Unpacking the effects of rural homestead development rights reform on rural revitalization in China

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Abstract: Rural homestead development rights (RHDR) reform is considered a pivotal tool for promoting rural revitalization in China. Thus, identifying the impact of RHDR reform on rural revitalization is crucial for comprehensively understanding the ongoing rural homestead system reform in China. We propose a unified theoretical framework to unpack the effectiveness of RHDR reform by contracting the effects of two approaches, i.e., the collective-oriented and the household-oriented strategies. Our theoretical analysis suggests that the two approaches affect rural revitalization differently through five channels, and the overall effects are stronger for the collective-oriented approach. Based on an unbalanced multi-period panel dataset from 2006 to 2018, we develop a comprehensive index system to measure rural revitalization. We then use propensity score matching combined with a difference-in-differences model and a two-way fixed effects model to identify the net effect of RHDR reform on rural revitalization. The baseline empirical results show that the rural revitalization performance of the treatment group with the RHDR reform is significantly higher, on average, than that of the control group. Further impact heterogeneity analysis shows that collective-oriented RHDR reform has a stronger impact than household-oriented RHDR reform on promoting rural revitalization. The findings not only underpin the significance of further conducting rural homestead system reform to comprehensively promote revitalization in China, but also provide a reference for the validity of the rural community as an effective organizational subject to reuse land resources intensively in a developing economy with an imperfect rural land market.

Keywords: land development rights; rural homestead; rural revitalization; China

1. Introduction

China's rapid urbanization process brought prosperity to many parts of the country in the last decades. However, the same process also raised concerns about a widening urban-rural divide and the sustainability of rural communities. A series of policies have been issued to revitalize rural China by combating challenges such as depopulation and rural land underutilization. Among these policies and reforms, rural homestead development rights (RHDR) reform is considered a pivotal tool for promoting rural revitalization in China. Both the central and local governments put great emphasis on these reforms. Hence, identifying the impact of RHDR reform on rural revitalization is of significant policy importance.

Existing studies have explored ways to make full use of and extend homestead functions to promote rural revitalization based on qualitative analysis (Gao et al., 2022; Li et al., 2014; Liu et al., 2014; Long et al., 2012, 2010; Tao et al., 2021). After the Chinese central government proposed a new exploration of the "three rights separation" *(san-quan-fen-zhi)* reform of rural homesteads in 2018, there were a variety of debates about how to efficiently manage and reuse rural homestead resources (Bramall, 2021; Zhou et al., 2020). Nevertheless, few studies have provided well-identified quantitative evidence of rural homestead reform practices in China. This is partly due to the lack of related homestead data of Chinese villages or households and partly due to the complex situation of identifying the impacts of the reform on rural revitalization because there is still a lack of index systems available to measure rural revitalization performance. In this case, it is impossible to scientifically understand the comprehensive impact of the rural homestead reform on rural revitalization, not to mention further analyzing the impacting heterogeneity, which is of great significance for the launch of more precise reform policies. In addition, extensive studies have explored the innovation mechanism, potential effects and limitations of land development rights as a policy tool to supplement land use planning and mediate strict land use control based on case studies or qualitative analysis all over the

world since the concept of land development rights was comprehensively formulated in the 1960s and 1970s (e.g., Barrese, 1982; Falco and Chiodelli, 2018; Linkous, 2017; Pruetz and Standridge, 2009; Wang et al., 2020). However, few studies have discussed the differences in the effects of different organizational subjects in implementing various rural land development rights programs based on empirical evidence, especially in a developing economy with an imperfect rural land market. Against this backdrop, it is important to analyze China's RHDR organizational means in implementing rural homestead land system reform to provide a reference for understanding how to better conduct rural land development rights programs in a developing economy with an undeveloped rural land market.

In this paper, we propose a unified theoretical framework to unpack the effectiveness of RHDR reforms on rural revitalization. Our analytical framework classifies RHDR reforms into two categories, i.e., collective-oriented and household-oriented reforms. The theoretical analysis suggests that the two approaches affect rural revitalization differently through five channels, i.e., *Industries*, *Environment*, *Culture*, *Governance* and *Income* as defined in the "Strategic Plan for Rural Revitalization (2018-2022)", and the overall effects are stronger for the collective-oriented approach. We then develop a comprehensive index system to measure rural revitalization performance in these five aspects and verify the theoretical model by using an unbalanced multi-period panel dataset from 2006 to 2018. Propensity score matching combined with the difference-in-differences method and two-way fixed effects models are used to identify the net effect of the RHDR reform on rural revitalization. Our findings support the hypotheses derived from the theoretical framework. The results are robust to alternative measurements of variables and estimation methods.

This study adds to our understanding of the impacts of rural homestead land reform on rural revitalization in four ways: (i) it establishes a reasonable index system to measure rural revitalization performance; (ii) it uses panel survey data of China's four typical provinces to provide empirical evidence for identifying the

impact of the reform; (iii) it unpacks the comprehensive impact and impacting heterogeneity of the reform by identifying two rural homestead rights reform types and putting them into the rural revitalization framework; and (iv) it provides a reference for feasible communal rural homestead land use methods under imperfect rural land markets in developing economies.

The remainder of this paper is structured as follows. Section 2 provides the institutional background of rural revitalization and the RHDR reform in China. Section 3 classifies the RHDR reform into two types according to the implementing subjects and develops a unified theoretical framework to analyze how RHDR reform impacts rural revitalization. Section 4 lays out the empirical models and introduces the data sources. Section 5 discusses the empirical findings and processes different tests. Section 6 provides further discussions on the deepening of the RHDR reform in China and discusses the policy implications of rural homestead reform in developing countries as a tool to promote rural revitalization. Section 7 summarizes the research findings.

2. Institutional Background

2.1 Urbanization and rural revitalization in China

China has undergone rapid economic development and experienced great social transformation since the opening-up reform in 1978. The per capita gross domestic product (GDP) increased from 385 Yuan (1 Yuan ≈ 0.14 USD) in 1978 to 85,698 Yuan in 2022, while the urbanization rate increased from 17.92% to 65.22% in the same period, increases of approximately 221.59 and 2.64 times, respectively. In the meantime, China has also witnessed a widening urban-rural income gap and faces a dual economy where urban areas are prospering and rural areas are languishing (Cheung, 2012; Han, 2020). Rural decline characterized by the outflows of labor, talent, capital and land from rural to urban areas has become a major challenge for policymakers seeking to promote the integrated development of urban and rural areas (Li et al., 2015; Wu

and Liu, 2020). In China's rural areas, 171.90 million migrant workers left for cities in search of job opportunities in 2022, and approximately 0.46 million ha of agricultural land was approved for construction and converted from rural areas to urban areas in 2022. Meanwhile, cities have attracted more than 70% of China's total public and private investments in fixed assets since 1980 (National Bureau of Statistics of China, 2023).

When increasing urban-rural disparities threatened socioeconomic stability, the Chinese government began to take action by launching rural-favored policies (Li et al., 2015). To promote rural development and alleviate rural decline, the Chinese government initiated a campaign named "Building Socialist New Countryside" in 2006, followed by the strategy of promoting "Rural Revitalization" in 2017 (Xi, 2019). "Building Socialist New Countryside" represented the central government's effort to improve the quality of life in the countryside. It was designed around five important aspects of rural communities: rural production, rural life, rural atmosphere, living environment, and rural management (Ahlers and Schubert, 2009; He, 2007; Jan et al., 2012). "Rural Revitalization" can be seen as an upgraded version of the "Building Socialist New Countryside" policy in terms of content and implementation intensity (Wang, 2023). Since its inception, "Rural Revitalization" has become a nation-level development strategy for managing the relationship between urban and rural areas in China (Xi, 2019). The CPC Central Committee and the State Council subsequently issued the "Strategic Plan for Rural Revitalization (2018-2022)" in 2018 to refine the five aspects of the "Building Socialist New Countryside" policy, i.e., advanced production, living environment, rural atmosphere, rural management and rural life, as rural industries, rural environments, rural culture, rural governance and rural income, respectively.

2.2 Rural homestead rights in China

Vitalizing the countryside requires the inflows and agglomeration of production factors in rural areas

(Tang, 2019). Rural homestead land in China plays an important role in rural revitalization because it accounts for a large proportion of rural construction land and can be used as a tool to attract production factors. The role that homestead plots play in rural areas extends far beyond places to build houses. The plots also provide households additional space for conducting other economic activities, such as those of the homestay, catering, cultural and creative industries (Gu et al., 2020; Zhang et al., 2023). The village collective can also develop secondary and tertiary industries, improve local living environments, increase the governance levels, and increase peasants' income by reusing homestead resources (Wu et al., 2018). In this process, rural areas attract and agglomerate production factors including capital, talent and land, to comprehensively promote rural development (Han, 2020; Liu et al., 2022; Zhang et al., 2022). This process also helps curb rural outmigration, which eventually increases the sustainability and resilience of rural communities (Li et al., 2022). Therefore, rural homestead land system reform could generate far-reaching impacts on rural revitalization, and in-depth analysis of these impacts is needed to better understand the ongoing rural homestead land reform in China.

As rural homestead land in China is collectively owned and restricted from free transactions in land markets, endowing rural collectives and households with land development rights has become a feasible path for rural homestead land reform (Machemer and Kaplowitz, 2000; Zhu, 2004). Rural homestead development rights, which allow the subject to obtain benefits by changing land use or land use intensity following the control of governments, are property rights separated from the ownership (Janssen-Jansen, 2008; Wang et al., 2020). The process of realizing rural homestead development rights is also the process of promoting rural revitalization through reusing homesteads and gathering production factors.

Under the strict farmland use control system in China, rural homestead land could provide flexible space for the development of rural characteristic industries, thus serving as a catalyst to promote rural revitalization

as a whole and preventing the occupation of farmland to develop rural secondary and tertiary industries. However, there are still a lot of unreasonable restrictions on rural homestead rights in China, and previous homestead management system could exacerbate poverty and hinder rural development (Liu and Li, 2017). Therefore, reallocating or reusing rural homestead resources is a crucial policy tool for attracting investment, talent and innovative technology to the countryside.

