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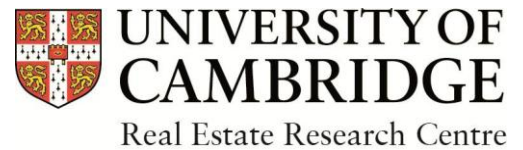
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Title: Unpacking the Effects of Rural Homestead Development Rights Reform on Rural Revitalization in China

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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 a pivotal tool to promote rural revitalization in China. Thus, identifying the impact of RHDR reform on rural revitalization is crucial for the successful implementation of rural homestead system reform in China. We propose a unified theoretical framework to unpack the effectiveness of RHDR reform by contrasting 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 difference-in-difference model and 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 analysis shows that collective-oriented RHDR reform has a stronger impact than household-oriented RHDR reform on promoting rural revitalization. The findings in this study not only underpin the significance of rural homestead system reform to promote rural revitalization in China, but also shed light on the role of rural community in efficient land resources management in developing countries.

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

1. Introduction

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) rose from 385 yuan in 1978 to 80 976 yuan in 2021, while the urbanization rate rose from 17.92% to 64.72% in the same period, an increase of about 209.32 and 2.61 times, respectively. China has also seen impressive urban-rural income gap and faced 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, talents, capital and land from rural to urban areas has become a major challenge for policy makers to promote the integrated development of urban and rural areas (Wu and Liu, 2020). In China's rural areas, 291 million migrant workers left for cities in search of job opportunities in 2019, around 0.53 million ha agricultural land were occupied by constructions in urban areas in 2017 and cities have attracted more than 70% of China's total public and private investments in fixed assets since 1980 (Liu and Li, 2017; National Bureau of Statistics of China, 2020).

To promote rural development and alleviate rural decline, the Chinese government has initiated a campaign namely "building socialist new countryside" in 2006 and further launched the strategy of promoting "rural revitalization" in 2017 (Xi, 2019). The CPC Central Committee and the State Council subsequently issued the "Strategic Plan for Rural Revitalization (2018-2022)" in 2018 to handle the prospects from an overall and strategic perspective. China is not alone in its efforts to revitalize the countryside. The governments of other countries, including those of the United States, United Kingdom, Australia, New Zealand, Sweden and Spain, have used planning, investment and subsidy strategies to encourage rural development (John, 1989; Liu and Li, 2017;

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67   Marsden, 2009). Revitalizing the countryside has become a common issue for both developing

68   and developed countries (Onitsuka and Hoshino, 2018). Nevertheless, situations in China might be

69   more complicated because of the dual land use and management system in urban and rural areas,

70   and among which the most complex and lagging-behind system is the rural homestead use and

71   management system (Liu and Xiong, 2018).

72   Vitalizing the countryside requires the inflows and agglomeration of production factors in

73   rural areas (Tang, 2019). Under the background of China's rapid urbanization, reallocating or

74   reusing rural homestead resources are crucial policy tools in attracting investment, talents and

75   innovative technology to the countryside. As Mujumdar (2002) specified in his study that rural

76   land seems to hold the key to overall development of the economy and the improvement in the

77   quality of rural life, rural homestead land in China also holds the key to rural revitalization

78   because it accounts for a large proportion of rural construction land. In 2015, following the

79   resolution formulated in December 2014 on the seventh meeting of the Central Leading Group for

80   Comprehensive Deepening Reforms presided by Xi Jinping, China launched a comprehensive

81   rural land reform in 33 pilot counties to systematically promote rural land system reform with

82   unprecedented efforts and suspended the implementation of some provisions of the "Land

83   Management Law" and "Urban Real Estate Administration Law"(Zhou et al., 2020). "Three lands"

84   (*san-kuai-di*) system pilot reforms, namely "rural land expropriation", "collective operational

85   construction land into market" and "rural homestead management system reform" paralleled and

86   finally integrated in each pilot county. In addition, the reform due date was postponed twice and

87   finally pinned down to end in 2019. However, only the pilot experience of rural homestead system

88   has not been included in the revision of relevant items of the previous two laws. This lag in

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89 legislation after pilots reflects that the effects of rural homestead system reform has not yet been

90 officially identified; and that how to effectively conduct this reform remains unsolved. Vitalizing

91 homestead resources and endowing rural collectives and households more homestead development

92 rights is the essence of rural homestead system reform in China. This prompts us to explore the

93 impact of RHDR reform on rural revitalization to better understand rural homestead system

94 reform in China.

95   Policy makers have attached great significance to promoting rural revitalization via rural

96 homestead land reform (Hanstad et al., 2002; Haque, 2003; Kong et al., 2018; Tan et al., 2020).

97 Rural homestead land in China is collectively owned and restricted from free transaction in land

98 markets (Kong et al., 2018). Under this background, endowing rural collectives and households

99 land development rights becomes a feasible path of rural homestead land reform (Machemer and

100 Kaplowitz, 2000; Zhu, 2004). The role homestead plots play for rural areas goes far beyond the

101 place to build houses. The plots also provide households additional space for conducting other

102 economic activities, such as homestay, catering, cultural and creative industries (Gu et al., 2020).

103 The village collective can also develop secondary and tertiary industries, improve local living

104 environments, raise the governance level, and increase peasants' income by reusing homestead

105 resources (Wu et al., 2018). In this process, rural areas attract and agglomerate production factors

106 including capital, talents and land to comprehensively promote rural development (Han, 2020; Ho

107 and Lin, 2004). Therefore, rural homestead land system reform could generate far-reaching

108 impacts on rural revitalization and in-depth analysis of these impacts is needed to better

109 understand the undergoing rural homestead land reform in China. Some studies have focused on

110 how to make full use of and extend homestead functions to promote rural revitalization based on

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111   qualitative analysis(Gao et al., 2022; Li et al., 2014; Liu et al., 2014; Long et al., 2012, 2010; Tao

112   et al., 2021). After Chinese central government proposed a new exploration of "three rights

113   separation" *(san-quan-fen-zhi)* reform of rural homestead in 2018, there are also a variety of

114   debates about how to efficiently manage and reuse rural homestead resources (Bramall, 2021; Y.

115   Zhou et al., 2020). Nevertheless, few studies have shed light on well-identified quantitative

116   evidence of rural homestead reform practices in China. This is partly due to the lack of related

117   homestead data of Chinese villages or households, and partly due to the complex situation of

118   identifying the impacts of the reform on rural revitalization because there is still a lack of index

119   system to measure rural revitalization performance.

