Article

Reform of Collective Land for Construction and Rental Housing and the Growth of Farmers' Property Income: Evidence from China

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Abstract: Increasing farmers' income has always been the core task of China's land reform. In 2017, a nationwide pilot project on the use of collective construction land for the construction of rental housing was launched. This study employed the synthetic difference-in-differences method to examine whether the reform contributed to the growth of farmers' property income. It was found that, compared with non-pilot areas, the property income of farmers in the pilot reform of collective construction land rental housing has increased by about 0.4334% on average, and this conclusion is still valid after a series of robustness tests. The role of the reform in promoting farmers' property income is more evident in Western China, Southern China and non-major grain-producing areas. By revealing the impact of the reform on farmers' property income, this paper enriches the literature related to the field of farmers' income increase and provides a policy reference for narrowing the urban–rural gap and achieving the development of rural revitalization and common prosperity.

Keywords: land supply side; collective construction land construction; rental market reform; farmers' property income; common prosperity

1. Introduction

Housing is an important issue concerning people's livelihood as well as social and economic development. The establishment of a healthy housing rental market for sustainable urban development has been a common concern in the formulation of land use policies around the world [1]. As the urbanization and industrialization process in China advances, an increasing number of rural migrants and newly employed university students are flooding into cities. According to China's Seventh Population Census (2020), as of 2020, China's floating population[1] was about 376 million. Compared with the sixth census in 2010, the floating population has increased by 69.73%. The housing problem of new citizens has gradually come to the fore due to the massive population flow into cities, which intensifies the demand pressure of urban construction land resources. China's demand for urban construction land area increased from 178,700 hectares in 2001 to 791,400 hectares in 2017, with an average annual increase of 21.43% [2]. This outward expansion has resulted in the overconsumption of urban construction land resources, and the supply potential of construction land within cities is becoming increasingly limited. To solve the outstanding housing problems in big cities, it is necessary to deepen the reform of the land market, exert efforts on the land supply side, increase the total amount of land put into construction and effectively increase the supply of guaranteed rental housing.

As one of the most fundamental structural systems in China, the urban–rural dualistic structure land system has played an important role in the country's urbanization and industrialization [3]. For a long time, China's urban and rural construction land market has been dualistic and closed. The Land Administration Law of the People's Republic

of China (2020) clearly states that China implements socialist public ownership of land. With the premise of public ownership, there are two ownership subjects: the state and the peasant collective. Urban land is owned by the state, and rural land is collectively owned by farmers. Urban construction land, including land for urban and rural housing and public facilities, industrial and mining land, land for traffic and water conservancy facilities, land for tourism and land for military facilities, is owned by the state. Collective construction land refers to the land invested or raised by township (town) village collective economic organizations and rural individuals for various non-agricultural construction, which is operated by village collective economic organizations or villagers' committees. As a result, the dual ownership of land in urban and rural areas has resulted in the dual characteristics of an urban and rural construction land use system.

Constrained by the framework of China's land system, the state strictly restricts the conversion of agricultural land into construction land, and urban construction land must use state-owned land. Collective construction land cannot be changed at will, and it needs to be expropriated by the government before it can enter the urban construction land market. Even though the government is required to compensate those whose land is expropriated in the process of land acquisition, since neither the owners of collective land nor the property rights to the land are clear [4–6], the government holds a monopoly position as a buyer, and farmers lack negotiation and bargaining power for agricultural land expropriation, which leads to compensation for land expropriation often being much lower than the actual value according to market-based pricing, and the gains from land appreciation are not equitably distributed between the government and farmers [7]. In the process of de-agriculturalization of agricultural land, the huge value-added land revenue generated is mainly monopolized and dominated by the government, and farmers lack the opportunity to share the land value-added benefits equally. At the same time, the circulation and mortgage of collective construction land are limited, and a large amount of collective land is idle or inefficient [8], which inhibits the growth of farmers' income.

Land is the most advantageous property for farmers. Farmers own about 250 million mu of collective construction land. The welfare of farmers depends not only on the quantity of factor resources they have but also on the functioning of factor markets [9]. The establishment of well-functioning land markets is crucial for balancing economic growth and resolving urban–rural conflicts [10]. Currently, China faces a daunting task regarding the compatibility of market development and institutional reform and still has not established an effective land factor market [11]. Due to the dualistic nature of land ownership, the government's monopoly on supply exacerbates the scarcity of land for construction in the absence of a formal rural land market [12,13]. The inability of collective land to be traded directly into the market has become a prominent shortcoming of the land market. In the dualistic market structure between urban and rural areas, houses on urban construction land can be rented, bought and sold and mortgaged, while rural houses generally suffer from a lack of channels to measure and realize their market value. Most of the houses built on collective land remain in the residential use function. The collective land has struggled to perform the economic and market functions it should and has not allowed farmers to maximize asset returns from the land [14,15].

An important method of increasing farmers' income is by allowing farmers to obtain property income through land marketization reform. Property income refers to income earned by people by virtue of elements involving their property, technology or managing certain activities [16]. It includes interest, rent and patent income obtained from the granting of the right to use property, dividend income from the operation of property and income from the appreciation of property [17]. For example, farmers are legally entitled to the possession, use, transfer and income of land and in turn receive income from the process of land transfer or lease [18–21]. The share of property income in disposable income is an important measure of the economic status of a country's inhabitants. Over the past decade, the share of farmers' property income in disposable income has generally increased but at a very low rate and is much lower than the share of national and urban residents (see

Figure 1). Among the four components of farmers' income, wage income and operational income account for the majority of farmers' income sources. Total property income still remains low (see Figure 2) and has yet to become an important source of income growth for farmers[2].
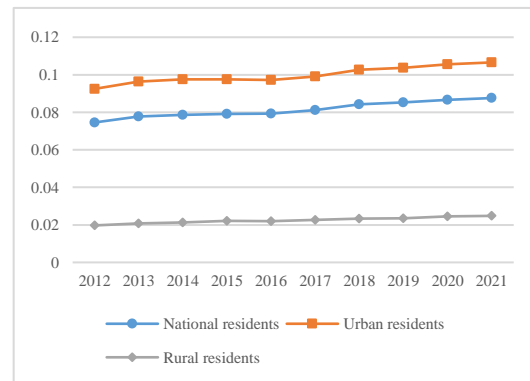

Figure 1. Residents' property income as a proportion of disposable income.
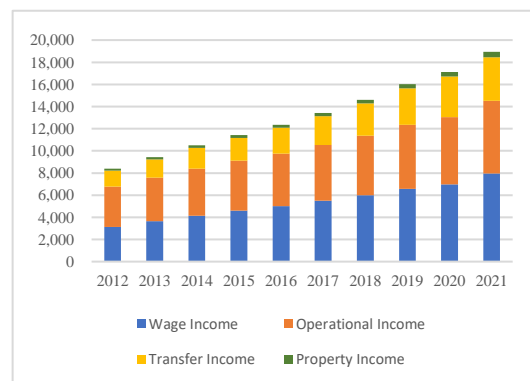

Figure 2. Income composition of rural residents[3].