2.3 Rural homestead development right reform (RHDR)

Policy makers have attached great significance to promoting rural development via rural homestead land reform (Hanstad et al., 2002; Haque, 2003; Kong et al., 2018; Tan et al., 2020). However, because of the sensitivity of the initial institutional arrangement of rural homesteads, the central government in China is very cautious in launching the rural homestead system reform. Therefore, rural homestead system reform has been explored at different levels for a long period in China. Before the socialist transformation in 1958 China, rural homestead land was privately owned by households, and there were few restrictions on its use and transactions (Dong, 2019). After the socialist transformation, rural homestead land became collectively owned, and many restrictions were set to ensure households' right of residence. As China's economy took off, the institutional arrangement of the rural homestead system lagged, and the exploration of reform under socialist public ownership was vigorously promoted after the 2000s (Dong, 2019; Xu et al., 2022). In general, the system has gone through the process from "separation of two rights" to "separation of three rights" and from "ensuring the right of residence" to "ensuring the right of residence and right of development as the property right" (Lu et al., 2020). Rural homestead resources are allowed to be reused to develop rural characteristic industries under certain conditions, especially after 2015, when rural homestead reform was promoted at the national level. China has gradually established a rural homestead system by endowing rural collectives and households with more homestead development rights.

Since the early 2000s, the RHDR reform has become a fundamental strategy to optimize the allocation of homestead resources (Zhu, 2004). It was launched before the "three rights separation" reform and was linked to it in practice in China. The RHDR is, in fact, a property right from which the subject obtains benefits by changing land use or land use intensity following the control of governments (Janssen-Jansen, 2008; Wang et al., 2020). From this perspective, RHDR reform could have a broader policy connotation than that of rural homestead use rights reform in China.

3. Theoretical framework

3.1. Two schools of thought: property owners vs. users

In China, rural homestead rights are collectively owned and distributed to rural households for free according to their membership status. Rural collectives hold the ownership, and households hold the right to use homestead plots. Thus, rural households' right to use homesteads is a type of property right obtained not from transactions through land markets, but from the national institutional arrangement. In this case, the boundaries and contents of this right are bound to be subjected to institutional arrangements, and free transactions of homestead plots on land markets are restricted (Alchian and Demsetz, 1972; Kong et al., 2018). In the absence of functional markets, the titling and transaction of property rights depend on specific institutional arrangements (Hart and Moore, 1990). According to Coase (1960), when there are transaction costs, the initial arrangement of property rights will affect the final allocation of rights, and further affect the total social welfare.

Under this restriction, with an increasing willingness of migrant rural households to lease homestead plots and an increasing demand for renting homestead plots to develop rural industries, the initial allocation of homestead rights negatively affects the allocation efficiency of rural homestead resources, resulting in the dissipation of land rents and the loss of overall social welfare.

As shown in Fig.1, S and D represent the supply curve and the demand curve of the homesteads, respectively. P and Q denote the equilibrium price and the equilibrium quantity of the homestead market, respectively. In China, restrictions on the usage and transfer of homestead rights pull the market away from its equilibrium. Specifically, the realized market price, P_1, is lower than that of the equilibrium price, P. However, when the market price is P_1, the supply would be Q_1, and the price the demander is willing to pay is P_2. Thus, there is a gap between P_1 and P_2. The shaded area defined by $(P_2-P_1)*Q_1$ represents the rent that might induce rent-seeking behavior and increase transaction costs (Barzel, 1997). To prevent such market failure, government interventions such as property rights reform are necessary to improve rural homestead resource allocation efficiency and promote rural development.

The RHDR reform provides an opportunity for rural homestead resource reallocation to different subjects by changing land use or land use intensity. According to the studies of Barzel (1997) and Levinson (1997), RHDR reforms shift the supply curve to the right, i.e., from S to S', because the RHDR reforms loosen the constraints on land development transfer and the supply side. The equilibrium price and the equilibrium quantity of the homestead market change from P and Q to P' and Q' correspondingly. Assuming that the realized market price is still P_1, the supply would be Q_1', and the price of the demand side would be P_2'. Comparing the shaded areas of $(P_2'-P_1)*Q_1'$ and $(P_2-P_1)*Q_1$, it is evident that the distortion of the homestead market would be adjusted and that the transaction costs could be decreased by implementing RHDR reforms. Although Levinson (1997) deemed that transferable development rights could lead to greater overall development, Shih et al. (2019) found that this transfer could generate a positive impact and density bonus on areas with strict land use plans. In the case of China, there are strong restrictions on rural homestead use and transactions. By implementing the RHDR reform, these restrictions could be partially eliminated and related industries could be widely developed, resulting in an overall comprehensive and positive impact on

rural development.

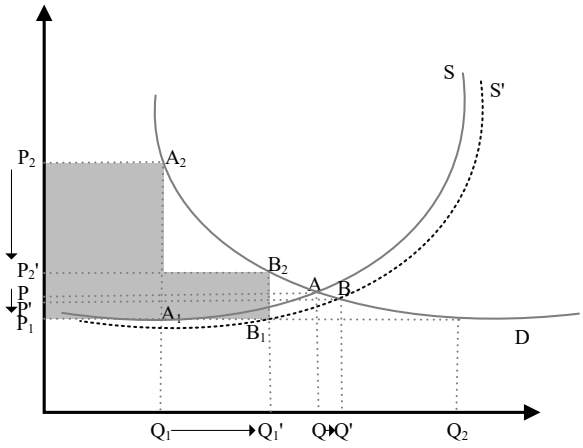

Fig.1. Land market distortion adjustment under the RHDR reform

Our analysis clearly shows the benefits of homestead rights reform in China. However, how to carry out this reform under the premise of ensuring rural collective ownership remains controversial, and the primary dispute is whether households or rural collectives are capable market subjects. Given that different subjects do not use the same resources with equal efficiency, property rights should be entitled to those who are more capable of reducing transaction costs (Coase, 1994). However, the question remains as to who may be a capable subject and how to determine the differences among subjects in their use of resources in rural China (Luo, 2017). Existing studies can be broadly classified into two groups based on their focus on property owners or users.

According to Hart (1995), property owners should be more capable of allocating property rights in incomplete contracts because the owners have residual claims on property rights. In China, rural collectives effectively hold the rights of rural lands and, consequently, residual claims on homestead rights. Moreover, collective tenure could improve land use efficiency and redistribution benefits where formal rural land and labor markets are not fully developed and the poorest households often require communal support for

subsistence (Zhao, 2020). Therefore, rural collectives are in a better position to manage rural homestead rights. Nevertheless, Barzel (1997) pointed out that when there is supervision cost, the problem of titling the residual control rights arises, and property users may become effective resource allocation subjects. Thus, low supervision costs and high flexibility in operation may also make it more efficient for rural households (i.e., property users) to be the subject of allocating homestead property rights in China. There is no consensus about which school of thoughts should be followed to model the homestead rights reform in China. Our research seeks to answer this question by incorporating both aspects in a unified framework.

3.2. The classification of RHDR reforms

Rural homestead use rights reform is mainly aimed at promoting land transfer and maintaining homestead use (Brandt et al., 2017; Zhou et al., 2020). Due to the restrictions on transaction scopes, the transfer of rural homestead use rights is basically restricted within the same village or town. Under these circumstances, RHDR reform provides an opportunity for direct and indirect types of rural homestead use rights transfer through the rearrangement of property rights among different subjects by changing land use or land use intensity. In other words, rural homestead land use rights reform might be carried out in the form of RHDR reform (Liu, 2019). Therefore, RHDR reform is more prevalent in local practices in the allocation of rural homestead resources. In fact, RHDR reform has been implemented in many places far beyond the 33 pilot counties in China.

We classify RHDR reform into two categories: collective-oriented and household-oriented reforms and analyze the impact mechanism of the two types of RHDR reform on rural revitalization on the five important aspects of promoting rural revitalization, that is, *Industries*, *Environment*, *Culture*, *Governance* and *Income*.

Collective-oriented RHDR reform is usually linked to rural land comprehensive consolidation projects. Consequently, its effect on the *Industries* and *Environment* aspects of rural revitalization is more pronounced.

The village collective needs to promote and manage the whole process, and the homestead resource allocation rights are assigned to the collective correspondingly. In local practice, rural collectives obtain project funds by mortgaging land rights or by attracting investments from diverse interest groups. Rural homestead land is consolidated according to project plans and households are relocated to new settlements accordingly. The new homestead areas are used based on plans, and the land is used more intensively. The living conditions and surrounding environment of the new homestead areas are also improved. The remaining homesteads are adjusted to collective operational construction land according to the plans to develop secondary and tertiary industries, such as the agro-processing industry, cultural and creative industry and manufacturing. This adjustment can solve the problem of a lack of scale and relevant land to develop new rural industries. Therefore, Collective-oriented RHDR reforms have a significant influence on the *Industries* and *Environment* aspects of rural revitalization.

Collective-oriented RHDR reform affects the *Governance*, *Culture* and *Income* aspects of rural revitalization as well. Specifically, job opportunities and collective assets also increase in addition to agricultural employment and primary industries, which would ultimately increase the income of households. In addition, the communication and coordination between the rural collective and households in every process of the project and the game negotiation with other stakeholders could enhance the village's governance capacity. Strengthening the supply of various cultural service facilities, such as the cultural activity center, in implementing the project is conducive to the improvement of the civilization of the villages.

Household-oriented RHDR reform is generally based on living environment upgrading projects to enhance the rural ecological environment and promote rural development. The households hold the right to develop homesteads for higher intensity uses. Public accessibility, connectivity and recreational facilities are primarily improved by the village collective. Then, the households upgrade their houses on the original

homestead to develop homestay, catering, agritainment and related industries. The difference compared with the collective-oriented RHDR reform is that there is no relocation of households and no adjustment of homesteads to collective operational construction land. The homestead land development rights are dispersed to every household respectively. As a result, the impact of household-oriented RHDR reform is stronger on the *Culture*, *Governance* and *Income* aspects of rural revitalization.

Specifically, through the gradual transformation and upgrading of villages, the rural landscape and local traditional culture are mainly preserved and inherited. The governance capacity of the village is strengthened by managing decentralized household industries and regular communication between cadres and households. By increasing land use intensity and extending land use beyond basic living requirements, rural households have opportunities to develop the family economy and increase their incomes. Household-oriented RHDR reforms have positive effects on rural industries and environment as well, because rural living conditions, ecological environment and business environment can improve if public facilities are developed or improved during the reform. However, the household-level decision model determines that such benefits are less certain than that of the Collective-oriented RHDR reforms.

3.3. A unified theoretical framework for RHDR reform and rural revitalization in China

The above analysis suggests that both collective-oriented and household-oriented RHDR reforms could generate positive impacts on rural revitalization. By consolidating homesteads for the purpose of higher productivity and a status of higher intensity, collective-oriented RHDR reform has more advantages in developing rural industries on scale operational land and enhancing rural environments through reconstruction. These stronger effects are highlighted by thicker lines and larger arrows going from the *Collective-oriented RHDR Reform* box to the *Industries* and *Environment* boxes. In contrast, household-oriented RHDR reform is more conducive to promoting the decentralized family economy and increasing

household income directly, and the rural landscape and traditional culture are more likely to be preserved by redevelopment than by reconstruction. The rural governance level also tends to be more fundamentally influenced by the reform in the efforts to improve the governance order to promote the optimization of the village business environments. Therefore, the effects from *household-oriented RHDR reform* on *Culture*, *Governance*, and *Income* are stronger, as indicated by the thicker lines in Figure 2. These are the hypotheses to be tested in later parts of this paper.

