	(−0.64)
T_{it}	0.103 ***	0.033	0.698	0.065	0.060	1.621 *	−0.033	−0.017	0.056 ***	0.007
	(2.91)	(0.85)	(1.33)	(1.10)	(1.09)	(1.82)	(−0.64)	(−0.75)	(3.74)	(0.31)
D_{it}	0.126 ***	−0.275 ***	−0.643	−0.343 ***	0.262 ***	1.718 ***	−0.182 **	−0.015	−0.015 ***	0.023
	(3.43)	(−8.37)	(−0.85)	(−4.93)	(2.91)	(3.05)	(−2.43)	(−0.61)	(−5.38)	(0.41)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	−6.372 ***	−2.829 ***	1.540	−5.039 ***	−3.732 **	−2.284	5.689 ***	−7.761 ***	−6.383 ***	−4.89 ***
	(−10.25)	(−2.64)	(0.30)	(−6.11)	(−2.46)	(−0.19)	(3.39)	(−14.89)	(−11.25)	(−11.47)
Samples	60	50	60	110	110	110	70	90	60	20
R^2	0.9660	0.9470	0.7740	0.8670	0.4680	0.3210	0.5470	0.8290	0.9750	0.9770

*, ** and *** indicate significance at the levels of 10%, 5% and 1%, respectively; The number in parentheses is t-vaues.

Table 4. Test of the effect of the pilot establishment on the economic development of the neighboring areas in the pilot land system.

	Shanxi	Qinghai	Inner Mongolia	Shaanxi	Gansu	Sichuan (Pi County)	Sichuan (Lu County)	Shandong	Henan	Ningxia
	lnpergdp	lnpergdp	lnpergdp	lnpergdp	lnpergdp	lnpergdp	lnpergdp	lnpergdp	lnpergdp	lnpergdp
$D_{it} \times T_{it}$	−0.020	−0.152	−0.688 *	0.244	−0.127	−0.753	0.004	−0.010	−0.050	−0.004
	(−0.52)	(−1.42)	(−1.80)	(1.10)	(−1.01)	(−1.18)	(0.09)	(−0.32)	(−0.86)	(−0.30)
T_{it}	−0.005	0.066	0.001	0.058	0.098	0.832 ***	0.026	−0.039 **	0.009	0.008
	(−0.37)	(0.69)	(0.01)	(1.30)	(1.54)	(2.66)	(1.44)	(−2.09)	(0.10)	(0.47)
D_{it}	0.033 **	−0.373 ***	0.614	−0.040	0.134	−0.867 ***	−0.103 ***	−0.017	−0.076	0.017
	(2.28)	(−3.04)	(1.63)	(−0.59)	(1.67)	(−5.50)	(−6.93)	(−0.87)	(−0.31)	(0.28)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	−8.646 ***	−8.036 ***	−2.646	−4.205 **	−8.648 ***	−24.340 ***	−4.385 ***	−7.772 ***	6.515	−5.372 ***
	(−29.96)	(−4.49)	(−0.68)	(−2.64)	(−4.35)	(−2.75)	(−5.75)	(−14.01)	(1.09)	(−14.92)
Samples	70	70	60	80	60	70	60	50	30	20
R^2	0.9970	0.8350	0.5080	0.8460	0.6730	0.6160	0.9830	0.9060	0.9610	0.9940

*, ** and *** indicate significance at the levels of 10%, 5% and 1%, respectively; The number in parentheses is t-values.

Table 5. Regression estimation of the breakpoints of regional economic development along the upper, middle, and lower reaches of the Yellow River Basin under the influence of the pilot land system.

Gross Regional Product	Along the Upper Reaches of the Yellow River		Along the Middle Reaches of the Yellow River		Down the Yellow River	
	0.008 (0.01)		0.431 ** (2.00)		0.219 * (1.95)	
		0.038 (0.41)		0.410 * (1.69)		0.233 * (1.69)
Control variables	No	Yes	No	Yes	No	Yes
Samples	42	42	14	14	14	14

* and ** indicate significance at the levels of 10%, 5% respectively; The number in parentheses is t-values.