120   This study adds to our understanding of the impacts of rural homestead land reform on rural

121   revitalization in three aspects: (i) establishing a reasonable index system to measure rural

122   revitalization performance; (ii) using a panel survey data of China's four typical provinces to

123   provide empirical evidence for identifying the impact of the reform; (iii) uncovering the facts of

124   feasible communal land use ways under imperfect rural land market in developing countries. The

125   remainder of this paper is structured as follows. Section 2 develops a theoretical framework to

126   analyze how RHDR reform impacts rural revitalization and classifies RHDR reform into two

127   types according to the implementing subjects. Section 3 lays out empirical models and introduces

128   data sources. Section 4 discusses the empirical findings and processes different tests. Section 5

129   provides further discussions for communal land use in developing economies. Section 6 concludes

130   the research findings and discusses policy implications of rural homestead reform in developing

131   countries as a tool to promote rural revitalization.

132   **2. Theoretical framework**

2.1. Property right system and rural homestead resource allocations

In functional markets, supply and demand jointly determine the market clearing price and quantity. As shown in Fig.1, S and D represent the supply curve and the demand curve of homestead respectively. P and Q denote the equilibrium price and the equilibrium quantity of homestead market respectively. This is not the case in China, where the initial arrangement of rural homestead rights is collectively owned and distributed to rural households for free according to their membership status. Rural collectives hold the ownership and the households hold the right to use homestead plots. Thus, rural households' right to use homestead is a type of property right obtained not from transactions through land markets, but from the national institutional arrangement. In this case, the boundary 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, 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 show in Fig.1, restrictions on the usage and transfer of homestead rights lead to an imbalance between supply and demand. Land value is distorted and the homestead market is imperfect. The actual market price, P_1, is lower than that of the equilibrium price P. However, when the market

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155 price is P_1, the supply would be Q_1, and the price the demander is willing to pay is P_2. Thus, there

156 is a gap between P_1 and P_2. The shared area, of which the size is determined by $(P_2-P_1)*Q_1$,

157 represents the rent that might induce rent-seeking behavior and increase transaction costs (Barzel,

158 1997). To prevent such market failure, government interventions such as property rights reform

159 are necessary to improve rural homestead resource allocation efficiency and promote rural

160 development.

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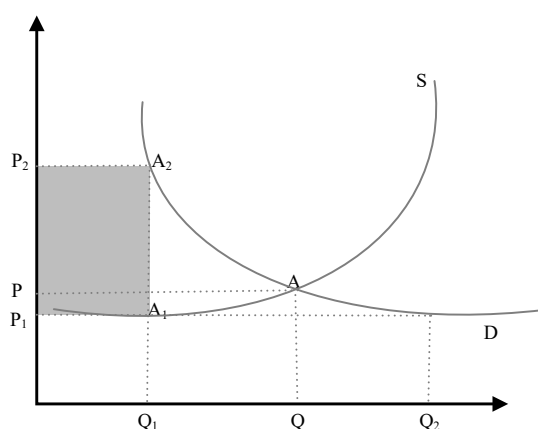
Fig.1. Land market distortions under restrictions of rural homestead rights transfer

163 Consensus has been reached on the necessity to carry out homestead rights reform in China.

164 However, how to carry out this reform remains controversial under the premise of ensuring rural

165 collective ownership, among which the primary dispute is whether households or rural collectives

166 are capable market subjects. Given that there are transaction costs in the market and different

167 subjects have different efficiencies in using the same resources, property rights should be entitled

168 to those who are more capable to reducing transaction costs (Coase, 1994). However, the problem

169 is who would be the capable subject and how to find the differences of subjects in using resources

170 in rural China (Luo, 2017).

171 Existing studies can be broadly classified into two groups based on their focus on either

172 property owners or property users. According to Hart (1995), property owners should be more

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173   capable of allocating property rights in incomplete contracts. The case in China is that rural

174   collectives own rural homestead land, although the ownership has deliberate institutional

175   ambiguity (Ho, 2001). Collective tenure might generate important efficiency and redistribution

176   benefits in a developing country, where formal rural land and labor markets are not fully

177   developed and the poorest households often require communal support for subsistence (Zhao,

178   2020). In addition, fulfilling land ownerships of rural collectives is one of the main reform

179   contents in China's "three rights separation" reform of rural homestead. With asymmetrical

180   information in rural homestead markets, entitling more powerful village collectives to the subject

181   of using homestead might be not only in line with improving property allocation efficiency, but

182   also in line with the development trend and the premise of the undergoing rural homestead reform.

183   Nevertheless, Barzel (1997) pointed out that when there is supervision cost, the problem of titling

184   the residual control rights will arise, and property users may also become effective resource

185   allocation subjects. Thus, low supervision costs and high flexibility in operation may also make it

186   more efficient for rural households (i.e., property users) to be the subject of allocating homestead

187   property rights in China. There is no consensus about which school of thoughts should be

188   followed to model the homestead rights reform in China. Our research sets out to answer this

189   question by incorporating both aspects in a unified framework.

190   **2.2. RHDR reform and its impacts on rural revitalization**

191   Since the early 2000s, the RHDR reform has become a fundamental strategy to optimize the

192   allocation of homestead resources(Zhu, 2004). It was launched before "three rights separation"

193   reform and was linked to it in practice in China. RHDR is, in fact, a property right from which the

194   subject obtains benefits via changing land use or land use intensity following the control of

9

195   governments (Janssen-Jansen, 2008; Wang et al., 2020). From this perspective, RHDR reform

196   could have a broader policy connotation than that of rural homestead use rights reform in China.

197   Rural homestead use rights reform is mainly aimed at promoting land transfer and

198   maintaining homestead use (Brandt et al., 2017; Y. Zhou et al., 2020). Due to the restrictions on

199   transaction scopes, the transfer of rural homestead use rights is basically restricted within the same

200   village or town. Under these circumstances, RHDR reform provides an opportunity for direct and

201   indirect types of rural homestead use rights transfer through rearranging property rights to

202   different subjects via changing land use or land use intensity. In other words, rural homestead land

203   use rights reform might be carried out via the form of RHDR reform (Liu, 2019). Therefore,

204   RHDR reform is more prevalent in local practices in the allocation of rural homestead resources.

205   According to the differences of dominant subjects, RHDR reform can be classified into

206   collective-oriented and household-oriented types[2]. Collective-oriented RHDR reform is usually

207   linked to rural land comprehensive consolidation projects. The village collective needs to arrange

208   and promote the whole project operation process and the homestead resource allocation rights are

209   assigned to the collective correspondingly. In local practice, rural collective obtains project funds

210   by mortgaging land rights or by attracting investments of diverse interest groups. According to the

211   related project planning, rural homestead land is then consolidated and households are relocated to

212   new settlements. The new homestead areas are well planned and the more intensive use of land is

213   made. The living conditions and surrounding environment of the new homestead areas are also

214   greatly improved by conducting the reform. The remaining homesteads would be adjusted to

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[2] For rural land in China, village collectives have the ownership and households hold the original use rights. They play dominant roles in the allocation of rural homestead resources. Following this logic, we classify the RHDR reform into centralized collective-oriented and decentralized household-oriented types. In addition, cross-regional transfer and transactions of RHDR are not included in this study to simplify the whole analysis.