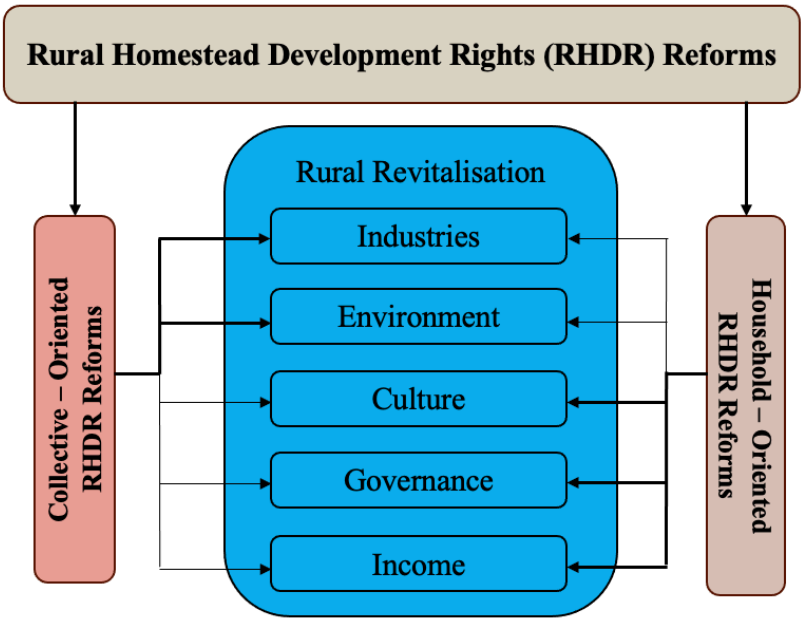

Fig.2. The impact of RHDR reforms on rural revitalization

4. Research methods and data

4.1. A comprehensive index system for rural revitalization performance measurements

We design a comprehensive index system to measure rural revitalization performance. The overall structure of the index system (i.e., the first tier in Table 1) is determined based on the five aspects of rural revitalization goals. Within each aspect, we follow the studies of Haggblade et al. (2007), Ward et al. (2009) and Zhang et al. (2018) to consider the subject roles of both collectives and households. The emphasis on farmers' perspective is an important aspect of our research design. According to the "No.1 Central Document"

in 2018, attention should be given to farmers' perception of rural revitalization performance and their sense of gain in the process of promoting rural revitalization. As shown in the "Second tier" and "Third tier" columns in Table 1, inputs from farmers are considered in all five aspects, and there is a good balance between collectives and households. Based on the deconstruction of the index system in the five aspects of rural revitalization in the "Strategic Plan for Rural Revitalization (2018-2022)", we formed a benchmark index system for measuring rural revitalization performance. On the basis of the benchmark index system, we referred to the studies of Haggblade et al. (2007), Ward et al. (2009) and Zhang et al. (2018) to form an optimized index system. Finally, the optimized index system was further adjusted based on the feedback of pre-investigation to obtain a reasonable index system. The final evaluation index system consists of five sub-indexes in the first tier, ten sub-indexes in the second tier and 34 sub-indexes in the third tier, as described in Table 1.

We then employ grey relational analysis (GRA) combined with fuzzy comprehensive evaluation (FCE) methods to measure the performance value of rural revitalization. GRA was developed by Julong Deng in 1982 and addresses uncertain systems with partially known information by generating, excavating and extracting useful information from the available data and materials (Deng, 1982; Liu et al., 2016). In view of the potential problems of incomplete and partial information in farmers' perception of rural revitalization performance, it is suitable to use GRA to measure the complex relationships among factors and determine the weights of the indicators. The formula of the most important coefficient of GRA, namely, the gray correlation coefficient ($\xi_i(k)$), is shown in Equation (1), where i is the id number of households involved in this study and k is the id number of the indicators of rural revitalization performance. $x_0(k)$ represents the reference sequence, and $x_i(k)$ represents the comparison sequence. ρ is the resolution coefficient, and generally, the value is 0.5 (Deng, 1982).

$$\xi_i(k) = \frac{\min_i \min_k |x_0(k) - x_i(k)| + \rho \max_i \max_k |x_0(k) - x_i(k)|}{|x_0(k) - x_i(k)| + \rho \max_i \max_k |x_0(k) - x_i(k)|} \quad (1)$$

Next, based on the measurement results of the index weights, FCE is used to calculate the rural revitalization performance value. FCE originates from the fuzzy set theory developed in 1965 (Zadeh, 1965). By transforming qualitative problems into quantitative ones, this method could naturally manage the initiative and fuzziness of human perception and address subjective and qualitative evaluation issues in performance measurement (Chang, 2021). In consideration of the complexity of the index system, multilayer FCE was performed in this study. Let the fuzzy set of rural revitalization performance perceived by households be υ, and the performance value before and after the RHDR reform be the subset ω of υ; then, the fuzzy function of household i is $\omega_i = \{x_i, \mu(x_i)\}$. $\mu(x_i)$ is the membership degree of ω, and $\mu(x_i) \in \lfloor 0,1 \rfloor$. Following the study of Yang et al (2018), the membership degree function of positive indicators is determined by equation (2), and that of the negative indicators is determined by formula (3). The vectorization result is obtained from the membership matrix and the index weights and is further normalized to obtain the final comprehensive rural revitalization performance value.

$$\mu(x_{ik}) = \frac{x_{ik} - x_{ik}^{min}}{x_{ik}^{max} - x_{ik}^{min}} (x_{ik}^{min} < x_{ik} < x_{ik}^{max}) \quad (2)$$

$$\mu(x_{ik}) = \frac{x_{ik}^{max} - x_{ik}}{x_{ik}^{max} - x_{ik}^{min}} (x_{ik}^{min} < x_{ik} < x_{ik}^{max}) \quad (3)$$

1 **Table 1 Rural revitalization performance evaluation index system**

First tier	Second tier	Third tier	Description
Rural industries	Income from industries	Household's agricultural income per year	Annual income of household engaged in local agricultural industry
		Household's non-agricultural income per year	Annual income of household engaged in local non-agricultural industries
	Integrated development of industries	Level of agricultural mechanization	Evaluation of agricultural machinery in the village
		Certification grade of agricultural products	Evaluation of the highest level of certification obtained by agricultural products in the village
		Processing degree of agricultural products	Evaluation of agricultural processing in the village
		Participation in farmers' cooperative	Participation in farmers' professional cooperative
		Popularity level of E-commerce	Evaluation of E-commerce promotion in the village
		Degree of industrial integrated development	Evaluation of types and integrated degree of industries in the village
Rural environment	Housing conditions	Housing area	Total floor area of family housing
		Housing quality	Building materials of the main load-bearing components of the house
		Housing security	Whether the house is located in a geological disaster-prone zone or not
	Ecological environment	Green coverage	Evaluation of green vegetation coverage of the village
		Air pollution	Evaluation of air pollution level of the village
		River course consolidation	Evaluation of remediation of the river in the village
		Sewage treatment	Evaluation of the situation of sewage treatment equipment in the village
		Garbage disposal	Evaluation of the situation of garbage disposal and classified recycling in the village
	Public services	Completeness of water, electricity, gas and information network	Evaluation of the installation of household's water, electricity, gas and communication network
		Convenience for children to go to school	Distance between household residence and primary school
		Medical and health services	Satisfaction with medical and health services in the village
		Completeness of cultural and sports facilities	Evaluation of the equipment of the village's cultural and sports facilities
		Transportation convenience	Evaluation of the bus stop settings

		Security situation of the community	Evaluation of the equipment of security facilities such as Skynet
Rural culture	Cultural development	Frequency of cultural activities	Evaluation of cultural activities carried out in the village
		Degree of historical and cultural (heritage) protection	Evaluation of the village's protection of historical culture (heritage)
		Effectiveness of farmers' education and training	Evaluation of the effectiveness of farmers' education and training
	Civilized life	Frequency of family dissensions	Estimation on the basis of the number of conflicts and disputes among the peasant families in the village
		Proportion of expenses on wedding and funeral events	Percentage of peasant family's annual wedding and funeral expenses in total household expenditure
Rural governance	Governance system	Village rules and regulations	Whether there are village rules and regulations
		Completeness of the villagers' rules of procedure	Based on the evaluation of the soundness of the villagers' rules of procedure
		Participation of rural sages and social organizations in village governance	The evaluation of the governance role of the village sages and social organizations
	Governance effectiveness	Frequency of dissensions between villagers	Estimated based on the number of conflicts and disputes among farmers in the village
		Degree of protection of farmers' rights and interests	Based on the evaluation of the protection of farmers' rights and interests in events such as land consolidation
Rural income	Household income and expenditure	Disposable income per household per year	Annual disposable income of peasant households
		Engel coefficient	Percentage of annual household food expenditure to total household expenditure

2

4.2. Estimation methods

We first use the propensity score matching (PSM) method to screen the sample data to control the problem of sample self-selection bias. The PSM method has greater advantages in dealing with self-selection bias problems of panel data because it does not need to assume functional forms, parameter constraints and error term distributions in advance (Heckman and Vytlacil, 2007). The average treatment effect (ATT) is shown below in formula (4), where Y_{1i} is the rural revitalization performance of the treated group and Y_{0i} is that of the control group. G_i is a dummy variable that indicates whether the household's village is included in the RHDR reform. If it is yes, $G_i = 1$, and otherwise, $G_i = 0$.

$$\mathrm{ATT} = \mathrm{E}(Y_{1i} \mid G_i = 1) - E(Y_{0i} \mid G_i = 0) \tag{4}$$

We then use the heterogeneous timing difference-in-differences (DID) method to explore the changes in rural revitalization performance with and without the RHDR reform as illustrated in equation (5).

$$Y_{it} = \alpha' + \beta' G_i \cdot Post_{it} + u_i^{'} + \sum_{t=2}^{T} \gamma_t^{'} D_t + w' X_{it} + \varepsilon'_{it} \tag{5}$$

where Y_{it} is the rural revitalization performance of household i in year t. $Post_{it}$ is a dummy variable indicating the situation before and after the reform. If it is after the reform, $Post_{it} = 1$, and otherwise, $Post_{it} = 0$. Since the treatment period of the policy is not completely consistent across samples, the treatment dummy variable varies from individual to individual. We add subscript i to $Post_t$. u_i' is the individual fixed effect, and D_t represents the time dummy variables. X_{it} denotes other control variables that affect rural revitalization performance. α', β', γ_t' and w' are indicators to be estimated, and ε_{it} is the error term.