This paper argues that the reasons for this result in the upstream region include the fact that most of the pilot areas along the upper reaches of the Yellow river Basin are sparsely populated; the level of education varies greatly; and farmers' understanding of the pilot land system varies and thus their motivation to participate varies, which affects the level of development of the total output value of the primary agriculture, forestry, animal husbandry, and fishery industry, as well as the secondary industry in the region, thus leading to a lack of obvious policy-driven effects. The causes for this result in the middle and lower reaches are as follows: the middle reach is a province with large energy resources and a developed secondary industry. The implementation of its land system pilot has revitalized the land resources in this region and provided space for the development of secondary industry. Therefore, the driving effect of policies in this region is obvious. In addition, the downstream region is rich in agricultural resources and has a large population, thus the region's agriculture, forestry, animal husbandry, and fishery industry are developing rapidly. The implementation of the land system reform policy has realized the rational utilization of land resources and injected new momentum into the development of the region's agriculture, forestry, animal husbandry, and fishery industry, thus the pilot land system has significantly driven the economic development of the region.

3.4. Robustness Test

In learning from the research of relevant scholars [51–53], we tested the robustness of the PSM-DID and RDD method by adjusting the sample period; replacing the matching variables, validity test, and placebo test; and changing the bandwidth.

3.4.1. Adjusting the Sample Period

In the above analysis, the sample time range was 2009–2018 and the time was divided into 2009–2014 and 2015–2018 based on the establishment time point of the pilot area in the land system pilot. The samples from 2009–2014 mainly described the medium-term and long-term economic environments, and the samples from 2015–2018 described the medium-term economic environment. An extension of the time range will cause error to increase. Therefore, in order to minimize the impact of the economic environment, this paper selects samples within a 3-year period before and after the establishment of the pilot areas in the land system pilot (from 2011 to 2014, t = 0; from 2015 to 2017, t = 1). The data robustness was tested again using the DID method and the results are shown in Table 6.

Table 6. Robustness test results for adjusting sample range.

	Shanxi	Qinghai	Inner Mongolia	Shaanxi	Gansu	Sichuan (Pi county)	Sichuan (Lu county)	Shandong	Henan	Ningxia
	lnpergdp	lnpergdp	lnpergdp	lnpergdp	lnpergdp	lnpergdp	lnpergdp	lnpergdp	lnpergdp	lnpergdp
$D_{it} \times T_{it}$	−0.068	−0.195 **	−1.290 *	0.325	−0.172 *	−0.764	0.053	0.020	−0.208 **	−0.010
	(−1.32)	(−2.03)	(−1.84)	(1.12)	(−1.81)	(−0.94)	(0.89)	(1.03)	(−2.65)	(−0.78)
T_{it}	0.068 ***	0.138	0.630	0.056	0.030	0.814	−0.162 ***	−0.020	0.190 ***	0.010
	(3.81)	(1.64)	(1.32)	(1.32)	(0.78)	(1.29)	(−3.59)	(−1.39)	(3.47)	(0.97)
D_{it}	0.102 ***	−0.102	1.029 *	−0.142 ***	0.102 *	0.350	−0.090 **	−0.020 *	0.675 ***	0.129 **
	(3.36)	(−1.32)	(1.71)	(−2.41)	(1.73)	(0.78)	(−2.19)	(−1.53)	(6.09)	(2.47)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	−8.776 ***	−11.760 ***	8.126 *	−5.419 ***	−4.162 ***	−20.840 **	10.120 ***	−7.356 ***	−17.680 ***	−3.015 ***
	(−17.70)	(−5.66)	(1.45)	(−6.15)	(−3.44)	(−2.47)	(8.05)	(−5.09)	(−8.42)	(−3.62)
Samples	96	88	88	144	128	144	96	112	64	24
R^2	0.9840	0.7810	0.5200	0.8360	0.5970	0.3630	0.7520	0.9320	0.8430	0.9870

*, ** and *** indicate significance at the levels of 10%, 5% and 1%, respectively; The number in parentheses is t-values.