10

215   collective operational construction land according to the planning, to develop secondary and

216   tertiary industries like agro-processing industry, cultural and creative industry and manufacturing.

217   This adjustment could solve the problem that there is a lack of scale and relevant land to develop

218   new rural industries. Job opportunities and collective assets also increase besides agricultural

219   employment and primary industries, which would ultimately increase the income of households.

220   In addition, the communication and coordination between rural collective and the households in

221   every process of the project and the game negotiation with other stakeholders could enhance the

222   village's governance capacity as well. Thus, this reform could generate positive and

223   comprehensive impacts on rural revitalization.

224   Household-oriented RHDR reform is in general based on living environment upgrading

225   programme to enhance rural ecological environment and promote rural development. The

226   households hold the right to develop homestead into higher intensity uses. The public accessibility,

227   connectivity and recreational facilities are improved by the village collective primarily. Then, the

228   households upgrade their houses on the original homestead to develop homestay, catering,

229   agritainment and related industries. The difference compared with the collective-oriented RHDR

230   reform is that there is no relocation of households and no adjustment of homestead to collective

231   operational construction land. The homestead resource allocation rights are dispersed to every

232   household respectively. By increasing land use intensity and extending land use beyond living,

233   rural households have the opportunities to develop family economy and increase their incomes.

234   Rural living conditions and ecological environment are enhanced by constructing or improving

235   public facilities. Through the gradual transformation and upgrading of the village, rural scape and

236   local traditional culture are mainly preserved and inherited. The governance capacity of the village

237   is strengthened by managing decentralized household industries and regular communication

238   between cadres and households. The gradually optimized business environment is also conducive

239   to the breeding and development of village industries. All the above aspects of improvements

240   would positively and comprehensively affect rural revitalization as well.

241   The above analysis suggests that both collective-oriented and household-oriented RHDR

242   reforms could generate positive and comprehensive impacts on rural revitalization. We are

243   interested in investigating which type of reform is more conducive to rural development under

244   China's imperfect rural land market. To answer this question, we follow the "Strategic Plan for

245   Rural Revitalization (2018-2022)" to include five important aspects of promoting rural

246   revitalization, that is, rural industries, rural environments, rural culture, rural governance and rural

247   income. These are essentially five channels through which different RHDR reforms affect rural

248   revitalization, as shown in Fig. 2. Specifically, through consolidating homestead to uses of higher

249   productivity and status of higher intensity, collective-oriented RHDR reform has more advantages

250   in developing rural industries on scale operational land and enhancing rural environments by

251   reconstruction. These stronger effects are highlighted by thicker lines and bigger arrow heads

252   going from the "Collective-oriented" box to the "Rural industries" and "Rural environments"

253   boxes. In contrast, household-oriented RHDR reform is more conducive to decentralized family

254   economy to increase household income directly, and rural scape and traditional culture are more

255   likely to be preserved by redevelopment rather than reconstruction. Rural governance level also

256   tends to be more fundamentally influenced by the reform in the efforts to improve the governance

257   order to promote the optimization of the village business environments. Therefore, the effects

258   from "Household-oriented" RHDR through "Rural culture", "Rural governance", and "Rural

259 income" are stronger. These are the hypotheses to be tested in later parts of this paper.
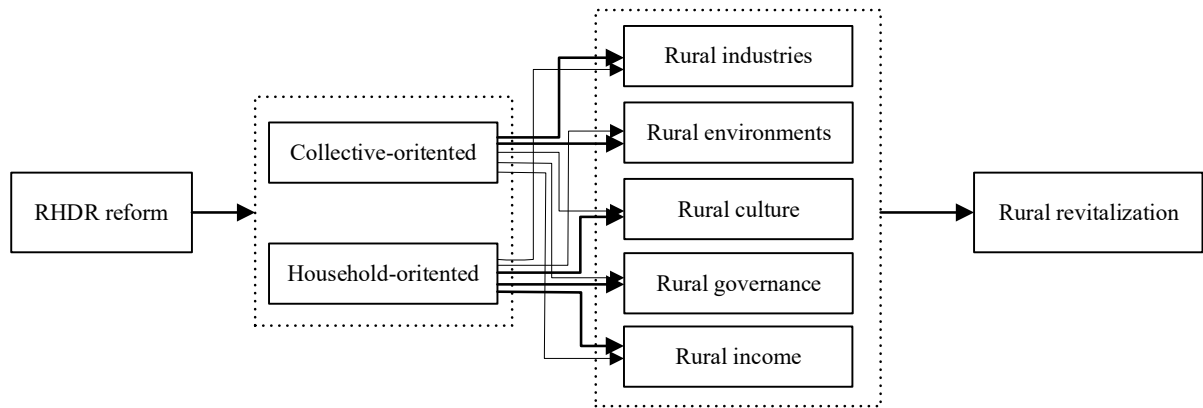
260
261 **Fig.2.** Primary impacting framework of RHDR reform on rural revitalization

3. Empirical strategies and implementations

3.1. Measuring rural revitalization performance

264   Rural revitalization is aimed at finding ways to improve rural economy and rural lives. The

265 need for villages to approach development from a wider perspective has drawn more attention to a

266 broad range of development goals rather than merely creating incentive for agricultural or

267 resource based business (Nelson and Norman Reid, 1996). Thus, multiple aspects need to be

268 considered to comprehensively evaluate rural revitalization performance.

269   We design a comprehensive index system to measure rural revitalization performance. The

270 overall structure of the index system (i.e., the first tier in Table 1) is determined based on the five

271 aspects of rural revitalization goals. Within each aspects, we follow the studies of Haggblade et al.

272 (2007), Ward et al. (2009) and Zhang et al. (2018) to consider the subject roles of both collectives

273 and households. The emphasis on farmers' perspective is an important aspect of our research

274 design. According to the "NO.1 Central Document" in 2018, which highlighted that attention

275 should be paid to farmers' perception of rural revitalization performance and their sense of gain in

276 the process of promoting rural revitalization. As show in the 'Second tier" and the "Third tier"

13

277   columns in Table 1, inputs from farmers are considered in all five aspects, and there is a good

278   balance between collectives and households. The final evaluation index system consists of five

279   sub-indexes in the first tier, ten sub-indexes in the second tier and 34 sub-indexes in the third tier,

280   as detailed in Table 1.