To further explore which type of the RHDR reform is more conducive to rural revitalization performance, we utilize the following two-way fixed effects (two-way FE) model to control for the

potential problems of unobservable missing variables that vary across individuals and time. In formula (6), G_{ij} is the dummy variable that denotes different types of RHDR reforms, such as collective-oriented or household-oriented RHDR reforms. u_i is the individual fixed effect and D_t represents the time dummy variable. α, β, γ_t and w are indicators to be estimated and ε_{it} is the error term.

$$Y_{it} = \alpha + \sum_{j=1}^{k} \beta_j G_{ij} \cdot Post_{it} + u_i + \sum_{t=2}^{T} \gamma_t D_t + wX_{it} + \varepsilon_{it} \quad (6)$$

4.3. Data collection and descriptive statistics

The dataset used in this empirical impact identification is an unbalanced multi-period panel collected from pilot villages (i.e., treatment group) and non-pilot villages (i.e., control group). Considering that the implementation period generally took 2 years, the scope of the pilot villages that were used to sample from was restricted to those projects that had been completed before 2018 at the latest. This sampling strategy ensures that our sample covers projects that have already been finished and hence the effect of the policy, if any, can be captured by the data. An unbalanced multi-period panel ranging from 2006 to 2018 was ultimately obtained.

According to the principles of comprehensiveness and representativeness, the treatment group of the dataset was selected from the households in villages where the RHDR reform was carried out through stratified sampling by region, province and village. Region was determined according to the three typical economic and geographical divisions of eastern, central and western China, and province and village were selected based on their representativeness in implementing the RHDR reform projects respectively. The control group was drawn from villages that were similar to the pilot villages in terms of geographical location, natural endowments and economic and social conditions, as shown in Fig.3. The number of sample households in each village was determined

according to the number of households in the village.

The questionnaire included questions about the information on interviewees and households, rural revitalization performance index system and control variables[1]. The contents of the questionnaire covered seven aspects, including information about the respondents and the households, household living conditions, industrial development, household economic situations, rural customs and governance, land use, and protection of farmers' rights and interests. To minimize potential measurement error due to recall, we refined and decomposed indicators by setting multiple questions and used qualitative methods to measure indicators that do not require reporting specific values. Before the investigation of households, interviews with the local cadres were conducted to learn about the overall situation of rural revitalization in the village and the establishment and implementation of the RHDR reform projects. The final dataset was thoroughly cleaned to ensure the validity of the survey, and a total of 666 questionnaires were obtained.

The control variables affecting rural revitalization performance were determined from four aspects: regional conditions, village resource endowments, human factors and individual characteristics of the respondents (Liu and Xiong, 2018; Ward et al., 2009). Specifically, four proxy indexes, i.e., gross domestic product per capita of central cities (*cgdp_ca*), rural homestead land area per capita (*rhland_ca*), the role of the village party committee in village development (*role_vpc*), and the age of the respondents (*age_r*), are selected. Furthermore, we define the control group as the default type and set two dummy variables for the RHDR reform types, *collective_o* for collective_oriented and *household_o* for household_oriented. The descriptive statistical analysis of the explanatory variables is shown in Table 2.

[1] The full questionnaire is available at http://*** (disguised for double-blind peer review).

Table 2 Descriptive statistics of explanatory variables

	Treatment group (*Obs.*=960)				Control group (*Obs.*=372)			
	mean	**s.e.**	**min**	**max**	**mean**	**s.e.**	**min**	**max**
collective_o	0.242	0.428	0	1	0	0	0	0
household_o	0.261	0.440	0	1	0	0	0	0
cgdp_ca	6.580	3.132	1.788	14.018	6.122	2.716	1.788	10.199
rhland_ca	0.579	0.679	0.032	6.670	0.655	0.554	0.089	3.335
role_vpc	3.305	1.024	1	5	2.626	0.736	1	5
age_r	53.384	13.843	18	86	55.780	12.181	19	87

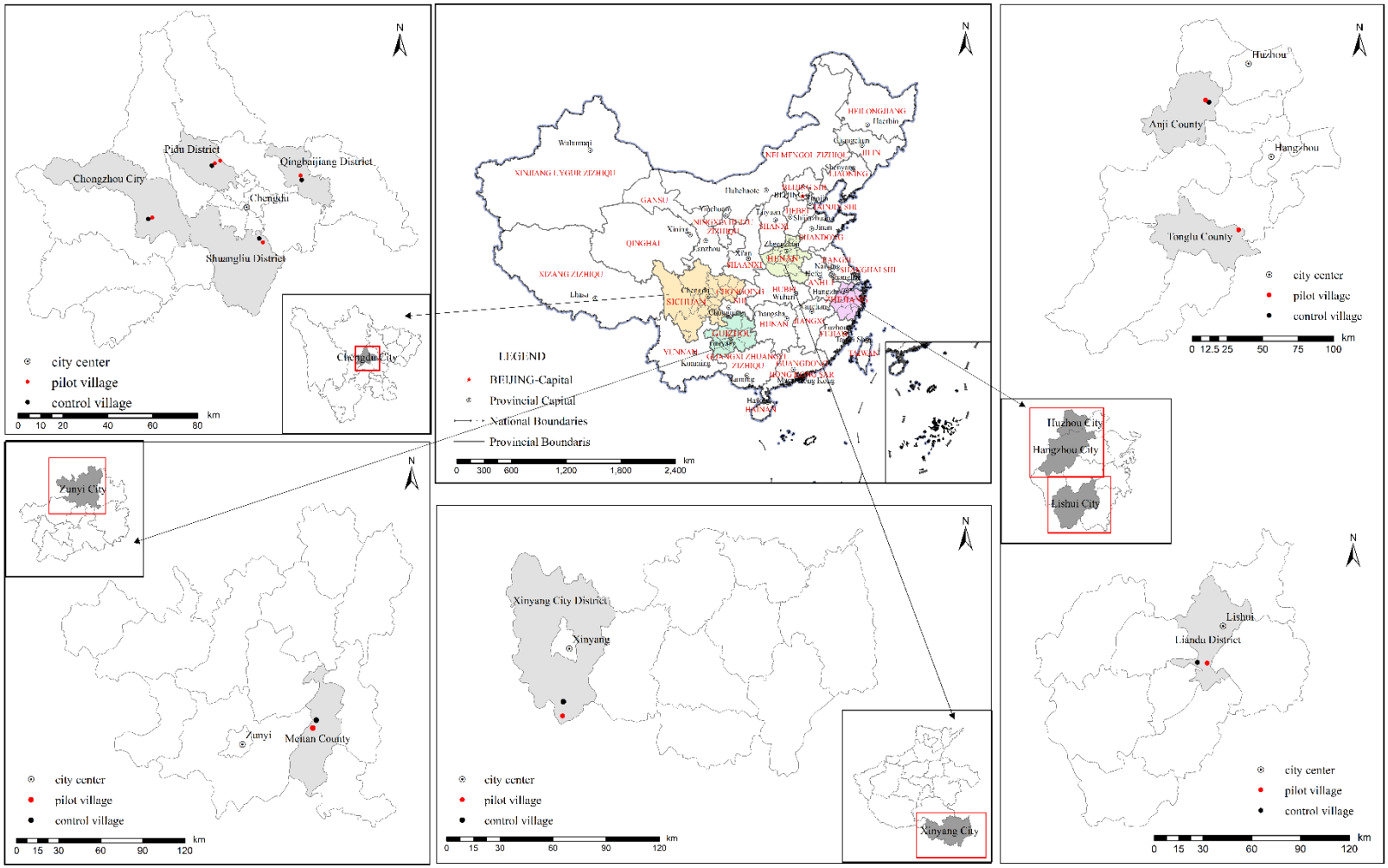

Fig.3. Locations of pilot and non-pilot villages

5. Empirical findings

5.1. Rural revitalization performance

Using the methods of GRA combined with FCE and the dataset of the survey, we calculated the value of rural revitalization performance. The mean value is 0.5411, and the frequency distribution of the whole sample is shown on the left of Fig.4. It is a bimodal distribution, which reflects that there are two combined subgroups or processes in the dataset. After further investigation, we find that the treatment group has different distribution characteristics from that of the control group, as shown on the right of Fig.4. This sheds light on the fact that with other things being equivalent, differences have arisen between the treatment group and the control group where there is no RHDR reform.

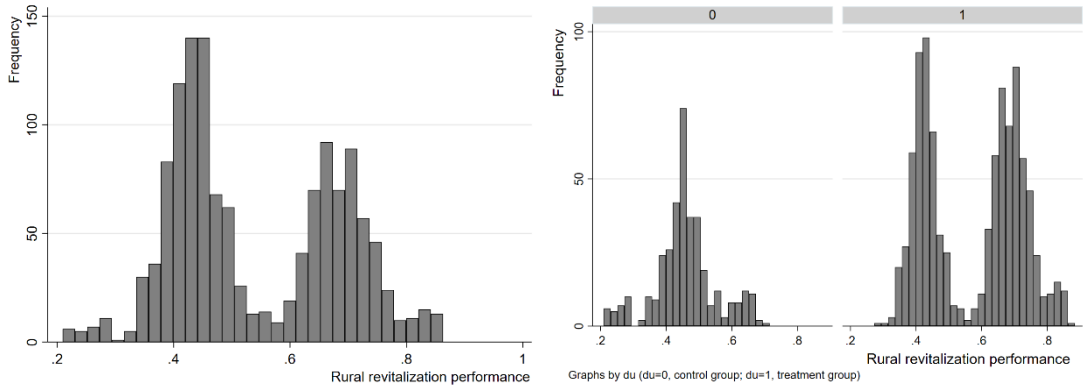

Fig.4. Frequency distribution of rural revitalization performance

5.2. Sample matching

Sample matching was processed with the prevalent method of nearest-neighbor matching within caliper of PSM. The caliper range was defined as 0.05. As shown in Table 3, the standardized bias of the explanatory variables decreased significantly from 16.60% before matching to 1.90% after matching. The *Pseudo-*R^2 and *LR chi*^{2} also decreased remarkably. In addition, according to the common support hypothesis test shown in Fig.5, the propensity scores of the treatment group and

the control group have a large common support range, indicating the high quality of sample matching and the low loss of samples. All these results indicate that the PSM results are valid. The average treatment effect, i.e., the gross positive impact of the RHDR reform on rural revitalization, is 0.120 and significant at the 0.01 level. We examine this effect further using the DID and two-way FE models in the next section.