As can be seen from the regression results in Table 6, firstly, the test results of Gansu Province and Henan Province were significant before adding the control variables and the results were similar to that above, while the test results of Shanxi Province, Qinghai Province, and the Inner Mongolia Autonomous Region along the Yellow River basin were not significant before adding the control variables. Secondly, the regression results of the Inner Mongolia Autonomous Region, Gansu Province, and Henan Province were significant after the control variables were added, which was similar to the test results above. In addition, the regression results of other provinces changed slightly and were close to the above regression results, which further confirmed the robustness of the above conclusion.

3.4.2. Replacing the Matching Variables

Before using DID, this paper adopted the one-to-one near neighbor propensity score matching method to match the control group with the similar treatment group and the matching variables included the variables of the gross output value of farming, forestry, animal husbandry, and fishery; the GDP of the secondary industry; population and education level; and the total agricultural machinery power. In order to test the robustness of the results, the matching variables were replaced with those that only represent the industrial structure (Sec) and then the treatment group was matched for one-to-one near neighbor propensity scores. After matching the control group, the DID was performed successively. Finally, the regression results obtained were similar to the test results above. It can be seen that the one-to-one near neighbor PSM method, as adopted in this paper, is robust. The results are shown in Table 7.

Table 7. Robustness test of the replacement-matched variables.

	Shanxi	Qinghai	Inner Mongolia	Shaanxi	Gansu	Sichuan (Pi County)	Sichuan (Lu County)	Shandong	Henan	Ningxia
	lnpergdp	lnpergdp	lnpergdp	lnpergdp	lnpergdp	lnpergdp	lnpergdp	lnpergdp	lnpergdp	lnpergdp
$D_{it} \times T_{it}$	−0.086 (−0.71)	−0.006 (−0.04)	−0.817 (−1.28)	−0.001 (−0.00)	−0.118 * (−1.77)	−1.236 (−1.41)	0.076 (0.08)	0.013 (0.24)	−0.248 ** (−2.29)	0.012 (0.52)
T_{it}	−0.164 (−1.43)	−0.074 (−0.51)	−0.029 (−0.05)	−0.063 (−0.67)	0.026 (0.45)	0.300 (0.50)	0.0725 (0.98)	−0.204 *** (−5.00)	0.2310 ** (2.45)	−0.013 (−0.63)
D_{it}	0.058 (0.68)	−0.638 *** (−7.52)	1.731 *** (3.54)	0.621 *** (8.64)	0.218 *** (4.86)	1.105 ** (2.18)	−0.325 *** (−3.96)	−0.060 (1.52)	0.498 *** (5.06)	−0.361 *** (−10.98)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	−6.010 *** (−3.74)	0.837 (0.47)	−3.677 (−0.87)	0.640 (0.47)	−39.260 *** (−5.08)	−39.260 *** (−5.08)	2.705 *** (3.39)	−4.807 *** (−5.16)	−9.109 *** (−5.18)	−11.216 *** (−8.82)
Samples	120	110	110	180	160	180	120	140	80	30
R^2	0.1580	0.0827	0.0304	0.0623	0.0185	0.1630	0.1140	0.2800	0.5270	0.9090

Note: *, ** and *** indicate significance at the levels of 10%, 5% and 1%, respectively; The number in parentheses is t-values.

3.4.3. Validity Test

The validity of the RDD method hinders economic individuals from completely manipulating or controlling grouping variables. In this paper, the year variable is the processing variable and the land system pilot is the grouping variable. The year variable is objective and cannot be manipulated by people, thus it meets the objectivity requirements of grouping variables. In addition, the second test concerned whether the control variable had continuity at the breakpoint. As is shown in Table 8, under the optimal bandwidth, all the control variables in the upper, middle, and lower regions along the Yellow River basin were not significant, which indicates that all the control variables do not jump at the breakpoint and meet the smoothness requirements. Therefore, the RDD used in this paper did not have a breakpoint effect with other influencing variables and the estimated results are robust.