The continuing growth in China's demand for construction land and the government's lagging ability to control land supply require solutions that are conducive to the development of both urban and rural areas [22]. In 2017, the government released the Pilot Scheme of Building Rental Housing with Collective Construction Land (hereinafter referred to as the Pilot Scheme), identifying the first 13 pilot cities, including Beijing[4]. As an important component of the rural land system reform, the reform shows a strong signal that the Chinese government is gradually opening up land transfer between urban and rural areas [23], and it is one of the most noticeable policy innovations in China's land use system in recent years. How can land marketization reform be connected to rural revitalization to truly revitalize idle land in rural areas, thereby better stimulating the endogenous momentum of rural revitalization? The answer to this question requires good management of the relationship between the market-oriented reform of land and the long-term income generation of farmers. Given the fact that urban land resources are limited, the problem of idle rural land needs to be solved. This paper takes the opportunity of collective construction land entering the rental market to explore how the market-oriented reform of collective land can play its role in increasing farmers' property income. It plays a vital role in narrowing the income gap between urban and rural areas and promoting common prosperity.

Collective construction land in the rental market is closely linked to farmers' property income, and the intrinsic relationship between the two needs to be explored in depth. The contributions of this paper are as follows: (1) The existing research provides a comprehensive literature basis and reference examples to solve the dilemma of collective construction land in building rental housing, and scholars pay more attention to the impact of reform

on rental housing market and macroenvironment. As an important part of rural land system reform, the impact of land marketization reform on farmers' property income has not received enough attention. This paper analyzes the factors of the urban–rural dual land system that restrict the growth of farmers' property income and further enriches the research on land marketization reform. (2) The limited discussion so far has mainly focused on case studies and the empirical level to explore the possible effects and impacts of policy, and systematic empirical tests are lacking. In this study, the SDID method was used for empirical testing. This approach weakens the traditional DID method's dependence on the parallel trend hypothesis and solves the problem of strong sample selection purpose and few pilot projects, which makes up for the deficiency of traditional evaluation reform and provides a new objective method for evaluating the effectiveness of reform. (3) Policymaking is a dynamic process of continuous improvement and development. On the basis of relevant research results, this paper strengthens the demonstration of the causal relationship between the reform of collective construction land rental housing and farmers' property income through the identification of action mechanisms and specifically identifies the mechanisms between them from three angles: economic development level, natural geographical conditions and land function differences. It was found that the promotion effect of reform on farmers' property income is more obvious in the western, southern and non-grain-producing areas of China. The research provides policy reference for narrowing the gap between urban and rural areas, realizing rural revitalization and common prosperity.

The reminder of this paper is structured as follows. The literature review is presented in Section 2; the empirical test model is outlined in Section 3; the empirical results are analyzed and the series of robustness tests are described in Section 4; the heterogeneous impact of collective construction land for rental housing reform on farmers' property income is detailed from the perspective of regional heterogeneity in Section 5 and the full findings of the study are summarized and policy recommendations are made in Section 6.

2. Research Review

Given the current institutional framework and social environment, the policy effects of the reform on the construction of rental housing on collective construction land and the impact they bring have attracted the attention of many scholars. From the existing research, it can be concluded that scholars pay more attention to the impact of the reform on the collective construction land and the analysis of the macroenvironment. In addition, the dilemmas of constructing rental housing on collective construction land with the policy implementation have received increasing attention from scholars. As an important part of rural land system reform, the influence of collective construction land on farmers' property income has not received enough attention. How to further promote and improve the policy and broaden the channels for increasing farmers' income is of great significance in forming a number of policy pilots that can be replicated and popularized.

Collective land is subject to systemic conditions and other constraints and requires top-level design to be improved before it can be truly productive [24]. Liu et al. (2017) [25] argue that with the advancement of urbanization, there is an increasing shortage of land for urban construction and a large number of people from rural areas flowing into cities, leaving many agricultural lands and houses idle. A bottom-up collective land reform can increase land supply, ease the conflict between housing supply and demand and establish a sound long-term mechanism for the stable and healthy development of the real estate market. On the one hand, the improvement of land markets can optimize the allocation of land resources [26]. The dualistic nature of the land system needs to be completely abolished, and farmers' collective land should be encouraged and guided to a more dynamic and fair market. Collective land reform can contribute to expanding the use of collective land, broadening the avenues for collective economic organizations and farmers to increase their incomes, and thus achieving rural revitalization [27]. On the other hand, the entry of collective land into the rental market is not only conducive to increasing the possibility

of accelerating the supply of rental housing in cities with limited land use targets [28] but also to improving land use efficiency and ensuring the stable development of the housing market [29].

Under the existing collective land system, the policy reform of collective construction land for rental housing still suffers from a number of problems. For example, there exist conflicts between the property rights of collective land and the administrative power of the government and in terms of how to achieve a fair and reasonable distribution of rental housing rent within the collective [30]. In China's land market, land acquisition and the primary land market are monopolized in a two-way manner by the government [31]. From the perspective of farmers' property rights, collective land cannot be freely transferred due to the lack of property rights compared to state-owned land, land use being inefficient and the long-term neglect of housing property rights of rural residents [3,32]. In the "collective land for rental housing" model, the government strives to promote the construction of a unified urban–rural construction land market and the free circulation of construction land. In the process of land factor mobility, land resources can be transformed into usable assets [16,33], which allows farmers to realize their land property rights. Hence, clear property rights and land rental markets with free circulation of factors contribute to increasing the incomes of rural residents [14,34–38] and guarantee the right of farmers to benefit from market transactions [32,39].