Table 3 Balance diagnostics of explanatory variables and average treatment effect of PSM

	Pseudo-R^2	***LR chi^2 (p-value)***	**Standardized bias**	**ATT(s.e.)**
Unmatched	0.008	12.310 (0.002)	16.600%	
Matched	0.000	0.380 (0.828)	1.900%	
				0.120*** (0.007)

Notes: a. Standard errors in parentheses; b.*** *p<0.01*.

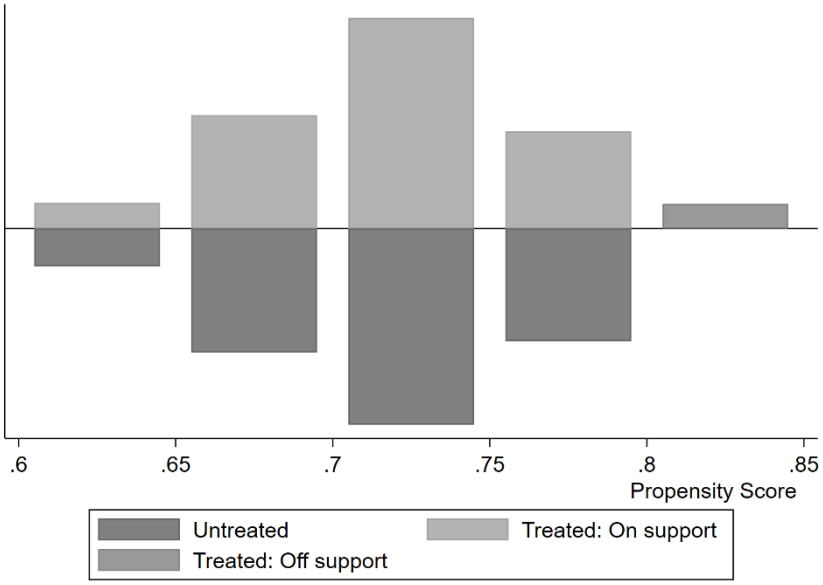

Fig.5. Common support of the propensity score

5.3. Impact of the RHDR reform on rural revitalization

The results of DID and PSM-DID models are given in Table 4. The coefficient estimate of $G \cdot Post$ is positive and statistically significant across all four models, suggesting a stable, significant and positive impact of RHDR reforms on rural revitalization. Furthermore, the coefficients of the interaction items would be underestimated without sample matching, as indicated by the larger

coefficient loadings in PSM-DID models. Although being selected as pilots is largely an exogenous policy shock or impact, villages that have advantages in reducing the potential cost of policy implementation are indeed more likely to be selected as pilot areas, resulting in the problem of sample selection bias. Through sample matching, the hidden randomized treatment observations could be selected from the dataset, and the net policy impact could be identified correspondingly. In view of this, we perform baseline analysis of the empirical results based on model (4) in Table 4 and affirm that the rural revitalization performance of the treatment group with the RHDR reform is 0.172 higher on average than that of the control group without the reform. The positive impact affirmed in our empirical results could also be supported by the study of Zhang and Wu (2015), who argued that the transfer of development rights brought profound changes to rural areas, including reconfiguring land-use patterns, transforming physical conditions in residential communities, and changing the representation of rural space.

Table 4 Estimation results of DID and PSM-DID models

	DID		PSM-DID	
	(1)	(2)	(3)	(4)
$G \cdot Post$	0.169***	0.159***	0.183***	0.172***
	(0.010)	(0.009)	(0.011)	(0.010)
Control variables	*No*	*Yes*	*No*	*Yes*
Individual effect	*Yes*	*Yes*	*Yes*	*Yes*
Time effect	*Yes*	*Yes*	*Yes*	*Yes*
Obs.	1332	1332	1239	1239
R^2	0.760	0.780	0.760	0.780

Notes: a. Standard errors in parentheses; b. $^{***}p<0.01$; c. *rrp* is the abbreviation of rural revitalization performance.

We further performed placebo test and parallel test to underpin the PSM-DID empirical result. The test results are shown in Figure 6 and Figure 7, respectively. The placebo test, in which the policy implementation time and treatment group were simultaneously randomized and resampling was taken 500 times, showed that the impact of the RHDR reform was not interfered by other

random factors. The parallel test, which was performed by decomposing the dynamic trend of the RHDR reform effect between years, showed the heterogeneity of the change trend between the treatment group and the control group before and after the reform. They both verified the validity of the PSM-DID empirical result of the study.

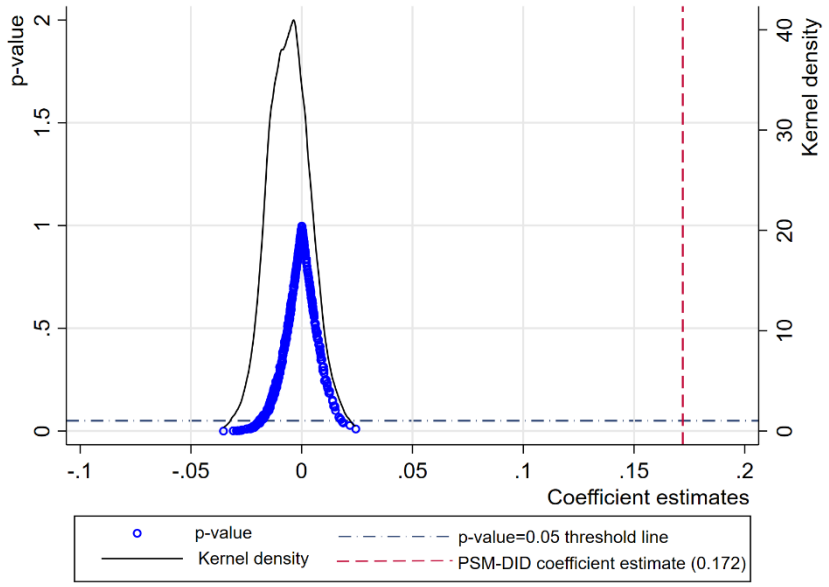

Fig.6. Placebo test result

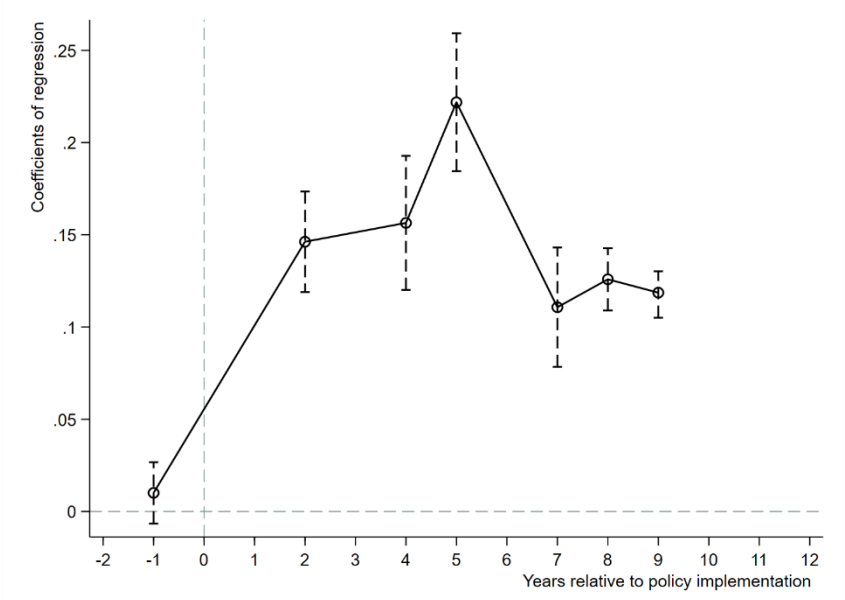

Fig.7. Parallel test result

5.4. Impact heterogeneity of the RHDR reform on rural revitalization

We further use two-way FE models to analyze the impact of collective-oriented and household-oriented RHDR reforms based on the overall performance as well as the five aspects of rural revitalization. The estimation results are shown in Table 5 and Table 6, respectively.

Results in Table 5 suggest that both types of the RHDR reform have stable, significant and positive impacts on total rural revitalization performance compared with the control group, which further underpins the above empirical results based on PSM-DID models. In addition, collective-oriented RHDR reform shows a stronger impact than household-oriented RHDR reform. This finding adds empirical evidence to the debate on which type of reform is more conducive to rural development in China. Wu and Yu (2022) conducted household surveys in 2019 in Jinzhai, Yicheng and Yujiang, three other pilot counties of the RHDR reform, and found that it was challenging for households to obtain information from the rural construction land market and manage homestead-related industries. Furthermore, the development of homestead-related industries is constrained by the completeness of public facilities, the governance level, and the ecological environment in the villages, which are under the centralized control of rural collectives (Jiang and Yin, 2021; Sun et al., 2022; Yan, 2019). In contrast to households, which generally hold a weak position in rural resource allocation in China, village collectives have a lot of advantages in obtaining information and coordinating resources. This statement can be verified in the study of Gao and Wu (2017), which showed that farmer cooperative is a relatively equitable organizational means of benefit distribution, community participation and bottom-up development in the case of revitalizing traditional villages through rural tourism in China.

Table 5 Impact heterogeneity of different types of the RHDR reform on total performance

	Two-way FE				
	rrp				
	(1)	(2)	(3)	(4)	(5)
collective_o · Post	0.243***	0.243***	0.250***	0.248***	0.248***
	(0.008)	(0.008)	(0.009)	(0.009)	(0.009)
household_o · Post	0.166***	0.167***	0.167***	0.150***	0.150***
	(0.006)	(0.005)	(0.005)	(0.005)	(0.005)
cgdp_ca		0.008***	0.008***	0.019***	0.019***
		(0.002)	(0.002)	(0.002)	(0.002)
rhland_ca			0.007*	0.007**	0.007**
			(0.004)	(0.004)	(0.004)
role_vpc				0.015***	0.015***
				(0.002)	(0.002)
age_r					-0.025***
					(0.002)
constant	0.493***	0.552***	0.548***	0.589***	2.005***
	(0.004)	(0.014)	(0.015)	(0.014)	(0.133)
Individual effect	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Time effect	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Obs.	1239	1239	1239	1239	1239
F	3161.39***	2678.94***	2398.39***	2660.67***	2660.67***
Within-R^2	0.963	0.964	0.964	0.967	0.967

Notes: a. Standard errors in parentheses; b.$^{***}p<0.01$, $^{**}p<0.05$, $^{*}p<0.1$; c. *rrp* is the abbreviation of rural revitalization performance.