281   We then employ grey relational analysis (GRA) combined with fuzzy comprehensive

282   evaluation (FCE) methods to measure the performance value of rural revitalization. GRA was

283   developed by Julong Deng in 1982 and deals with uncertain systems with partially known

284   information through generating, excavating and extracting useful information from the available

285   data and materials (Deng, 1982; Liu et al., 2016). In view of the potential problems of incomplete

286   and partial information in farmers' perception of rural revitalization performance, it is suitable to

287   use GRA to measure the complex relationship among factors and determine the weights of the

288   indicators. The formula of the most important coefficient of GRA, namely the gray correlation

289   coefficient ($\xi_i(k)$), is shown in Equation (1), where i is the id number of households involved in

290   this study and k is the id number of the indicators of rural revitalization performance.

291     $x_0(k)$ stands for the reference sequence and $x_i(k)$ stands for the comparison sequence. ρ is

292   resolution coefficient and generally, the value is 0.5 (Deng, 1982).

293
$$\xi_i(k) = \frac{\min_i \min_k |x_0(k) - x_i(k)| + \rho \max_i \max_k |x_0(k) - x_i(k)|}{|x_0(k) - x_i(k)| + \rho \max_i \max_k |x_0(k) - x_i(k)|} \quad (1)$$

294   Next, based on the measurement results of index weights, FCE is used to calculate the rural

295   revitalization performance value. FCE originates from the fuzzy set theory developed in 1965

296   (Zadeh, 1965). By transforming qualitative problems into quantitative ones, this method could

297   quite naturally manage the initiative and fuzziness of human perception and deal with subjective

298   and qualitative evaluation issues in performance measurement (Chang, 2021). In consideration of

14

299   the complexity of the index system, multi-layer FCE was performed in this study. Let the fuzzy set

300   of rural revitalization performance perceived by households as υ, and the performance value

301   before and after the RHDR reform as the subset ω of υ, then the fuzzy function of household i

302   is $\omega_i = \{x_i, \mu(x_i)\}$. $\mu(x_i)$ is the membership degree of ω, and $\mu(x_i) \in [0,1]$. Following the

303   study of Yang et al (2018), the membership degree function of positive indicators is determined by

304   equation (2) and that of the negative indicators is determined by formula (3). The vectorization

305   result was obtained from the membership matrix and the index weights and was further

306   normalized to get the final comprehensive rural revitalization performance value.

307
$$\mu(x_{ik}) = \frac{x_{ik}-x_{ik}^{min}}{x_{ik}^{max}-x_{ik}^{min}} (x_{ik}^{min} < x_{ik} < x_{ik}^{max}) \tag{2}$$

308
$$\mu(x_{ik}) = \frac{x_{ik}^{max}-x_{ik}}{x_{ik}^{max}-x_{ik}^{min}} (x_{ik}^{min} < x_{ik} < x_{ik}^{max}) \tag{3}$$

15

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	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	Types and integrated degree of industries in the village
Rural environments	Housing conditions	Housing area	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 point or not
	Ecological environment	Green coverage	Green vegetation coverage of the village
		Air pollution	Air pollution level of the village
		River course consolidation	Remediation of the river in the village
		Sewage treatment	Situation of sewage treatment equipment in the village
		Garbage disposal	Situation of garbage disposal and classified recycling in the village
	Public services	Completeness of water, electricity, gas and information network	According to the evaluation of the installation of household's water, electricity, gas and communication network
		Convenience of children to go to school	Distance between residence and primary school
		Medical and health services	Satisfaction with medical and health services in the village
		Completeness of cultural and sports facilities	According to the evaluation of the equipment of the village's cultural and sports facilities
		Transportation convenience	Bus stop settings
		Security situation of the community	The equipment of security facilities such as Skynet

16

Rural culture	Cultural development	Frequency of cultural activities	According to the evaluation of cultural activities carried out in the village
		Degree of historical and cultural (heritage) protection	According to the evaluation of the village's protection of historical culture (heritage)
		Effectiveness of farmers' education and training	Based on the evaluation of the effectiveness of farmers' education and training
	Civilized life	Frequency of family dissensions	Estimated 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	Based on 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 like 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

310

3.2. Estimation methods

To clearly identify the impacts of the RHDR reform on rural revitalization, the key challenge

is to recognize and solve potential endogenous problems. Various identification strategies are

utilized to deal with these problems in this study. Firstly, panel data is used to control for the

possible problems of missing variables that might be unobservable and do not vary over time.

Secondly, reverse causality of the relationship between the RHDR reform and rural revitalization

performance is carefully analyzed. For village collectives and rural households, whether they can

be included in the RHDR reform is largely an exogenous policy shock or impact. Therefore, there

is no reverse causality of the relationship between the RHDR reform and rural revitalization

performance. However, in practice, there are indeed villages that are actively declared by the

village party committee, or are close to the central city and have civilized village culture and good

transportation infrastructure, which can reduce the resistance and cost of policy implementation,

and are more likely to be selected as pilot areas, resulting in the problem of selection bias of

samples. Given this, empirical models that can solve the problem of self-selection bias are used.

Thirdly, measurement error of the pilot villages is considered comprehensively. The list of the

selected policy pilot villages can be obtained from the official documents. Once selected as a pilot

village, it can be observed and the corresponding rural households in this village are clarified, thus

avoiding the problem of measurement error to a large extent. By using these identification

strategies, different types of endogenous problems can be primarily solved and the consistency of

model estimation parameters can be ensured.

We firstly use 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

333   self-selection bias problems of panel data because it does not need to assume functional forms,

334   parameter constraints and error term distributions in advance (Heckman and Vytlacil, 2007). By

335   using information from the control group to estimate the outcomes that the experimental group

336   might have produced if left untreated, the PSM method constructs a proxy indicator for

337   counterfactual outcomes. The average treatment effect (ATT) could be shown as below in formula

338   (4), where Y_{1i} is rural revitalization performance of the treated group and Y_{0i} is that of the

339   control group. G_i is a dummy variable which indicates whether the households' villages are

340   included in the RHDR reform. If it is yes, $G_i = 1$, and otherwise $G_i = 0$.