As one of the most striking policy innovations in China's land use system in recent years, the use of collective construction land to build rental housing is not only an important part of realizing the long-term mechanism of the real estate market but also can increase the supply of urban rental housing and reduce the pressure of new citizens to rent. At the same time, it is a booster of rural land system reform and an effective means to promote the overall development of urban and rural areas. On the basis of relevant research results, this study further explored the relationship between collective construction land rental housing and farmers' property income, verified the relationship and influence through specific data and put forward corresponding policy measures.

3. Theoretical Framework

3.1. Institutional Background

The supply of rental housing is an important link to cultivate and develop the housing rental market, while the supply of newly built rental housing is highly dependent on the effective excavation of land stock resources. In recent years, China has taken collective construction land as the key element of its land policy, and the establishment of a unified construction land market in urban and rural areas is a strong signal that China's government is gradually opening up urban and rural land circulation. Furthermore, the mutual borrowing between land and housing policy has promoted the gestation and development of the pilot work of building rental housing on collective construction land. In order to increase the supply of rental housing and alleviate the contradiction between housing supply and demand, the Ministry of Land and Resources and the Ministry of Housing and Urban-Rural Development, on the basis of local voluntariness, decided to carry out the first batch of pilot projects of using collective construction land to build rental housing in 13 cities, including Beijing, and formulated the Pilot Program of Using Collective Construction Land to Build Rental Housing. The realization of the reform of collective construction land rental housing is helpful to reform the rural land system, increase the supply of urban rental housing and promote the balanced development of urban and rural areas. Using collective construction land to build rental housing makes housing a special commodity not only meeting the "objective needs" of residents but also helping to balance the housing policy objectives between the dual attributes of serving housing equity and economic stability, which is the proper meaning of deepening the reform of the rural land system. Taking the land system as a breakthrough, the reform of the rural land system can be deepened to increase farmers' property income. Increasing farmers' property income is a

wise choice that conforms to the trend of social and economic development and promotes farmers' wealth accumulation.

3.2. Method

The property income of farmers in China mainly comes from land, houses and funds. ① Land is the most important means of production and property of farmers, and the property income from land mainly refers to the income obtained through land expropriation and the transfer of land contractual management rights. However, with the continuous improvement of urbanization level, rural land expropriation will gradually decrease, and the proportion of compensation income from land expropriation in farmers' property income will gradually decrease; ② Property income from housing mainly refers to the income obtained through housing rental and compensation for demolition. Due to the strict restriction of the law on the circulation of farmers' homesteads and collective property houses, farmers' property rights have long been limited and are unable to meet the increasingly diverse demands of farmers' housing rights. With the reform of farmland ownership and the rural housing system, farmers' housing property income is gradually guaranteed by law. ③ Property income from funds mainly refers to income obtained through savings, private lending and investment in financial products.

With the advance of the reform of collective land entering the market, the reform of collective construction land rental housing can revitalize collective resources, ensure that farmers share the land value-added income and increase land property income. Compared with the well-planned state-owned land, there are some problems in rural land, such as "hollowing out" and a large amount of idle land after the collapse of township enterprises. Because this kind of land cannot participate in the circulation, it is allocated to the market, which leads to the rural collective property being idle. After the implementation of the reform, the use of collective construction land is more market-oriented, and the nature of land use can be changed without local government expropriation, thus narrowing the gap between the income of collective construction land and the income of surrounding state-owned land. Moreover, land ownership and management rights still belong to farmers, and farmers will not lose their income because of land acquisition. At the same time, the village collective can obtain a relatively stable rental income through independent development, construction and operation of rented houses of collective construction land.

With the sustained and rapid development of rural and agricultural economy, the income of rural residents in China has increased steadily, the concept of financial management has also changed constantly and the demand for investment and financial management is increasing day by day. After the implementation of the reform, the channels for collective economic organizations and farmers to increase their income have been broadened, and the urbanization process has been accelerated: the development of urbanization has increased employment opportunities, promoted the transfer of rural surplus labor force, improved the labor productivity of agricultural employees and provided opportunities for farmers to obtain wage income in cities. With the expansion of cities and towns, more rural areas extend to neighboring cities, creating sales markets for agricultural products in rural areas, improving the comparative economic benefits of agriculture and improving farmers' operational income. With the increase in farmers' income brought about by the reform, the monetary assets owned by farmers' families have increased, which increases the funds available for subjective control in farmers' hands as well as the bank savings and convertible investment funds, thus indirectly increasing farmers' property income.

4. Method and Data

4.1. Method

How to objectively assess the performance of systems and policies, especially to quantitatively examine the dynamic causality test of the economic impact of new system formulation or new policy implementation, has become an urgent problem for the economics community. The difference-in-differences (DID) method is the most commonly used

method in economics worldwide to assess the effects of policies. However, this method still suffers from problems in its application, such as endogeneity and dynamic heterogeneity [40]. In practice, farmers' property income in the pilot areas is highly volatile due to factors such as urban size and does not satisfy the core presupposition of the DID method's assumption of parallel trends between the treatment and control groups. A more purposive grouping and sample selection may make it difficult to establish a natural experiment characterized by randomness. In terms of the pilot areas, the demand for rental housing in these cities is high, the village and township collective economic bodies are willing to build and have the financial resources to do so and the government has relatively strong regulatory and service capacity, which defies the requirements of random grouping and random sampling. Therefore, the results obtained using the general DID are not the true "net effect" of the policy.

To weaken the reliance of the DID method on the assumption of parallel trends and to address the situation of more purposive sample selection and fewer pilots, this study referred to the synthetic difference-in-differences (SDID) method employed by Dmitry Arkhangelsky et al. (2021) [41] for an empirical analysis. The specific implementation process of SDID consists of the following: (1) Determine the weights of individuals. The weights of the individuals in the treatment group are determined based on the information before the policy treatment, thus the trend in the weighted mean of the predicted variables for individuals in the control group that is consistent with the trend in the treatment group. (2) Determine the time weight λ_i. Weights for each period are determined so that the difference between the arithmetic mean of the predicted variables in each control group after the reform and the weighted mean before the reform remains constant. (3) Calculate the treatment effect of the policy. The average treatment effect of the policy is estimated using a weighted two-way fixed effects model based on individual weights and time weights. The average treatment effect of the policy is then obtained by solving the following minimization question.

$$(\hat{\tau}^{sdid}, \hat{\mu}, \hat{\alpha}, \hat{\beta}) = \underset{\tau,\mu,\alpha,\beta}{\arg\min}\left\{ \sum_{i=1}^{N} \sum_{t=1}^{T} \left(Y_{it} - \mu - \alpha_i - \beta_t - W_{it}\tau\right)^2 \hat{\omega}_i^{sdid} \hat{\lambda}_t^{sdid} \right\}$$

where the arg min () function denotes the value of the variable for which the objective function takes its minimum value, N represents the individual, T represents time and the outcome of the *i-th* individual at the *t-th* time period is expressed as Y_{it}. Upon finding individual weights ω_i and time weights λ_i, the causal effect τ of policy implementation is estimated using the above weights in a regression with two-way fixed effects with α_i and β_i. W_{it} is a binary variable indicating whether or not the policy treatment was received and takes the value of 0 or 1.