Furthermore, Table 6 suggests that collective-oriented RHDR reform shows a greater impact on the performances in the *Industries* and *Environment* aspects of rural revitalization, while household-oriented RHDR reform shows a greater impact on the performances in the *Culture*, *Governance* and *Income* aspects. This finding supports the theoretical framework developed in Fig.2. Moreover, the rural governance level tends to be more fundamentally influenced by the efforts to promote the decentralized household businesses. Liu et al. (2013) find that it is difficult to make good projects work in rural communities that lack good governance. Thus, the improvement of the governance level could be coordinated with the increase of the overall quality of rural landscapes and the promotion of rural industrialization and rural development in implementing land

development rights projects (Janssen-Jansen, 2008; Smith, 2010). Nevertheless, rural collectives could generate important efficiency in allocating land resources to develop rural industries in the context of an imperfect land market (Zhou et al., 2020), although there are also multiple challenges in restructuring rural culture and lagging impacts on rural households' income to be faced.

Table 6 Impact heterogeneity of different types of the RHDR reform on sub-performance

	Two-way FE				
	rrp_ind	*rrp_env*	*rrp_cul*	*rrp_gov*	*rrp_inc*
	(1)	(2)	(3)	(4)	(5)
collective_o · Post	0.063***	0.170***	0.011***	0.004*	0.000*
	(0.004)	(0.004)	(0.002)	(0.003)	(0.001)
household_o · Post	0.042***	0.081***	0.020***	0.015***	0.007***
	(0.003)	(0.006)	(0.002)	(0.002)	(0.002)
Control variables	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Individual effect	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Time effect	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Obs.	1239	1239	1239	1239	1239
F	733.71***	2343.80***	164.60***	586.80***	41.86***
Within-R^2	0.866	0.965	0.737	0.863	0.398

Notes: a. Standard errors in parentheses; b.$^{***}p<0.01$, $^{**}p<0.05$, $^{*}p<0.1$; c. *rrp_ind, rrp_env, rrp_cul, rrp_gov,* and *rrp_inc* are the abbreviations of rural revitalization performance in rural industries, rural environments, rural culture, rural governance, and rural income respectively.

5.5. Robustness test and endogeneity analysis

We estimated seven models to further examine the validity and reliability of the findings, as shown in Table 7. In Model 1 we used the quartile-ordered form of the gross domestic product per capita of central cities (*cgdp_ca_4*) as an alternative measurement of control variables. Model 2 adopted the entropy weight method combined with the FCE method as an alternative measurement method of rural revitalization performance (*rrp2*). Model 3 dropped observations with better economic conditions (i.e., in the eastern region) to control the possible interference of sample heterogeneity on causal effect estimates. Alternative estimation methods, i.e., OLS, random effects (RE) and Tobit methods, were used in Models 4, 5 and 6, respectively. Finally, Model 7 used "*gender*

ratio $Post_{it}$*" as the instrumental variable (IV) to address the potential endogeneity problems associated with *role_vpc*. The IV-2SLS model passed both the under-identification test and the weak instrumental variable test, indicating the validity of the IV. As shown in the first two rows in Table 7, the impact and impact heterogeneity of the RHDR reform on rural revitalization performance show a strong stability.

Table 7 Estimation results of the robustness test and endogeneity analysis

	Two-way FE			Mixed OLS	RE	Tobit	IV-2SLS
	rrp	*rrp2*	*rrp*	*rrp*	*rrp*	*rrp*	*rrp*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
collective_o · Post	0.248***	0.220***	0.250***	0.257***	0.227***	0.253***	0.153***
	(0.009)	(0.015)	(0.009)	(0.007)	(0.007)	(0.007)	(0.013)
household_o · Post	0.151***	0.182***	0.107***	0.221***	0.157***	0.219***	0.066***
	(0.005)	(0.006)	(0.007)	(0.007)	(0.007)	(0.006)	(0.018)
cgdp_ca		0.004*	0.069***	0.001*	0.009***	0.001*	
		(0.003)	(0.013)	(0.001)	(0.002)	(0.001)	
cgdp_ca_4	0.030***						0.052***
	(0.003)						(0.006)
rhland_ca	0.007*	0.022***	0.008**	-0.000	0.001	-0.000*	-0.012***
	(0.004)	(0.005)	(0.004)	(0.003)	(0.003)	(0.003)	(0.004)
role_vpc	0.015***	0.008**	0.010***	0.026***	0.016***	0.024***	0.112***
	(0.002)	(0.003)	(0.003)	(0.003)	(0.002)	(0.003)	(0.012)
age_r	-0.023***	-0.051***	-0.048***	-0.000**	-0.001***	-0.000	-0.000
	(0.003)	(0.003)	(0.008)	(0.000)	(0.000)	(0.000)	(0.000)
constant	1.829***	3.102***	2.587***	0.394***	0.448***	0.388***	0.197***
	(0.146)	(0.156)	(0.350)	(0.011)	(0.011)	(0.011)	(0.032)
Individual effect	*Yes*	*Yes*	*Yes*	*No*	*Yes*	*No*	*Yes*
Time effect	*Yes*	*Yes*	*Yes*	*No*	*Yes*	*No*	*Yes*
Obs.	1239	1239	877	1239	1239	1239	1239
F	2660.39***	956.36***	1367.51***	654.10***			583.86***
Wald-chi²					28702.96***	4553.84***	
Within-R²	0.967	0.883	0.960		0.960		
Adj-R²				0.760			
LM statistic							54.657***
K-P Wald F statistic							60.384

Notes: a. Standard errors in parentheses; b.$^{***}p<0.01$, $^{**}p<0.05$, $^{*}p<0.1$; c. *rrp, rrp2* are the abbreviation of rural revitalization performance.

6. Discussions and policy implications

The empirical findings of this study based on the survey data of rural households not only provide evidence for the positive impact of the RHDR reform on rural revitalization performance, but also inspire discussions on how to further effectively carry out the reform in China. As it is known that rural homesteads play a pivotal role in the daily life of rural households and the sustainable development of rural areas, policy makers should be cautious in the process of policy diffusion. Therefore, although there is a consensus on the necessity of launching rural homestead system reform, feasible paths to effectively conduct rural homestead reform are still not clear for policy makers and are under exploration in practice, especially in the background of an imperfect rural land market (Liu, 2019). To some extent, the RHDR reform in China was launched as a compromise trial between direct transactions and no transactions of rural homestead resources. Some concerns have been raised in the pilot process of the RHDR reform as well. The main concerns can be divided into two aspects (He, 2021). Firstly, there is concern about whether the impact of the reform on rural development is positive or negative, given the potential risks that rural households might be compelled to be relocated and the possible pressure on local budgets to improve rural infrastructure. Secondly, there is concern whether granting rural households more land rights might instead make them the targets of capital plunder and reduce their benefits, given the weak abilities of households to obtain market information from imperfect land markets and make rational decisions. Based on the findings of this study, it is credible to clarify that the RHDR reform has generated a positive impact on rural revitalization performance overall. However, the heterogeneity analysis shows that household-oriented RHDR reform does have a weaker impact on rural revitalization than that of collective-oriented RHDR reform. In this case, concerns should be shifted to how to improve rural households' abilities to obtain market information and to agglomerate

production factors for promoting rural development. In the case of decentralized rural households holding the homestead development rights, it is of great importance to have village planning for the coordinated development of rural homestay, catering, agritainment and related rural industries. Otherwise, it is easy for the village to fall into the homogeneous repeated construction and unhealthy competition among households. Moreover, more attention should be paid to promoting the public participation of households and the information disclosure of collectives, and to attracting the investment of social capital and the inflow of production factors, rather than concentrating on the launch the reform itself.

In addition, the role of rural collectives in using rural homestead resources should be re-examined according to the results of the impact heterogeneity analysis in this study. In general, decentralized rural households and centralized rural collectives can both be effective subjects for reusing rural homestead resources, although they might generate different levels of impacts on rural development. The role of rural households has already been highlighted in current land use policies in China because households are the specific users of homesteads and their basic rights to use homestead land should be guaranteed. However, the role of rural collectives in using rural homesteads has not yet been fully recognized. Rural collectives are a typical organizational type of community (Storey, 2009). As the owners, collectives should not only be the managers of homesteads, but also the subjects capable of using and transferring homesteads on the market. However, this study is not intended to challenge the validity of decentralized rural households' participation and partnership in using homesteads, but to provide empirical evidence for further understanding the role of the more powerful rural collectives, which has not received enough attention in policy formulation in China. With the development of urban-rural integration, tourism,

manufacturing, and recreation have increasingly paralleled agriculture as dominant economic drivers in rural areas (Irwin et al., 2010). The growing shift away from what has been referred to as landscapes of production to landscapes of consumption and the apparent commodification of the countryside means that we are in an era where rural areas are increasingly seeking to reimagine themselves to deal with the broader processes of rural change and rural restructuring (Mujumdar, 2002; Storey, 2009). This shift could pose a series of challenges to rural economic and social systems, stimulating comprehensive rural restructuring (Qu et al., 2021). Under these circumstances, rural collectives, which have advantages in integrating with markets, taking risks and negotiating with other interest groups should take the leading role in agglomerating land resources or transferring land use rights to develop scale industries that decentralized rural households might not be so capable to handle with (Osborne et al., 2004).

From "building socialist new countryside" to promoting "rural revitalization", it is not only a process of policy evolution, but also a process of comprehensively promoting rural development in China. Therefore, by the time the rural revitalization strategy was put forward in 2017, China had actually come a long way in revitalizing the countryside, which provided a basis for exploring the impact of the RHDR reform on rural revitalization across the years. However, more targeted policies are also needed to meet the needs of more comprehensive rural development in China. We draw two policy implications from the results of our study. First, more targeted policies to enhance the effectiveness of household-oriented RHDR reform on rural revitalization need to be further introduced. Village planning to coordinate the development of rural-related industries should be formulated and implemented. Regular training is also needed to enhance the abilities of rural households to connect with imperfect land markets. Rural collectives should formulate village

industry access rules, strengthen village regulations, and establish village development committees. Other related policies include promoting public participation to enhance the willingness of rural households to be involved in rural revitalization, increasing the information disclosure of rural collectives, and improving the involvement of social capital. Second, more attention should be paid to rural collectives in the policy formulation of the RHDR reform, such as carrying out relevant training to enhance the ability of collectives to coordinately the use of homesteads and other land resources in rural areas. Moreover, with the deepening of rural property rights reform in China, the RHDR reform needs to be coordinated with other related reforms to jointly promote the sustainable development of rural areas, mainly including the "three rights separation" reform of rural homesteads, the increasing versus decreasing balance reform of urban-rural construction land, the collective operational construction land into market reform and the regional-wide land consolidation reform. Deininger (2003) specified that supporting infrastructure, access to credit, technology, and markets are also essential to elevate the asset returns of rural land resources. Given this, further systematic institutional reform to couple the factors of labor, land and capital is needed to address different problems in the implementation of the rural revitalization strategy in China (Han, 2020). In addition, communal land tenure is prevalent across many developing countries. It usually implements a principle that allows owners to use their land but restricts their right to transfer it (Gottlieb and Grobovšek, 2019). This might hinder the emergence and development of the rural land market and induce rural poverty (Bardhan and Mookherjee, 2010). Transforming and diversifying the rural economy based on rural construction land brings opportunities to village renewal in the developing world (Haggblade et al., 2007). The findings of this study also provide a reference for reusing rural homesteads in developing countries where land holds the key to the overall

development of the rural economy and the improvement in the quality of rural life.