Table 8. Continuity test of the control variables.

	Along the Upper Reaches of the Yellow River	Along the Middle Reaches of the Yellow River	Down the Yellow River
Gro	0.035 (0.02)	−0.114 (−0.53)	−0.878 (−0.71)
Sec	−0.061 (−0.04)	−5.857 (−0.71)	−0.090 (−1.24)
Pop	−0.309 (−0.52)	1.073 (0.42)	−0.193 (−0.13)
Edu	1.659 (0.12)	1.291 (0.53)	−0.551 (−0.16)
Agr	1.164 (−0.70)	2.159 (0.48)	6.780 (0.26)

3.4.4. Placebo Test

In order to ensure the credibility of the conclusion, this paper adopted the placebo test for demonstration. The test idea is: if the estimated results show an obvious "jump" in the policy breakpoint year, it indicates that the reliability of the estimated results using the RDD method is low; otherwise, it has a high reliability. Therefore, it is assumed that the breakpoint years of the land system pilot were 2014 and 2016, and the placebo test was conducted. The estimated results are shown in Table 9. Under the optimal bandwidth, the estimated results, by changing the location of the bandwidth, had no significant effect, which proves that the policy breakpoint was 2015, therefore the estimated results in this paper are highly reliable.

Table 9. Placebo test.

Gross Regional Product	Along the Upper Reaches of the Yellow River	Along the Middle Reaches of the Yellow River	Down the Yellow River
2014	0.014 (0.02)	0.015 (0.11)	0.011 (0.09)
2016	0.009 (0.01)	0.452 (0.85)	0.016 (0.21)
Samples	42	14	14

3.4.5. Regression with Different Bandwidth

Along the Yellow River basin, based on the complex geographical characteristics and rapid development of the economic environment, only accurate grasp and precise policy implementation can ensure that implementation of the land system pilot produces the best effect. Therefore, samples near the optimal bandwidth were selected and estimated many times, and the results are as shown in Table 10. All regression results were not significant at 0.5 and 2 times bandwidth. In the regression results of the middle reaches area along the Yellow River basin, the land system pilot driving effects on regional economic development were significant at 0.5 and 2 times bandwidth. The driving effects were 0.353 and 0.461, and driving effects would increase with the increase of bandwidth. For the regression results along the lower reaches of the Yellow River basin, the driving effects of the pilot land system on regional economic development were significant at 0.5 and 2 times bandwidth, and the driving effect was 0.254 and 0.216, respectively. The driving effect decreases with the increase of bandwidth. The estimated results are consistent with the baseline regression results, which proves that the conclusions in this paper are robust to some extent.

Table 10. Robustness test: different bandwidths.

Gross Regional Product	Along the Upper Reaches of the Yellow River	Along the Middle Reaches of the Yellow River	Down the Yellow River
lwald50	0.003 (0.00)	0.353 ** (2.54)	0.254 *** (2.74)
lwald200	0.008 (0.01)	0.461 * (1.90)	0.216 *** (2.74)
Samples	42	14	14

*, ** and *** indicate significance at the levels of 10%, 5% and 1%, respectively; The number in parentheses is t-values.

4. Discussion

The "pilot" is a common mode of governance used for policy formulation, reform, and innovation in China since its reform and opening-up, and understanding the variation in the policy effects of pilot systems has become an important part of explaining China's economic and social development in the new era. Over the past two decades, the land issue is the key to address issues relating to "agriculture, rural areas and farmers". and the importance of land resources in rural areas cannot be overstated.