Compared to the synthetic control method (SCM), SDID removes the differences caused by the time factor before and after the policy by introducing time weights, which reduces the estimation bias and improves the accuracy of the estimation. In contrast to the DID method, SDID on the one hand provides a higher weight to the control group, which is similar to the treatment group, and on the other hand provides a higher weight to the pre-treatment time period, which is similar to the policy treatment period, thus leading to more robust estimation results. Finally, the SDID method weakens the reliance on the parallel trend assumption as it re-weights and matches trends prior to the introduction of the policy. This feature makes it more appropriate for the research scenario in this study. For all of these reasons, SDID was adopted in this study to estimate the treatment effects of policies.

4.2. Model Design and Variable Descriptions

4.2.1. Model Design

The following econometric model was constructed to test the assumptions presented in the foregoing.

$$ln(income\_f_{it}) = \alpha_0 + \alpha_1 Change_{it} + \alpha_2 CV_{it} + City_i + Year_t + \varepsilon_{it} \tag{1}$$

$$Change_{it} = Treated_i \times Time_t \tag{2}$$

where $ln(income\_f_{it})$ represents farmers' property income, the core predicted variable $Change_{it}$ denotes a dummy variable for whether collective land in city i is in the rental market in year t, CV_{it} denotes a set of control variables related to farmers' property income, $City_i$ represents city fixed effects that control for city characteristics that do not vary over time, $Year_t$ represents year fixed effects that control for macroeconomic shocks that do not vary with region and city and ε_{it} is a stochastic disturbance term.

4.2.2. Variable Descriptions

(1) Predicted variable: farmers' property income $ln(income\_f_{it})$. In this study, the logarithm of farmers' property income was used to represent farmers' property income in order to eliminate as much heteroskedasticity as possible, to enhance the economic significance of the regression parameters and to eliminate the effect of different units on parameter estimation.

(2) Core explanatory variables: $Change_{it}$, a dummy variable for collective land in the rental market. In this study, whether a city was selected as a pilot city for collective construction land to establish a rental market was used as the core explanatory variable. $Time_t$ is the time dummy variable; if the time is after the reform year, then $Time_t = 1$, otherwise 0. $Treated_i$ is the experimental group dummy variable; if the individual is located in the pilot area, then $Treated_i = 1$, otherwise 0.

(3) Control variables CV_{it}. To control for factors affecting farmers' property income as thoroughly as possible, referring to the existing literature and combining with the present study, the CV_{it} set selected includes six factors: (i) Government scale (*government*), expressed as the amount of government fiscal expenditure. Rural financial expenditure is a reliable guarantee for the increase in farmers' income, which can effectively alleviate the externality of public goods necessary to promote agricultural growth. The more rural financial funds, the higher the farmers' income. (ii) Share of primary sector (*agriculture*), expressed as the share of primary sector output in local GDP. The proportion of agricultural income growth in national GDP is related to the vital interests of farmers, and a considerable part of farmers' income comes from agricultural production. The higher the proportion of primary industry, the higher the farmers' income. (iii) Degree of rural informatization (*internet*), expressed by the number of rural fixed telephones (*telephones*) and the number of rural internet broadband access households (*internet*). Promoting information services to guide rural economic development has a positive impact on supporting farmers' entrepreneurship and expanding the employment of rural surplus labor. The higher the degree of rural informatization, the higher the farmers' income. (iv) Rural infrastructure development, expressed in terms of rural electricity consumption (*electricity*), effective irrigation area (*irrigation*) and total agricultural mechanical power (*mechanics*). Rural infrastructure construction plays an important role in increasing farmers' employment, developing non-agricultural industries and narrowing the gap between the rich and the poor in urban and rural areas. The more complete the infrastructure construction, the higher the farmers' income. (v) Scale of agricultural production, expressed in terms of crops sown (*crops*). Consolidating the foundation of agricultural development and expanding the scale of agricultural production will be conducive to promoting macroeconomic growth, stimulating employment and increasing farmers' income. (vi) Bargaining power of government (*governor*) and people (*farmer*), with GDP-standardized public budget revenue and gross agricultural, forestry and fishery product as proxy variables for government and farmer bargaining power,

respectively. The public budget revenue refers to the government's raising of revenue with tax as the main body as a social manager by virtue of national political power; the total output value of agriculture, forestry, animal husbandry and fishery is the total quantity of all products of agriculture, forestry, animal husbandry and fishery expressed in monetary terms, which reflects the total value of farmers' agricultural production in a certain period. When farmers' bargaining power is stronger than the government's bargaining power, they can gain more benefits and increase their income.

4.3. Sample Selection

There are currently around 160 million people living in rented accommodation in urban areas in China, mainly newly employed university students and migrant workers. In large and medium-sized cities where house prices and rents are high, the supply of land and housing is chronically low. On the one hand, the supply of residential land in first and second-tier cities is exceptionally low, and land prices have skyrocketed. At a time of high property prices, the rental market in large and medium-sized cities in China suffers from a severe total housing stock shortage, high rental prices and an unreasonable supply structure. Meanwhile, collective land is unable to be directly transformed into land for urban housing. Under the high pressure of the red line for agricultural land, the total amount of state-owned land in large cities has hit its peak.

The current land regulatory system is one of the major factors contributing to this status quo. The government has identified the first batch of pilot schemes for the use of collective construction land for rental housing in cities such as Beijing and Shanghai based on local wishes. The 13 pilot cities selected basically comprise cities with fast-rising property prices, which provides a more precise grasp of the demand side. As representative cities with a net inflow of population, these cities have a greater demand for rental housing, the collective economic bodies in villages and towns have the willingness to build and the financial resources to do so and the government's capacity to supervise and provide services is relatively strong.