341
$$\text{ATT} = \text{E}(Y_{1i} \mid G_i = 1) - E(Y_{0i} \mid G_i = 0) \tag{4}$$

342   We then use heterogeneous timing difference in difference (DID) method to explore the

343   changes of rural revitalization performance with and without the RHDR reform. This method

344   could eliminate the effects of natural differences that do not change over time by differentiating

345   the treated group and the control group before and after the implementation of the reform, thus

346   identifying the net policy effects. The model equation is as follows,

347
$$Y_{it} = \alpha' + \beta' G_i \cdot Post_{it} + u_i^{'} + \sum_{t=2}^{T} \gamma_t^{'} D_t + w'X_{it} + \varepsilon'_{it} \tag{5}$$

348   where Y_{it} is the rural revitalization performance of household i in year t. $Post_{it}$ is a dummy

349   variable indicating the situation before and after the reform. If it is after the reform, $Post_{it} = 1$,

350   and otherwise, $Post_{it} = 0$. Since the treatment period of the policy is not completely consistent,

351   the treatment dummy variable varies from individual to individual. We add subscript i to $Post_t$.

352   u_i' is the individual fixed effect and D_t represents the time dummy variables. X_{it} denotes other

353   control variables that affect rural revitalization performance. α', β', γ_t' and w' are indicators to

354   be estimated and ε_{it} is the error term.

355   To further explore which type of the RHDR reform is more conducive to rural revitalization

19

356 performance, we utilize the following two-way fixed effects (Two-way FE) model to control for

357 the potential problems of unobservable missing variables that vary across individuals and time. In

358 formula (6), G_{ij} is the dummy variable which denotes different types of RHDR reform, such as

359 collective-oriented or household-oriented RHDR reforms. u_i is the individual fixed effect and

360 D_t represents the time dummy variables. α, β, γ_t and w are indicators to be estimated and

361 ε_{it} is the error term.

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

363 **3.3. Data**

364   The dataset used in this empirical impact identification is an unbalanced multi-period panel

365 collected in one year before the pilot reform was approved and 2018. Considering that the

366 implementation period generally took 2 years, the scope of pilot villages that were used to sample

367 from was restricted to those projects that had been approved by 2016 and finished before 2018 at

368 the latest. An unbalanced multi-period panel ranging from 2006 to 2018 was obtained. According

369 to the principles of comprehensiveness and representativeness, the treatment group of the dataset

370 was randomly selected from the households in villages where the RHDR reform was carried out

371 through stratified random sampling, by region, province and village. The control group was drawn

372 from villages that are similar to pilot villages in geographical location and in natural endowment

373 and economic and social conditions, as shown in Fig.3. The number of sample households in each

374 village was determined according to the number of households in the village. The questionnaire

375 includes questions about the information on interviewees and households, rural revitalization

376 performance index system and control variables. In order to minimize potential measurement error

377 due to recall, we refine and decompose indicators by setting multiple questions, and use

20

378   qualitative methods to measure indicators that do not require reporting specific value. Before the

379   investigation of households, interviews with the local cadres were conducted to learn about the

380   overall situation of rural revitalization in the village and the establishment and implementation of

381   the RHDR reform project. The final dataset was thoroughly cleaned to ensure the validity of the

382   survey and a total of 670 questionnaires were obtained.

383   Control variables affecting rural revitalization performance were determined from four

384   aspects: regional condition, village resource endowment, human factor and individual

385   characteristics of the respondents. According to Ward et al.(2009), regional economic conditions

386   especially the development level of central urban areas could generate substantial impacts on the

387   development of surrounding rural areas. The village endowment determines the resources

388   constraint boundary of land reform and rural development (Liu and Xiong, 2018). In addition,

389   villages with advantageous human factors such as governance level of quality can lower

390   institutional costs and promote rural development. We also control individual characteristics of the

391   respondents to better identify the causality. Correspondingly, four proxy indexes, i.e. gross

392   domestic product per capita of central cities (*cgdp_ca*), rural homestead land area per capita

393   (*rhland_ca*), the role of the village party committee playing in village development (*role_vpc*), the

394   age of the respondents (*age_r*), are selected. Furthermore, we define the control group as the

395   default type, and set two dummy variables for the RHDR reform types, *collective_o* for

396   collective_oriented and *household_o* for household_oritented. The descriptive statistical analysis

397   of explanatory variables is shown in Table 2.

398

Table 2 Descriptive statistics of explanatory variables

	Treatment group (*Obs.*=966)				Control group (*Obs.*=374)			
	mean	s.e.	min	max	mean	s.e.	min	max
collective_o	0.240	0.427	0	1	0	0	0	0

21

household_o	0.260	0.439	0	1	0	0	0	0
cgdp_ca	6.560	3.132	1.788	14.018	6.122	2.709	1.788	10.199
rhland_ca	0.579	0.678	0.032	6.670	0.655	0.553	0.089	3.335
role_vpc	3.301	1.024	1	5	2.631	0.738	1	5
age_r	53.138	14.150	11	86	55.559	12.517	14	87