7. Conclusions

The RHDR reform in China provides paths to fulfill the need for the effective reuse of rural homesteads and thus promote different aspects of rural revitalization. Well-identified empirical evidence on the impact of the reform on rural revitalization is still rare. This study is aimed at synthesizing the understanding of the ongoing rural homestead system reform and providing empirical evidence for identifying the impact of the RHDR reform on rural revitalization performance. On the basis of applying property theory to China's rural homestead situation, a theoretical framework for analyzing how RHDR reform impacts rural revitalization is developed and the RHDR reform is classified into two types according to the dominant implementing subjects, i.e., the collective-oriented type and the household-oriented type. An index system for evaluating rural revitalization performance is developed as well. Based on panel survey data of China's four typical provinces, this paper uses the empirical methods of propensity score matching (PSM) combined with a difference-in-differences (DID) model and a two-way fixed effects (two-way FE) model to explore the impact of the RHDR reform on rural revitalization. The baseline empirical results show that the rural revitalization performance of the treatment group with the RHDR reform is 0.172 higher on average than that of the control group without the reform. Further impact heterogeneity analysis shows that both types of the RHDR reform have stable, significant and positive impacts on total rural revitalization performance compared with the control group, but collective-oriented RHDR reform has a stronger impact than household-oriented RHDR reform on promoting rural revitalization. In addition, impact heterogeneity analysis indicates that collective-oriented RHDR reform has a greater impact on the sub-performances of rural industries and rural

environments, while household-oriented RHDR reform has a greater impact on the sub-performances of rural culture, rural governance and rural income.

Rural homestead resource allocation is closely connected to rural development and has generated comprehensive impacts on revitalizing rural areas in China. In this case, top-down policies to strengthen the regulations of the RHDR reform need to be further introduced, and more attention should be paid to rural collectives in policy formulation of the RHDR reform. Therefore, the empirical findings of our study not only underpin the significance of further conducting rural homestead system reform to comprehensively promote revitalization in China, but also shed light on the validity of rural community as an effective organizational means to intensively use land resources in a developing economy with an undeveloped rural land market. However, there are still some limitations to this study. On the one hand, cases of cross-regional transfer and transactions of RHDR are not included in this study to simplify the whole analysis; on the other hand, the period of the sample data before the RHDR reform is short due to the difficulty of collecting data before the reform. Future studies could include the cases of cross-regional transfer and transactions of RHDR and add more samples to the dataset to further diversify the observations and underpin the empirical findings.

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References

Ahlers, A.L., Schubert, G., 2009. “Building a New Socialist Countryside” - Only a Political Slogan? J. Curr. Chinese Aff. 38, 35–62. https://doi.org/10.1017/S0305741013001045

Alchian, A., Demsetz, H., 1972. Production, information costs, and economic organization. Am. Econ. Rev. 62, 777–795. https://doi.org/10.1017/CBO9780511817410.015

Bardhan, P., Mookherjee, D., 2010. Determinants of redistributive politics: An empirical analysis of land reforms in West Bengal, India. Am. Econ. Rev. 100, 1572–1600. https://doi.org/10.1257/aer.100.4.1572

Barrese, J.T., 1982. The transfer of development rights: empirical evidence from Bucks County, Pennsylvania. Rev. Reg. Stud. 12, 50–57. https://doi.org/10.52324/001c.7974

Barzel, Y., 1997. Economic Analysis of Property Rights. Cambridge University Press, Cambridge.

Bramall, C., 2021. Comments on power over property: The political economy of communist land reform in China. China Q. 246, 626–628. https://doi.org/10.1017/s0305741021000436

Brandt, L., Whiting, S.H., Zhang, L., Zhang, T., 2017. Changing property-rights regimes: A study of rural land tenure in China. China Q. 232, 1026–1049. https://doi.org/10.1017/S0305741017001035

Chang, L., 2021. Application of Fuzzy Comprehensive Evaluation based on Genetic Algorithm in Psychological Measurement. Sci. Program. 2021, 9607006. https://doi.org/10.1155/2021/9607006

Cheung, C.P., 2012. The paradox of China’s urban-rural integration: The Hukou system, rural policy, and rural land development. Urban anthropol. 41, 293–328. https://doi.org/www.jstor.org/stable/23339810

Coase, R.H., 1994. Essays on Economics and Economists. The University of Chicago Press, Chicago.

Coase, R.H., 1960. The problem of social cost. J. Law Econ. 1–44. https://doi.org/10.1086/674872

Deininger, K., 2003. Land Policies for Growth and Poverty Reduction. World Bank and Oxford University Press, Washington, D.C.

Deng, J., 1982. Control problems of grey systems. Syst. Control Lett. 1, 288–294. https://doi.org/10.1016/S0167-6911(82)80025-X

Dong, X., 2019. The circulation of housing land use right in the past 70 years since the founding of new China: Institutional change,current dilemma and reform direction. Chinese Rural Econ. 2–27. https://doi.org/kns.cnki.net/kcms/detail/11.1262.f.20190628.1551.002.html

Falco, E., Chiodelli, F., 2018. The transfer of development rights in the midst of the economic crisis: Potential, innovation and limits in Italy. Land use policy 72, 381–388. https://doi.org/10.1016/j.landusepol.2017.12.069

Gao, J., Cai, Y., Liu, Y., Wen, Q., Marcouiller, D.W., Chen, J., 2022. Understanding the underutilization of rural housing land in China: A multi-level modeling approach. J. Rural Stud. 89, 73–81. https://doi.org/10.1016/j.jrurstud.2021.11.020

Gao, J., Wu, B., 2017. Revitalizing traditional villages through rural tourism: A case study of Yuanjia Village, Shaanxi Province, China. Tour. Manag. 63, 223–233. https://doi.org/10.1016/j.tourman.2017.04.003

Gottlieb, C., Grobovšek, J., 2019. Communal land and agricultural productivity. J. Dev. Econ. 138, 135–152. https://doi.org/10.1016/j.jdeveco.2018.11.001

Gu, H., Ling, Y., Shen, T., Yang, L., 2020. How does rural homestead influence the hukou transfer intention of rural-urban migrants in China? Habitat Int. 105, 102267.

https://doi.org/10.1016/j.habitatint.2020.102267

Haggblade, S., Hazell, P.B.., Reardon, T., 2007. Transforming the Rural Nonfarm Economy: Opportunities and Threats in the Developing World. Johns Hopkins University Press, Baltimore.

Han, J., 2020. How to promote rural revitalization via introducing skilled labor, deepening land reform and facilitating investment? China Agric. Econ. Rev. 12, 577–582. https://doi.org/10.1108/CAER-02-2020-0020

Hanstad, T., Brown, J., Prosterman, R., 2002. Larger homestead plots as land reform? International experience and analysis from Karnataka. Econ. Polit. Wkly. 37, 3053–3062. https://doi.org/www.jstor.org/stable/4412390

Haque, T., 2003. Reforms for agricultural growth and rural development. Econ. Polit. Wkly. 38, 5031–5033. https://doi.org/www.jstor.org/stable/4414335

Hart, O., 1995. Firms,Contracts,and Financial Structure, Clarendon. ed. Oxford.

Hart, O., Moore, J., 1990. Property Rights and the Nature of the Firm. J. Polit. Econ. 98, 1119–1158. https://doi.org/10.1086/261729

He, X., 2021. Homestead,rural revitalization and urbanization. J. Nanjing Agric. Univ. Sci. Ed. 21, 1–8. https://doi.org/10.19714/j.cnki.1671-7465.2021.0050

He, X., 2007. New Rural Construction and the Chinese Path. Chinese Sociol. Anthropol. 39, 26–38. https://doi.org/10.2753/CSA0009-4625390402

Heckman, J.J., Vytlacil, E.J., 2007. Econometric Evaluation of Social Programs, Part II: Using the Marginal Treatment Effect to Organize Alternative Econometric Estimators to Evaluate Social Programs, and to Forecast their Effects in New Environments, in: Handbook of Econometrics. pp. 4875–5143. https://doi.org/10.1016/S1573-4412(07)06071-0

Irwin, E.G., Isserman, A.M., Kilkenny, M., Partridge, M.D., 2010. A Century of Research on Rural Development and Regional Issues. Am. J. Agric. Econ. 92, 522–553. https://doi.org/10.1093/ajae/aaq008

Jan, D., van der P., Ye, J., Sergio, S., 2012. Rural development through the construction of new, nested, markets: comparative perspectives from China, Brazil and the European Union. J. Peasant Stud. 39, 133–173. https://doi.org/10.1080/03066150.2011.652619

Janssen-Jansen, L.B., 2008. Space for Space, a transferable development rights initiative for changing the Dutch landscape. Landsc. Urban Plan. 87, 192–200. https://doi.org/10.1016/j.landurbplan.2008.06.002

Jiang, H., Yin, Q., 2021. What effect the demand for homestays: evidence from Airbnb in China. Appl. Econ. Lett. 28, 10–14. https://doi.org/10.1080/13504851.2020.1725231

Kong, X., Liu, Y., Jiang, P., Tian, Y., Zou, Y., 2018. A novel framework for rural homestead land transfer under collective ownership in China. Land use policy 78, 138–146. https://doi.org/10.1016/j.landusepol.2018.06.046

Levinson, A., 1997. Why oppose TDRs?: Transferable development rights can increase overall development. Reg. Sci. Urban Econ. 27, 283–296. https://doi.org/10.1016/S0166-0462(96)02163-1

Li, Y., Chen, C., Wang, Y., Liu, Y., 2014. Urban-rural transformation and farmland conversion in China: The application of the environmental Kuznets Curve. J. Rural Stud. 36, 311–317. https://doi.org/10.1016/j.jrurstud.2014.10.005

Li, Y., Huang, H., Song, C., 2022. The nexus between urbanization and rural development in China: Evidence from panel data analysis. Growth Change 53, 1037–1051.

https://doi.org/10.1111/grow.12535

Li, Y., Li, Y., Westlund, H., Liu, Y., 2015. Urban-rural transformation in relation to cultivated land conversion in China: Implications for optimizing land use and balanced regional development. Land use policy 47, 218–224. https://doi.org/10.1016/j.landusepol.2015.04.011