Firstly, it is clear from the analysis of this study that the factors affecting the economic development of the pilot areas are the total output value of agriculture, forestry, animal husbandry, and fishery; the gross value of secondary industry; the total power of agricultural mechanization; and the number of people and level of education. In addition, there are significant differences in the degree and direction of influence of the five factors, which may be related to the unique geographical location of each area, natural resources, industrial structure, regional culture, the intensity of implementation of the land system in the pilot areas, the farmers' acceptance of the system, etc. The pilot areas and non-pilot areas in this study are located in the upper, middle, and lower reaches of the Yellow River basin in China, with a wide distribution and significant differences in the resources between regions, resulting in different industrial structures and different labor demands, therefore different impacts on regional economic development. In addition, the current land system reform began in 2014, the system has been implemented for a relatively short period of time, the implementation of the system varies from region to region, the level of education of farmers varies, and there are differences in the understanding and acceptance of the policy, which is not sufficient to fully detect the potential impact of various factors, potentially making the policy effect in some areas not yet visible.

Secondly, the purpose of this study was to explore the general policy effects suitable for pilot land systems. The current land system reform contains three systems: rural land acquisition, market entry of collective business construction land, and reform of the residential base system, and the content of each system and the participating subjects involved are different, which may lead to differences in the economic benefits brought about by different types of land system reform, thereby affecting the study's impact on the economic development of each region. The impact does not take into account the differences in the policy effects of different types of land systems, thus it cannot be directly applied to the study of pilot policy effects of specific types of land systems. However it is clear that analyzing the impact of the policy effects of different types of land systems on regional economic development will be a research direction that needs to be improved in the future.

5. Conclusions and Policy Implications

In China, the countryside is the main testing ground for optimizing land problems. To solve land problems, the first option is to carry out land system reform. The implementation of any system reform policy faces multiple challenges and the implementation of the pilot project provides a new method for the effectiveness of the land system pilot project, which will be continuously optimized in the process of pilot scale expansion. Based on the panel data of 10 pilot areas and 111 non-pilot sample areas selected from 2009 to 2018, this paper used the PSM-DID and RDD method to test the driving effect of the establishment of pilot areas on local economic development in the land system pilot and conducted relevant robustness tests. The main conclusions are as follows: First, in the land system pilot, the establishment of pilot areas has a significant and general impact on the local economic development, while the policy effects of different pilot areas along the Yellow River basin are quite different. Second, there is a significant difference in the impact of the pilot establishment on the economic development of the near and distant neighbors, that is, there is a spatial spillover difference in policy effects. Thirdly, there are spatial differences in the driving effect of the land system pilot on the economic development of the upper, middle, and lower reaches of the Yellow River basin, which shows that the driving effect of the middle reaches is the strongest and that of the upper reaches is the weakest.

In the land system pilot, the impact of pilot establishment on regional economic development has regional heterogeneity and the policy effect spillover is not a special phenomenon in rural areas. In the new era and new situation, the overall implementation effect of the rural revitalization strategy is related to the further development of rural land expropriation, the entry of collective construction of land into the market, and the revitalization of rural idle homesteads. Based on the above conclusions, the following policy implications are concluded: Firstly, we should adhere to the differentiated, accurate, and refined development mode and put an end to the "one-size-fits-all" policy, that is, in response to the natural characteristics and industrial structure of a region, we must implement categorized policies, fully mobilize and revitalize rural land resources, and improve the level of regional economic development. Secondly, we must be clear regarding the main policy direction and should highlight key points. In the land system pilot, the promotion and replication of the typical experience that significantly drives the local near and distant neighbors can provide a typical example for other areas to improve their reform efficiency. Thirdly, we must improve the land system reform, standardize the procedures of rural land expropriation, improve the entry of collective operating construction land to the market and rural homestead transfer procedure, build a transparent price system, and broaden the channels of expropriation and market entry.

Finally, the data used in this paper were obtained from the China Statistical Yearbook as well as from regional statistical yearbooks and statistical bulletins, etc., which may be one-sided in terms of exploring the policy effects of the land system on pilot areas and non-pilot areas. This will also be addressed in the next step of our studies.

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