399

22

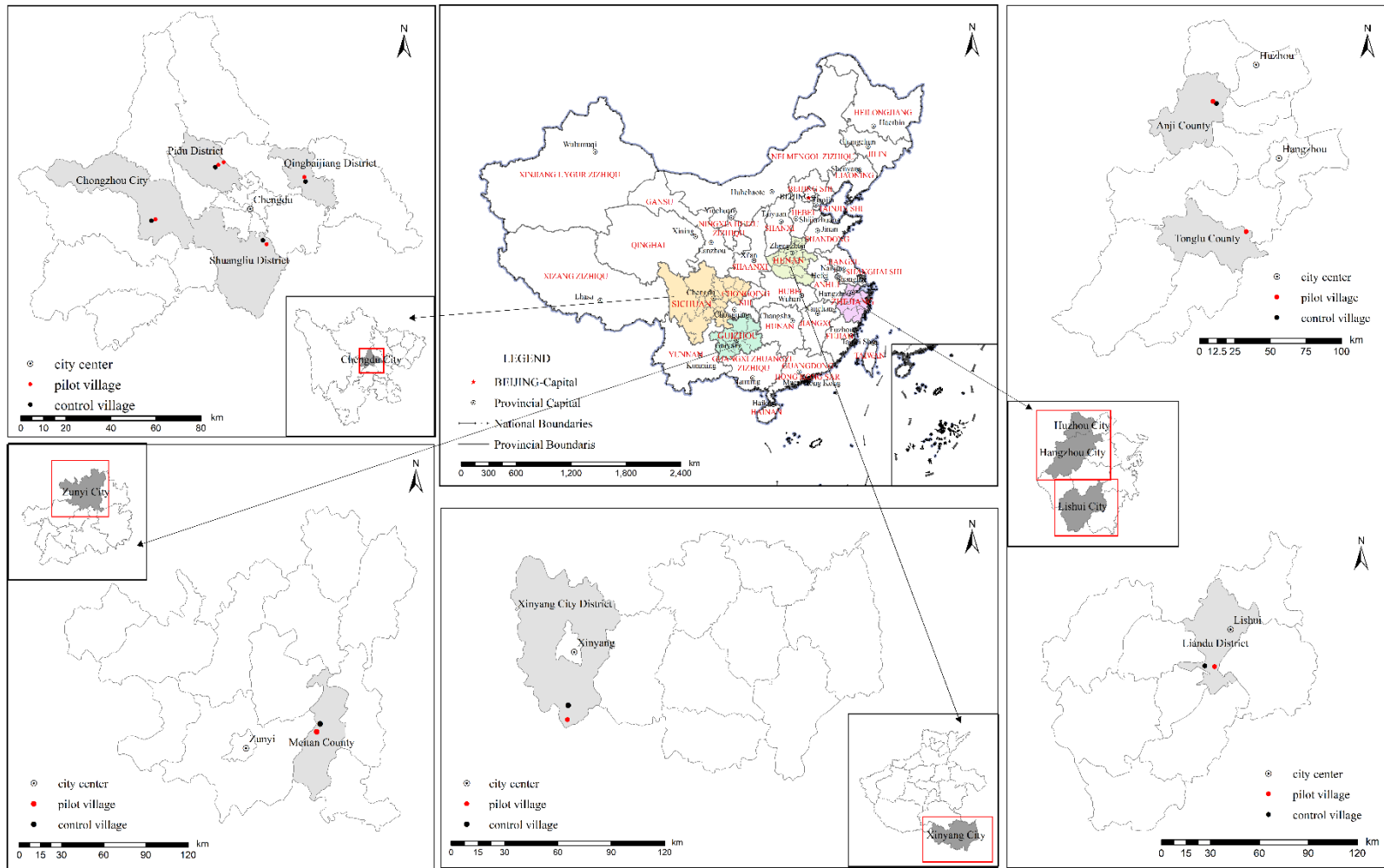**Fig.3.** Primary impacting framework of RHDR reform on rural revitalization

4. Empirical Findings

4.1. Rural revitalization performance

404   Using the methods of GRA combined with FCE and the dataset of the survey, we calculated

405   the value of rural revitalization performance. The mean of the value is 0.5411 and the frequency

406   distribution of the whole sample is shown on the left of Fig.4. It is a bimodal distribution, which

407   reflects that there are two combined subgroups or processes in the dataset. After further

408   investigation, we find that the treatment group has different distribution characteristics from that

409   of the control group, as shown on the right of Fig.4. This sheds light on the fact that with other

410   things being equivalent, differences have arisen between the treatment group and the control group

411   where there is no RHDR reform.

412
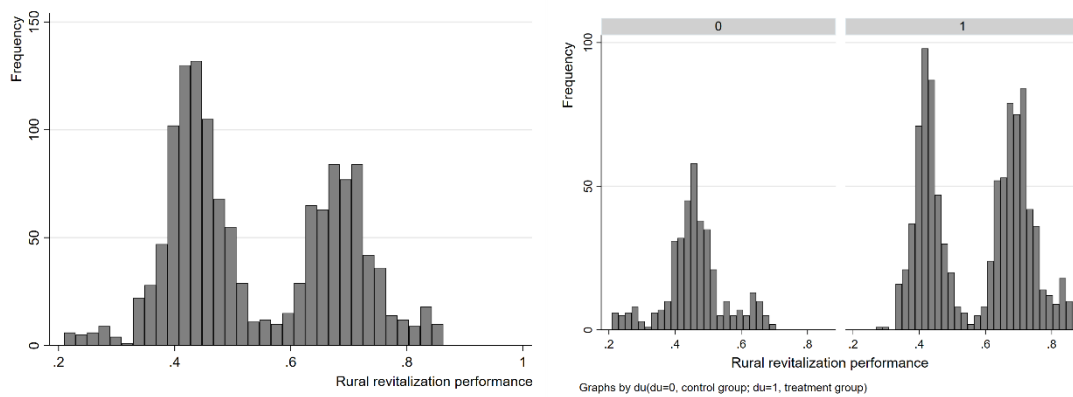
413   **Fig.4.** Frequency distribution of rural revitalization performance

414   ## 4.2. Sample matching

415   Sample matching was processed with the prevalent method of nearest-neighbor matching

416   within caliper of PSM. The caliper range is defined as 0.05. In order to ensure the reliability of the

417   matching results, we further conducted balance diagnostics and common support test. As shown in

418   Table 3, the standardized bias of the explanatory variables decreased significantly from 16.30%

24

before matching to 0.40% after matching. The *Pseudo-R²* and *LR chi²* are also decreased

remarkably. In addition, according to the common support hypothesis test shown in Fig.5,

propensity scores of the treatment group and the control group have a large common support range,

showing a high quality of sample matching and low loss of samples. All these indicate that the

PSM model used in the study satisfies the conditional independence assumption and the common

support hypothesis and sample self-selection bias is effectively eliminated after matching. The

average treatment effect of the treatment group is 0.117 and significant at 0.01 level, which

indicates the gross positive impact of the RHDR reform on rural revitalization. We will further

examine this effect using the DID and two-way FE models.

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

	Pseudo-R²	*LR chi² (p-value)*	**Standardized bias**	**ATT(s.e.)**
Unmatched	0.008	12.080 (0.002)	16.300%	
Matched	0.000	0.020 (0.991)	0.400%	
				0.117*** (0.007)
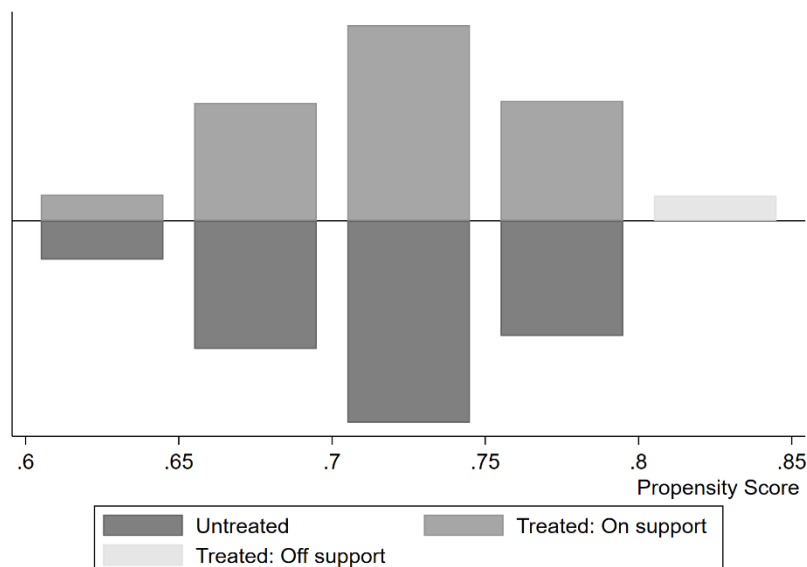
Notes: a. Standard errors in parentheses; b. *** *p<0.01*.