The realization of the reform of the construction of rental housing on collective construction land will contribute to the reform of the rural land system, increase the supply of urban rental housing and promote the balanced development of urban and rural areas and will be an important innovation in the reform of the urban and rural housing and land systems in the new era of China. Before the reform, collective construction land had to be expropriated through the government and changed to state-owned land before it went to the market for trading. After the reform, only collective construction land in some areas can be directly traded in the rental market, while collective construction land in non-pilot areas is still unable to circulate freely in the land factor market. As such, the implementation of this policy amounts to a "quasi-natural experiment" and provides an opportunity to accurately identify the policy effects of collective construction land in the rental market on farmers' property income. Therefore, compared with other cities, the pilot reform in these cities will produce more observable policy effects. The pilot reform will help to reduce the reform cost, accumulate experience and provide advanced experience and typical cases that can be used for reference and replicated for later promotion in the whole country.

4.4. Data Sources and Pre-Treatment

Since 2014, the government has officially released the per capita disposable income of residents and the per capita disposable income of permanent residents by urban and rural areas to the public. The new indicator differs significantly from the original per capita disposable income of urban residents and the net income of rural residents in terms of the scope and caliber of statistics. Hence, this study selected municipality-level cities in China from 2014–2019 as the original sample to conduct a systematic empirical analysis on the policy effects of building rental housing on collective construction land. The initial data were obtained by manual collation of the indicators related to farmers' property income from the statistical yearbooks of each city, and the raw data were treated as follows:

(1) The missing values of the initial data were added by using the statistical bulletins of each municipality-level city, government documents and consulting the local statistical bureau. (2) The Tibet Autonomous Region, where many samples are missing, was excluded. (3) Samples with missing or abnormal main variables were excluded. (4) Taking 2014 as the base period, the data related to farmers' property income were deflated by applying the consumer price index for each city. (5) Taking 2014 as the base period, the GDP indicator was used to standardize the data. (6) In order to eliminate the influence of heteroskedasticity as much as possible, a natural logarithm treatment was applied to the relevant variables. Finally, 1284 data items were obtained from 214 municipality-level cities as sample data.

4.5. Descriptive Statistics

Table 1 gives the results of descriptive statistics for the main variables in this study. As shown in Table 1, the mean value of farmers' property income is 5.7279 and the standard deviation is 0.9880. It provides a good data source for this study to further explore the issue of how to increase farmers' property income.

Table 1. Descriptive statistics for main variables.

Variables	Symbols	Mean Values	Standard Deviations	Minimum Values	Maximum Values
Farmers' property income	$ln(income\_f_{it})$	5.7279	0.9880	2.6589	9.1751
Government	$ln\_government$	14.5299	1.0871	11.4879	18.2405
Agriculture	$agriculture$	10.3930	6.7637	0.0300	44.9800
Internet	$ln\_internet$	4.5053	0.8738	1.6094	7.1854
Telephones	$ln\_telephone$	5.9946	0.7833	3.8712	8.3129
Electricity	$ln\_electricity$	11.8308	1.3321	4.0775	15.6234
Irrigation	$ln\_irrigation$	11.9272	1.1716	8.1490	15.5832
Mechanics	$ln\_mechanics$	14.6412	0.9517	11.4186	17.4145
Crops	ln_crops	13.0033	1.1467	8.4937	15.9861
Governor	$ln\_governor$	13.6976	1.0642	11.2962	17.4470
Farmer	ln_farmer	14.2399	0.7906	11.2263	16.3193

5. Results Analysis

5.1. Baseline Regression Results

This study first estimated the impact of collective construction land for rental housing reform on farmers' property income. The main results of the baseline regressions are presented in Table 2, Among them, $Change_{it}$ represents the "policy effect variable" of the reform implementation, which indicates the difference of policy effect between pilot areas and non-pilot areas after the implementation of the reform policy. Specifically, column (1) provides the results of estimating the fixed effects of DID in controlling for city and year. The regression coefficient for the core explanatory variable is 0.5962, which is significantly positive at the level of 5%. Column (2) provides the regression results for DID with the inclusion of control variables. Columns (3) and (4) provide the regression results for SDID, with all results showing significantly positive. Regarding the economic significance of the estimated coefficients, the magnitudes of the estimated coefficients are relatively similar across regressions. Taking the SDID estimation results in column (4) as an example, after controlling the fixed effects of cities and years and adding control variables, after the implementation of the reform, compared with the non-pilot areas, the property income of farmers in the pilot areas increased by 0.4334%, showing a statistically significant 1% level. This suggests that the policy of building rental housing on collective construction land has significantly contributed to the property income of farmers, i.e., the "net effect" of the reform on farmers' property income is positive.

Table 2. Baseline regression results.

	(1)	(2)	(3)	(4)
	ln(income_f_{it})	*ln(income_f_{it})*	*ln(income_f_{it})*	*ln(income_f_{it})*
	DID		**SDID**	
Change$_{it}$	0.5962 **	0.4036 *	0.5271 ***	0.4334 ***
	(2.08)	(1.66)	(5.87)	(5.36)
Control	NO	YES	NO	YES
Fixed effect of year	YES	YES	YES	YES
Fixed effect of city	YES	YES	YES	YES
Observations	1284	1284	1284	1284
R-squared	0.96	0.97		

Note: ***, ** and * denote significant at the levels of 1%, 5% and 10%, respectively; values in brackets are regional cluster t-statistics, as in the following tables.