Li, Y., Liu, Y., Long, H., Cui, W., 2014. Community-based rural residential land consolidation and allocation can help to revitalize hollowed villages in traditional agricultural areas of China: Evidence from Dancheng County, Henan Province. Land use policy 39, 188–198. https://doi.org/10.1016/j.landusepol.2014.02.016

Linkous, E.R., 2017. Transfer of development rights and urban land markets. Environ. Plan. A 49, 1122–1145. https://doi.org/10.1177/0308518X16686794

Liu, C., Zhang, L., Huang, J., Luo, R., Yi, H., Shi, Y., Rozelle, S., 2013. Project design, village governance and infrastructure quality in rural China. China Agric. Econ. Rev. 5, 248–280. https://doi.org/10.1108/17561371311331124

Liu, H., Li, G., Wang, K., 2022. Homestead reduction, economic agglomeration and rural economic development: evidence from Shanghai, China. China Agric. Econ. Rev. 14, 274–293. https://doi.org/10.1108/CAER-02-2021-0035

Liu, S., 2019. The structure and changes of China's land system. China Agric. Econ. Rev. 11, 471–488. https://doi.org/10.1108/CAER-05-2018-0102

Liu, S., Xiong, X., 2018. Implementation of rural revitalization strategy and institutional supply in China. China Rev. Polit. Econ. 9, 80-96(in Chinese). https://doi.org/http://kns.cnki.net/kcms/detail/detail.aspx?FileName=ZZJP201804008&DbName=CJFQ2018

Liu, S., Yang, Y., Xie, N., Forrest, J., 2016. New progress of Grey System Theory in the new millennium. Grey Syst. Theory Appl. 6, 2–31. https://doi.org/10.1108/gs-09-2015-0054

Liu, Y., Li, Y., 2017. Revitalize the world's countryside. Nature 548, 275–277. https://doi.org/10.1038/548275a

Liu, Y., Yang, R., Long, H., Gao, J., Wang, J., 2014. Implications of land-use change in rural China: A case study of Yucheng, Shandong province. Land use policy 40, 111–118. https://doi.org/10.1016/j.landusepol.2013.03.012

Long, H., Li, Y., Liu, Y., Woods, M., Zou, J., 2012. Accelerated restructuring in rural China fueled by 'increasing vs. decreasing balance' land-use policy for dealing with hollowed villages. Land use policy 29, 11–22. https://doi.org/10.1016/j.landusepol.2011.04.003

Long, H., Liu, Y., Li, X., Chen, Y., 2010. Building new countryside in China: A geographical perspective. Land use policy 27, 457–470. https://doi.org/10.1016/j.landusepol.2009.06.006

Lu, X., Peng, W., Huang, X., Fu, Q., Zhang, Q., 2020. Homestead management in China from the "separation of two rights" to the "separation of three rights": Visualization and analysis of hot topics and trends by mapping knowledge domains of academic papers in China National Knowledge Infrastructure (CNKI). Land use policy 97, 104670. https://doi.org/10.1016/j.landusepol.2020.104670

Luo, B., 2017. Rethinking and extension of the Coase Theorem: Reform and choice of land circulation institutions in rural China. Econ. Res. J. 178–193.(in Chinese)

Machemer, P., Kaplowitz, M.D., 2000. Transferable Development rights: A Market-based Land Use Control, in: Property Rights, Economics, and the Environment. Routledge.

Mujumdar, N.A., 2002. Rural development: New perceptions. Econ. Polit. Wkly. 37, 3983–3987.

https://doi.org/www.jstor.org/stable/4412654

National Bureau of Statistics of China, 2023. Statistical Communiqué of the People's Republic of China on the 2022 National Economic and Social Development. https://doi.org/www.stats.gov.cn/sj/zxfb/202302/t20230228_1919011.html

Osborne, S.P., Williamson, A., Beattie, R., 2004. Community involvement in rural regeneration partnerships: Exploring the rural dimension. Local Gov. Stud. 30, 156–181. https://doi.org/10.1080/0300393042000267218

Pruetz, R., Standridge, N., 2009. What makes transfer of development rights work? J. Am. Plan. Assoc. 75, 78–87. https://doi.org/10.1080/01944360802565627

Qu, Y., Jiang, G., Ma, W., Li, Z., 2021. How does the rural settlement transition contribute to shaping sustainable rural development? Evidence from Shandong, China. J. Rural Stud. 82, 279–293. https://doi.org/10.1016/j.jrurstud.2021.01.027

Shih, M., Chiang, Y.-H., Chang, H.B., 2019. Where does floating TDR land? An analysis of location attributes in real estate development in Taiwan. Land use policy 82, 832–840. https://doi.org/10.1016/j.landusepol.2018.12.029

Smith, G., 2010. The hollow state: Rural governance in China. China Q. 203, 601–618. https://doi.org/10.1017/S0305741010000615

Storey, D., 2009. Economic Development, Rural. Int. Encycl. Hum. Geogr. 310–314. https://doi.org/10.1016/B978-008044910-4.00898-1

Sun, S., Wang, X., Hu, M., 2022. Spatial distribution of Airbnb and its influencing factors: A case study of Suzhou, China. Appl. Geogr. 139, 102641. https://doi.org/10.1016/j.apgeog.2022.102641

Tan, R., Wang, R., Heerink, N., 2020. Liberalizing rural-to-urban construction land transfers in China: Distribution effects. China Econ. Rev. 60, 1–12. https://doi.org/10.1016/j.chieco.2018.01.001

Tang, Z., 2019. Rural revitalization and scientific management in the Pearl River Delta— scientific decision based on scientific rationality and public understanding. Glob. Transitions 1, 241–250. https://doi.org/10.1016/j.glt.2019.11.003

Tao, Z., Guanghui, J., Wenqiu, M., Guangyong, L., Yanbo, Q., Yingying, T., Qinglei, Z., Yaya, T., 2021. Dying villages to prosperous villages: A perspective from revitalization of idle rural residential land (IRRL). J. Rural Stud. 84, 45–54. https://doi.org/10.1016/j.jrurstud.2021.02.010

Wang, H., He, C., Li, W., Nie, X., Zhong, H., Wen, L., 2020. Will transferable development rights (TDR) increase regional economic imbalance? — A quota transaction case of cultivated land conversion and reclamation in Guangxi, China. Habitat Int. 104, 102254. https://doi.org/10.1016/j.habitatint.2020.102254

Wang, J., 2023. Building a New Socialist Countryside, in: Rural Revitalization in China. Springer Nature Singapore, Singapore, pp. 121–144. https://doi.org/10.1007/978-981-19-9028-1_7

Ward, N., Brown, D.L., Ã, N.W., Brown, D.L., 2009. Placing the rural in regional development. Reg. Stud. 43, 1237–1244. https://doi.org/10.1080/00343400903234696

Wu, B., Liu, L., 2020. Social capital for rural revitalization in China: A critical evaluation on the government's new countryside programme in Chengdu. Land use policy 91, 104268. https://doi.org/10.1016/j.landusepol.2019.104268

Wu, Y., Mo, Z., Peng, Y., Skitmore, M., 2018. Market-driven land nationalization in China: A new system for the capitalization of rural homesteads. Land use policy 70, 559–569. https://doi.org/10.1016/j.landusepol.2017.10.003

Wu, Y., Yu, Y., 2022. Impact of rural residential land transfer on rural households' livelihood vulnerability: Based on household survey in Jinzhai,Yicheng and Yujiang. J. Agro-Forestry Econ. Manag. 21, 207–216. https://doi.org/10.16195/j.cnki.cn36-1328/f.2022.02.23

Xi, J., 2019. The rural revitalization strategy: The key to our efforts concerning agriculture, rural areas and farmers in the New Era. Qiushi 2–5. https://doi.org/www.qstheory.cn/dukan/qs/2019-06/01/c_1124561415.htm

Xu, Z., Zhuo, Y., Li, G., Bennett, R.M., Liao, R., Wu, C., Wu, Y., 2022. An LADM–based model to facilitate land tenure reform of rural homesteads in China. Land use policy 120, 106271. https://doi.org/10.1016/j.landusepol.2022.106271

Yan, J., 2019. Agritainment: A Chinese style of leisure and aesthetic space. Sp. Cult. 22, 142–152. https://doi.org/10.1177/1206331218793322

Yang, W., Xu, K., Lian, J., Bin, L., Ma, C., 2018. Multiple flood vulnerability assessment approach based on fuzzy comprehensive evaluation method and coordinated development degree model. J. Environ. Manage. 213, 440–450. https://doi.org/10.1016/j.jenvman.2018.02.085

Zadeh, L.A., 1965. Fuzzy sets. Inf. Control 8, 338–353. https://doi.org/10.1016/S0019-9958(65)90241-X

Zhang, B., Zhao, Y., Wang, Z., 2023. How to understand the mixed land use of rural settlements? Empirical evidence from the Pearl River Delta, China. Habitat Int. 136, 102818. https://doi.org/10.1016/j.habitatint.2023.102818

Zhang, Q.F., Wu, J., 2015. Political dynamics in land commodification: Commodifying rural land development rights in Chengdu, China. Geoforum 1–12. https://doi.org/10.1016/j.geoforum.2015.10.001

Zhang, T., Li, M., Xu, Y., 2018. Construction of rural revitalization evaluation index system and empirical study. Manage. World 99–105. https://doi.org/10.19744/j.cnki-1235/f.2018.08.009

Zhang, Y., Long, H., Ma, L., Tu, S., Li, Y., Ge, D., 2022. Analysis of rural economic restructuring driven by e-commerce based on the space of flows: The case of Xiaying village in central China. J. Rural Stud. 93, 196–209. https://doi.org/10.1016/j.jrurstud.2018.12.001

Zhao, X., 2020. Land and labor allocation under communal tenure: Theory and evidence from China. J. Dev. Econ. 147, 102526. https://doi.org/10.1016/j.jdeveco.2020.102526

Zhou, L., Zhang, W., Fang, C., Sun, H., Lin, J., 2020. Actors and network in the marketization of rural collectively-owned commercial construction land (RCOCCL) in China: A pilot case of Langfa, Beijing. Land use policy 99, 104990. https://doi.org/10.1016/j.landusepol.2020.104990

Zhou, Y., Li, X., Liu, Y., 2020. Rural land system reforms in China: History, issues, measures and prospects. Land use policy 91, 1–15. https://doi.org/10.1016/j.landusepol.2019.104330

Zhu, J., 2004. From land use right to land development right: Institutional change in China's urban development. Urban Stud. 41, 1249–1267. https://doi.org/10.1080/0042098042000214770