Fig.5. Common support of propensity score

4.3. Impacts of RHDR reform on rural revitalization

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433   To compare the differences with and without sample matching, we preformed regressions

434   using DID and PSM-DID models. The estimation results and the differences are shown in Table 4.

435   According to the estimation results, it can be primarily concluded that the RHDR reform generates

436   a stable, significant and positive impact on rural revitalization performance after controlling for

437   the influence of other factors. Furthermore, it can be seen that the coefficients of the interaction

438   items would be underestimated without sample matching. Although being selected as pilots is

439   largely an exogenous policy shock or impact, villages that have advantages in reducing the

440   potential cost of policy implementation are indeed more likely to be selected as pilot areas,

441   resulting in the problem of sample selection bias. Through sample matching, the hidden

442   randomized treatment observations could be selected from the dataset and the net policy impact

443   could be identified correspondingly. In view of this, we perform baseline analysis of the empirical

444   results based on model (4) in Table 4 and affirm that the rural revitalization performance of the

445   treatment group with the RHDR reform is 0.172 higher on average than that of the control group

446   without the reform.

447   **Table 4** Estimation results of DID and PSM-DID models

	DID		PSM-DID	
	rrp		*rrp*	
	(1)	(2)	(3)	(4)
$G \cdot Post$	0.169***	0.159***	0.184***	0.172***
	(0.009)	(0.009)	(0.010)	(0.010)
Control variables	*No*	*Yes*	*No*	*Yes*
Individual effect	*Yes*	*Yes*	*Yes*	*Yes*
Time effect	*Yes*	*Yes*	*Yes*	*Yes*
Obs.	1340	1340	1247	1247
R^2	0.760	0.780	0.760	0.780

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

449   The RHDR reform provides an opportunity for rural homestead resources reallocation to

450 different subjects via changing land use or land use intensity. The empirical results of this study

451 provide evidence that rural development is enhanced through land reallocation activities triggered

452 by the RHDR reform. According to the studies of Barzel (1997) and Levinson (1997), the

453 enhancement effect could be further analyzed in the following schematic diagram. As shown in

454 Fig.6, the supply curve shifts to the right, i.e. from s to s', because the RHDR reform loosens the

455 constraints on land development transfer and the supply side. The equilibrium price and the

456 equilibrium quantity of homestead market changes from P and Q to P' and Q' correspondingly.

457 Assuming that the actual market price is still P_1, the supply would be Q_1', and the price of the

458 demand side is P_2'. Comparing the shaded areas of $(P_2'-P_1)*Q_1'$ and $(P_2-P_1)*Q_1$, it is easily to find

459 that the distortion of homestead market would be adjusted and the transaction costs could be

460 decreased by implementing the RHDR reform. Although Levinson (1997) deemed that

461 transferable development rights could lead to greater overall development, Shih et al. (2019) found

462 that this transfer could generate positive impact and density bonus on areas having strict land use

463 plan. In the case of China, there are strong restrictions on rural homestead use and transactions. By

464 implementing the RHDR reform, the restrictions could be partially eliminated and related

465 industries could be widely developed, resulting in the overall comprehensive and positive impact

466 on rural development. The positive impact affirmed in our empirical results could also be

467 underpinned by the study of Zhang and Wu (2015), which argues that the development rights

468 transfer brought profound changes to rural areas, including re-configuring land-use patterns,

469 transforming physical conditions in residential communities, and the representation of rural space.

470
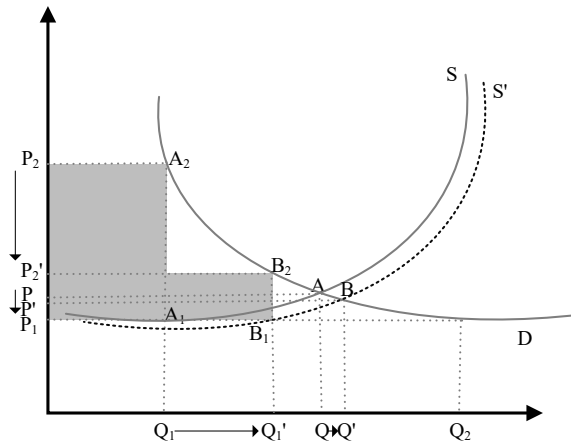
Fig.6. Land market distortion adjustment under the RHDR reform

471

472   **4.4. Heterogeneity Analysis**

473   On the basis of identifying the positive impact of the RHDR reform on rural development, we

474   further use Two-way FE models to analyze the heterogeneity of this impact according to the

475   different types in practice, i.e. the centralized collective-oriented and the decentralized

476   household-oriented types. To comprehensively explore the heterogeneity, regressions were carried

477   out from two perspectives: one is the impacting difference of the two types on the overall

478   performance, and the other is the impacting difference of the two types on the sub-performance of

479   the five aspects of rural revitalization. The estimation results are shown in Table 5 and Table 6

480   respectively.

481   According to the estimation results in Table 5, it can be found that both types of the RHDR

482   reform have stable, significant and positive impacts on total rural revitalization performance

483   compared with the control group, which further underpins the above empirical results based on

484   PSM-DID models. In addition, it is interesting to find that collective-oriented RHDR reform

485   shows a stronger impact than household-oriented RHDR reform. This interesting finding could

486   provide empirical evidence for the debate on which type of reform is more conducive to rural

28

development under the background of China's imperfect rural land market. Wu and Yu (2022)

conducted household surveys in 2019 in Jinzhai, Yicheng and Yujiang, another three pilot counties

of the RHDR reform, and found that it was challenging for households to obtain information from

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 ecological environment in the villages, which are under

centralized control of rural collectives (Jiang and Yin, 2021; Sun et al., 2022; Yan, 2019). In

contrast to the fact that households generally holding a weak position in rural resource allocation

in China, the village collectives, have a lot of advantages in obtaining information and

coordinating resources. This statement can also 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 Impacting 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***	0.247***	0.247***
	(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***	0.553***	0.548***	0.590***	1.993***

	(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.	1247	1247	1247	1247	1247
F	3221.84***	2738.80***	2453.27***	2712.17***	2712.17***
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.