5.2. Robustness Test

5.2.1. Parallel Trend Test

The baseline regression results of this paper show that when estimating with the ordinary DID model, the resulting policy effects are significantly positive, regardless of whether control variables are included. To avoid selection bias, a presupposition in the choice to use a common DID is to satisfy the common trend assumption. It is therefore necessary to test that there are no significant differences between the control and treatment groups at the base period. Figure 3 shows the results of the test, from which it can be seen that the presupposition of the common trend assumption is not satisfied, and therefore the results of using common DID do not represent a true net effect of the policy. We then tested the parallel trend of SDID, and the fitting results are provided in Figure 4. The treatment group had a similar trend to the synthetic control group before the introduction of the policy, and after the policy was introduced, the treatment group showed a significant upward trend relative to the synthetic control group. The above results suggest that the entry of collective land into the rental market has increased the property income of farmers, which satisfies the parallel trend test.
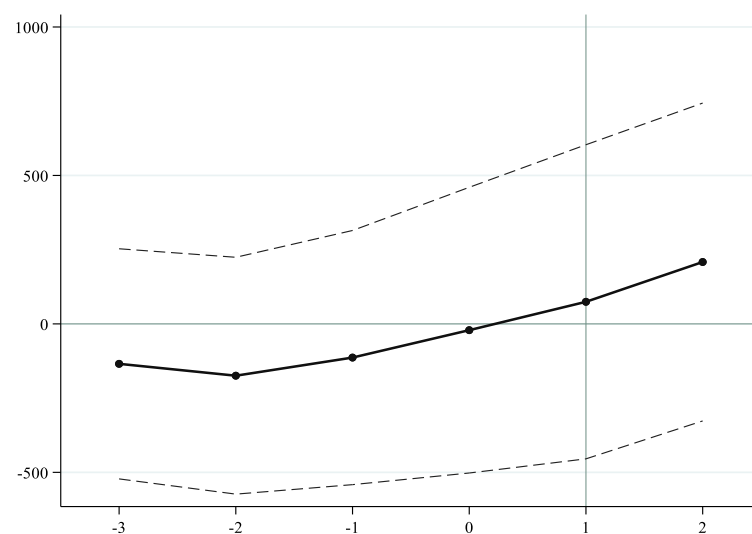
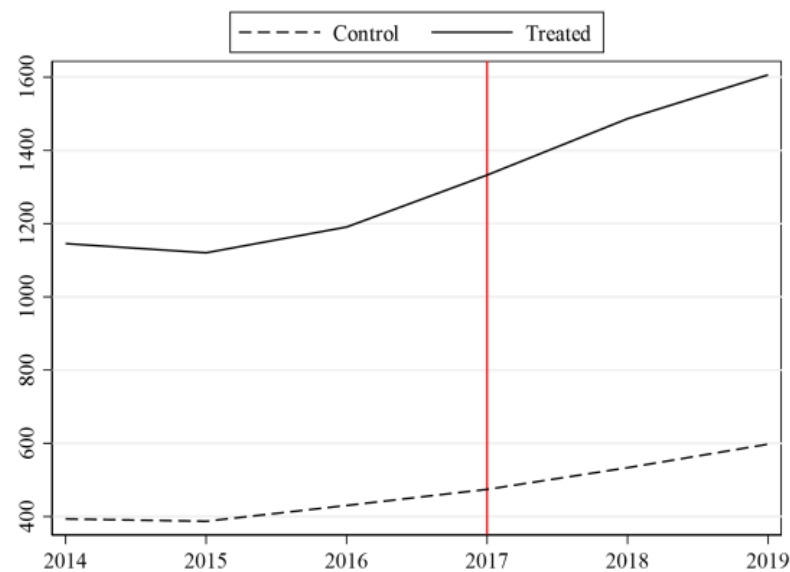**Figure 3.** Difference-in-differences parallel trend test.

Figure 4. Synthetic difference-in-differences fitting.

5.2.2. Propensity-Score-Matching Method (PSM-DID)

As the urban characteristics of municipality-level cities may differ between the experimental and control groups, direct estimation by DID may lead to bias in the results due to self-selection of the sample. By using the PSM-DID method, this study can both address the problems of self-selection bias in the sample, reduce the differences between the pre-treatment and control groups before the reform and mitigate the problem of endogeneity due to reverse causality, thus accurately identifying policy effects [42]. Hence, this study employed the PSM-DID for testing. According to the research methods of Heyman et al. (2007) [43] and Bockerman and Ilmakunnas (2009) [44], this study matched the experimental group to the control group with the most similar characteristics using the year-by-year PSM-DID and the cross-sectional PSM-DID methods, respectively, based on the characteristic variables at the regional level. The matched groups showed a wide range of common values for the propensity scores of the experimental and control groups, which satisfied the requirements for the PSM method. After the samples were matched, the policy effect of the reform on farmers' property income was tested. The results are shown in Table 3, where columns (1) and (2) denote the results after regression of year-by-year and cross-sectional PSM-DID, respectively. After selecting the sample regressions that meet the common support assumptions after matching, this study finds that the estimated coefficients and t-values of the core explanatory variables remain largely consistent with the results of the previous baseline regressions, which are positive at the 1% and 5% levels of significance, respectively. This suggests that the facilitation effect of the reform on farmers' property income is stable regardless of the matching method used, which further demonstrates the robustness of the conclusions of this paper.

5.2.3. Replacement of Farmers' Property Income Measurement Variables

In the baseline regression model, this study used the natural logarithm of farmers' property income to measure the growth of farmers' property income. To further enhance the robustness of the benchmark regression results, we conducted robustness testing by replacing measures of the explanatory variables. Based on the existing literature, this study used "the absolute number of farmers' property income" to measure farmers' property income. Column (3) of Table 3 provides the results of the test. After replacing the explanatory variables, it was found that the reform of collective construction land for rental housing significantly contributes to the increase in farmers' property income, further supporting the robustness of the baseline regression results of this paper.

Table 3. Robustness test regression results.

	(1)	(2)	(3)	(4)	(5)	(6)
	Year-by-Year PSM-DID	Cross-Section PSM-DID	Replacement of Explanatory Variables	Exclusion of Direct-Administrated Municipalities	Exclusion of Other Policy Interferences	
Change$_{it}$	0.9096 *** (2.66)	0.7282 ** (2.00)	0.4109 *** (5.23)	0.2088 *** (3.62)		
Policy$_{SDID}$					6.8492 *** (6.88)	6.8302 *** (6.72)
Policy$_{2015}$					4.6037 (1.58)	
Policy$_{2016}$						4.6421 (1.05)
Control	YES	YES	YES	YES	YES	YES
Fixed effect of year	YES	YES	YES	YES	YES	YES
Fixed effect of city	YES	YES	YES	YES	YES	YES
Observations	274	738	1284	1260	1284	1284
R-squared	0.21	0.25				

Note: ***, ** and * denote significant at the levels of 1%, 5% and 10%, respectively; values in brackets are regional cluster t-statistics.

5.2.4. Exclusion of Samples of Cities with Relatively Special Administrative Systems and Economic Development

In the pilot cities, the inclusion of samples from directly administrated municipalities such as Beijing and Shanghai had an impact on the accuracy of the test results. These cities are politically and economically superior to other municipality-level cities. The directly administrated municipalities play a guiding role in the economy and have a high degree of autonomy in the economy. The property income profile of local farmers also has certain advantages compared to other municipality-level cities. The test results in column (4) of Table 3 show that the estimated coefficients of the farmers' property income variable remain significant, further supporting the robustness of the baseline regression results in this paper.

5.2.5. Exclusion of Other Policy Interferences

Although the above tests provide further support for the robustness of the baseline regression results, in reality there are still some uncertainties that may affect the test results. For example, the implementation of a policy may be largely influenced by other exogenous events or policy shocks, which in turn make it impossible to accurately assess the effects of the implementation of that policy. The market entry of collective land within the scope of compliance has been at a pilot stage since 2015. The status of several major pilot efforts to bring collective land to the market at the national level has been dominated by the reform of putting collective business construction land on the market introduced in 2015, the pilot mortgage loans for the operation rights of contracted rural land as well as the pilot mortgage loans for farmers' housing properties introduced in 2016. Other pilot efforts to market collective land have increased the farmers' property income to some extent.

The pilot mortgage loans are universally applicable as the operation rights of rural contracted land involve cities across the country. However, the 33 pilot cities for the market entry of collective operation construction land and the pilot mortgage loans for farmers' housing properties cover a limited area and are regionally representative. It is therefore reasonable to speculate whether the policy effect of collective construction land for the construction of rental housing is influenced by the market entry of collective business construction land and the reform of mortgage loans for farmers' housing properties. This

study tested the robustness of the conclusions by referring to the approaches of Bai et al. (2022) [45] and included two dummy variables for the year of policy implementation in turn in the baseline regression model to control for their effect on the estimation results. In Table 3, columns (5) and (6) show that the coefficients in the regression equation remain significantly positive after controlling for both categories of policies. That is, the reform had a significant increase effect on farmers' property income in the cities of the treatment group. This suggests that the increase in farmers' property income was originated from the collective rental housing reform, rather than being caused by other policies.

5.2.6. Instrumental Variable (IV) Method

One of the major difficulties in this study is dealing with the endogeneity of the impact of reforms on farmers' property income. The endogeneity problem is caused by the omission of potentially important variables on the one hand and, on the other hand, by the possibility of reverse causality between the core explanatory and dependent variables. For the issue of omitted variables, various important factors commonly used to influence farmers' property income were set in equation (1) based on the references where possible, particularly controlling for fixed effects at the city and individual levels, and the issue of omitted variables was not prominent. Regarding the issue of reverse causality, the 13 pilot cities were among super- and mega-cities as well as pilot cities for the development of housing rental markets in terms of pilot reform areas. These pilot cities have certain advantages in terms of development conditions, and farmers have greater control over their property income. Therefore, this paper argues that the selection of the reform pilots may have been influenced by the level of farmers' property income.

For this reason, the instrument variables used in this study were "number of urban residents" and "disposable income of urban residents". ① Correlation: From the perspective of city size, there is a correlation between whether a city chooses to voluntarily include itself in the list of pilot cities and its size. The current mega and super-sized cities in China, represented by first-tier cities, gather the finest resources in the country and attract the inflow of rural migrants. From the perspective of economic development, population tends to move from less developed areas to developed areas. The disposable income of urban residents in a city has long been an important indicator of the income level of local residents. The higher the disposable income for urban residents in a region, the more attractive to the inflow of population. ② Exogeneity: From the perspective of the city size, the size of a city depends on the size of its population[5]. The criteria for classifying the size of cities rarely have a direct influence on the property income of farmers within the target cities. From the perspective of economic development, the increase in disposable income of urban residents promotes the development of secondary and tertiary industries in urban areas, which creates more employment opportunities. The large number of rural migrants moving to cities and the increasing wage income of farmers do not directly affect the farmers' property income within the target cities. Therefore, the IV selected for this study satisfies the correlation and exogeneity assumptions of the instrumental variables. Table 4 provides the test results of the instrumental variables. After obtaining unbiased results using two-stage estimation and regressing the model using control year and region fixed effects, it is evident that the F-statistic of the first-stage regression is very large, indicating the absence of weak instrumental variables. Furthermore, the policy effect remains significantly positive after the instrumental variables have been used, which is consistent with the results of the previous baseline regression. This suggests that there is no causal endogeneity between the reform of collective construction land for rental housing and farmers' property income.

Table 4. Instrumental variables regression results.

IV	1/(Number of Urban Residents)		1/(Disposable Income of Urban Residents)	
	$ln(income\_f_{it})$	$income\_f_{it}$	$ln(income\_f_{it})$	$income\_f_{it}$
SDID	1.6144 ***	2239.651 **	2.5088 ***	2432.382 ***
	(2.58)	(2.22)	(3.51)	(3.39)
Control	YES	YES	YES	YES
Fixed effect of year	YES	YES	YES	YES
Fixed effect of city	YES	YES	YES	YES
Observations	1284	1284	1284	1284
F-statistic in Stage 1	35.300		44.964	

Note: ***, ** and * denote significant at the levels of 1%, 5% and 10%, respectively; values in brackets are regional cluster t-statistics.

6. Further Analysis

The structural imbalance of land in China has become an urgent issue of concern. The main contradiction in the urban construction land market in China is that supply of construction land indicators does not sufficiently match demand, the structural imbalance in the supply of state-owned construction land and the spatial mismatch of indicators are particularly evident [46] and that the structural imbalance in the supply of construction land has driven up the price of land and housing and exacerbated the trend of widening property disparity between urban and rural areas. Hence, to further explore whether there is regional heterogeneity in the impact of collective construction land for rental housing on farmers' property income, this study divided the sample into cities according to differences in economic development levels, differences in physical geographical characteristics and differences in land functions to examine heterogeneity.

6.1. Differences in Economic Development Levels

This study divided cities into three regions, comprising Eastern, Central and Western China[6], according to the differences in economic development levels, and the regression analysis was conducted separately. The regression results in columns (1) and (3) in Table 5 indicate that the comparison of data across regions in China reveals that the contribution of collective land to the rental market reform to farmers' property income shows an uneven regional development. The reason for this may be that land is the production factor on which farmers depend most and which has a significant impact on property income. Compared to the East and Central regions, rural productivity in the West is relatively backward, economic development is slow, farmers are more dependent on land and the impact of collective land in the rental market on the increase in their farmers' property income is more significant.

6.2. Differences in Physical and Geographical Characteristics

The regression analysis was carried out separately by dividing the cities into northern and southern regions according to the differences in physical geographical characteristics[7]. The regression results in columns (4) and (5) in Table 5 show that the contribution of collective land to the rental market reform to farmers' property income is significant in both southern and northern regions, with the contribution effect being higher in the southern region than that in the northern region. The reasons for this may be the difference in industrial structure between the south and the north, with the economic structure of the south being more labor-intensive and talent-intensive in nature, and this type of industry tends to absorb human employment. Rural migrants, newly employed university students and high-tech talent prefer to flow into the more developed economic regions, thus making the employment attraction of southern cities far greater than that of northern cities. With the inflow of people, the rental market is more "active" in the south than that in the north,

and the circulation of collective land is accelerating, with a corresponding increase in collective rental housing and the resulting increase in rental income for farmers.

Table 5. Regional heterogeneity regression results.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Differences in Economic Development Levels			Differences in Physical and Geographical Characteristics		Differences in Land Function	
	Eastern Region	**Central Region**	**Western Region**	**Northern Region**	**Southern Region**	**Main Grain-Producing Areas**	**Non-Main Grain-Producing Areas**
SDID	5.1743 **	5.1413 **	4.5265 ***	5.2033 **	5.2689 **	4.6951 ***	5.0593 ***
	(2.46)	(2.20)	(3.39)	(2.43)	(2.09)	(3.25)	(3.23)
Control	YES	YES	YES	YES	YES	YES	YES
Fixed effect of year	YES	YES	YES	YES	YES	YES	YES
Fixed effect of city	YES	YES	YES	YES	YES	YES	YES
N	558	324	402	486	798	744	540

Note: ***, ** and * denote significant at the levels of 1%, 5% and 10%, respectively; values in brackets are regional cluster t-statistics.

6.3. Differences in Land Function

According to the different functions of land, this study divided the urban areas of China into main grain-producing areas and non-main grain-producing areas, and separate regression analyses were conducted[8]. The regression results in columns (6) and (7) in Table 5 show that the facilitation effect of collective land to rental market reform on farmers' property income is significant in both main grain-producing areas and non-main grain-producing areas, and the facilitation effect is higher in non-main grain-producing areas than that in main grain-producing areas. This might be due to the fact that farmers in the main grain-producing areas mainly engage in or specialize in agricultural production, thereby earning an income comparable to that of people moving to the cities, so that the number of migrants to the cities is relatively low, and the volume of turnover and demand in the rental market is consequently low.

7. Conclusions and Policy Recommendations

7.1. Conclusions of the Study

The dualistic land system between urban and rural areas and the inadequate market mechanism for land factors are the main obstacles to collective land transactions. In 2017, the reform of the use of land for collective construction to build rental housing was introduced on a nationwide pilot basis. The study of how to increase farmers' property income by broadening the use of collective construction land has become increasingly essential to the realities of rural revitalization and common prosperity. This study used the policy reform of collective construction land for rental housing as a "quasi-natural experiment" and empirically analyzed the impact of the reform on farmers' property income by means of the synthetic difference-in-differences (SDID) method using statistical data from 2014–2019 at the municipality-level. The study found that the reform of collective construction land for rental housing has a significant contribution to farmers' property income. This conclusion remains robust after a series of robustness tests including parallel trend tests, PSM-DID, replacement of the measure of the explanatory variable, exclusion of other policy effects and instrumental variable tests. The results of the heterogeneity test suggest that the reform has had a more significant effect in contributing to farmers' property income in the western, southern and non-main grain-producing areas of China.

7.2. Policy Recommendations

This paper provides a deeper understanding of the practical effects of the policies. It helps to provide policy reference for further building a healthy housing rental market, establishing a sound long-term mechanism for a sound real estate development, facilitating the optimal allocation and economical and intensive use of collective land and accelerating the urbanization process.

(1) The reform focuses on collective construction land, which is subject to more serious crude use and is not fully valued. Due to restrictions on the circulation and mortgage of collective construction land, the increase in farmers' property income involved in this part of the land is inhibited. Hence, it is important to gradually change the development mode of the crude use of collective construction land in the past through reform and promote the intensive and economical use of collective construction land. By activating this reserve, it is possible to break through the bottleneck of land that constrains the economic development of China and release new space for industrial development and urbanization.

(2) The reform of building rental housing on collective construction land has a significant positive effect on farmers' property income, especially in the western, southern and non-main grain-producing areas of China. Therefore, it is necessary to closely focus on the important and difficult issues of different regions and establish a region-specific benefit-sharing mechanism with regional characteristics; continue to promote the construction of factor markets and focus on building a unified urban and rural construction land market; strictly fulfil the main responsibility of the government; coordinate and promote the pilot schemes and provide replicable and promotable experiences and models across the country.

Notes

1. Floating population is a concept of the household registration system in China. It refers to the population who has left the household registration and lived in other places, but there is no clear, accurate and unified definition at present. Internationally, similar groups are called "domestic immigrants".

2. Data source: National Bureau of Statistics of China (NBSC): http://www.stats.gov.cn/ (accessed on 22 August 2022).

3. Color should be used for Figures 1 and 2 in print.

4. The first batch of pilot cities for the use of land for collective construction to build rental housing comprised the 13 cities of Beijing, Shanghai, Shenyang, Nanjing, Hangzhou, Hefei, Xiamen, Zhengzhou, Wuhan, Guangzhou, Foshan, Zhaoqing and Chengdu.

5. According to the Circular on Adjusting the Criteria for the Classification of City Size issued by the State Council in November 2014, cities with a resident population of more than 5 million and less than 10 million in urban areas are considered megacities, and cities with a resident population of more than 10 million in urban areas are considered super-cities, with the resident population in urban areas as the statistical caliber.

6   Mainly with reference to the national work plan of 1986. The eastern region includes Hebei, Shandong, Beijing, Tianjin, Liaoning, Jiangsu, Zhejiang, Shanghai, Guangdong, Guangxi, Fujian and Hainan; the central region includes Hubei, Hunan, Inner Mongolia, Jilin, Heilongjiang, Shanxi, Jiangxi, Henan and Anhui; the western region includes Guizhou, Yunnan, Chongqing, Sichuan, Shaanxi, Ningxia, Gansu, Qinghai, Xinjiang and Tibet.

7   Mainly in accordance with the Qinling–Huai Line.

8   The 13 provinces (autonomous regions) of Hebei, Inner Mongolia, Liaoning, Jilin, Heilongjiang, Jiangsu, Henan, Shandong, Hubei, Hunan, Jiangxi, Anhui and Sichuan are identified as the main grain producing areas in China, according to the document issued by the Ministry of Finance in December 2003.

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