Another important finding about the impact heterogeneity according to the estimation results in Table 6 is that collective-oriented RHDR reform shows a greater impact on the sub-performances of rural industries and rural environments, while household-oriented RHDR reform shows a greater impact on the sub-performances of rural culture, rural governance and rural income. This heterogeneity is consistent with the reform contents and features of the two types as well. As analyzed in the above impacting framework section, collective-oriented RHDR reform has more advantages in developing rural industries on scale operational land and enhancing rural environments by reconstruction, while household-oriented RHDR reform is more conducive to decentralized family economy to increase household income directly, and is more likely to preserve rural traditional culture by redevelopment rather than reconstruction. Moreover, rural governance level also tends to be more fundamentally influenced by the efforts of promoting the decentralized household business. 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

30

520   imperfect land market (Zhou et al., 2020), although there are also multiple challenges in

521   restructuring rural culture and lagging impacts on rural households' income to be faced.

522   **Table 6** Impacting 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)	(0.007)	(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.	1247	1247	1247	1247	1247
F	741.41***	2355.11***	167.50***	602.46***	42.15***
Within-R^2	0.865	0.965	0.738	0.862	0.396

523 *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, rrp_inc* are the
524 abbreviations of rural revitalization performance in rural industries, rural environments, rural culture, rural governance, rural income
525 respectively.

4.5. Robustness checks

527   In order to further examine the stability of the impact and the impact heterogeneity of the

528 RHDR reform on rural revitalization performance, and to control the potential endogeneity

529 problem, we conducted the following tests: (i) change the form of control variables, using the

530 quartile ordered form of the gross domestic product per capita of central cities (*cgdp_ca_4*) to

531 mitigate the possible interference of variable setting on causal effect estimates; (ii) change the

532 measurement method of rural revitalization performance, using the entropy weight method

533 combined with the FCE method to re-evaluate the rural revitalization performance (*rrp2*); (iii)

534 remove the samples in the eastern region, dropping the observations with better economic

535 conditions to control the possible interference of sample heterogeneity on causal effect estimates;

536 (iv) change the estimation methods, using multiple and suitable models including mixed OLS,

31

random effects (RE) and Tobit to further investigate the sensitivity of the key coefficients to model

setting; (v) consider the possible endogenous problems of control variables. The *role_vpc* might be

an endogenous variable. Although it is theoretically not closely related to the RHDR reform types

because the village committee cannot decide the reform types, and thus would not interfere with

the coefficient estimation of the key independent variables, it might affect the estimation of its

own coefficient. We use "$gender\ ratio*Post_{it}$" as the instrument variable(IV) to conduct IV-2SLS

regression. Both the insufficient recognition test and the weak instrumental variable test indicate

the validity of the IV. As can be seen in Table 7, the impact and the impact heterogeneity of the

RHDR reform on rural revitalization performance show a strong stability.

<div style="text-align:center">**Table 7** Estimation results of robustness test and endogeneity analysis</div>

	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	0.247***	0.219***	0.249***	0.257***	0.227***	0.253***	0.153***
	(0.009)	(0.014)	(0.009)	(0.007)	(0.007)	(0.007)	(0.013)
household_o · Post	0.150***	0.181***	0.108***	0.221***	0.157***	0.219***	0.066***
	(0.005)	(0.006)	(0.007)	(0.007)	(0.007)	(0.006)	(0.018)
cgdp_ca		0.008*	0.069***	0.001*	0.009***	0.001*	
		(0.005)	(0.013)	(0.001)	(0.002)	(0.001)	
cgdp_ca_4	0.031***						0.052***
	(0.003)						(0.006)
rhland_ca	0.007*	0.021***	0.008**	-0.000	0.000	-0.000*	-0.011***
	(0.004)	(0.005)	(0.004)	(0.003)	(0.002)	(0.003)	(0.004)
role_vpc	0.016***	0.007**	0.010***	0.026***	0.016***	0.024***	0.113***
	(0.002)	(0.003)	(0.003)	(0.003)	(0.002)	(0.003)	(0.007)
age_r	-0.023***	-0.050***	-0.048***	-0.000**	-0.001***	-0.000	-0.004
	(0.003)	(0.003)	(0.008)	(0.000)	(0.000)	(0.000)	(0.002)
constant	1.815***	3.019***	2.600***	0.393***	0.447***	0.387***	0.194***
	(0.145)	(0.177)	(0.349)	(0.011)	(0.011)	(0.011)	(0.031)
Individual effect	*Yes*	*Yes*	*Yes*	*No*	*Yes*	*No*	*Yes*
Time effect	*Yes*	*Yes*	*Yes*	*No*	*Yes*	*No*	*Yes*
Obs.	1247	1247	881	1247	1247	1247	1247
F	2712.92***	959.09***	1363.19***	659.78***			589.01***
Wald-chi²					28707.87***	4604.49***	

<div style="text-align:center">32</div>

Within-R²	0.967	0.882	0.960		0.959	
Adj-R²				0.760		
LM statistic					56.675***	
K-P Wald F statistic					64.373	

5. Discussions and policy implications

550   The empirical findings in this study based on the survey data of rural households not only

551   provide evidence for the positive impact of RHDR reform on rural revitalization performance, but

552   also inspire discussions on how to further effectively carrying out the reform. As is known that

553   rural homestead plays a pivotal role in the daily life of rural households and the sustainable

554   development of rural areas, it should be cautious in the process of policy diffusion. Therefore,

555   although there is consensus on the necessity of rural homestead system reform, it is actually still

556   not clear for policy makers and under exploration in practice to find feasible paths to effectively

557   conduct the rural homestead reform (Liu, 2019). To some extent, the RHDR reform was launched

558   as a compromise trial between direct transactions and no transactions of rural homestead resources.

559   Some concerns have been raised in the pilot process of the RHDR reform as well. The main

560   concerns can be divided into two aspects (He, 2021). First, whether the impact of the reform on

561   rural development is positive or negative, given the potential risks that rural households might be

562   compelled to be relocated and the possible pressure on local budgets to improve rural

563   infrastructure. Second, whether granting rural households more land rights might instead make

564   them the targets of capital plunder and reduce their benefits, given the weak abilities of households

565   to obtain market information from the imperfect land markets and make rational decisions. Based

566   on the findings in this study, it is credible to clarify that the RHDR reform has generated positive

567   impact on rural revitalization performance on average. In this case, the concerns should be shifted

568   to how to better regulate and manage the implementation of the reform, such as paying more

569   attention to public participation and information disclosure and attracting the investment of social

570   capital, rather than concentrating on the launch of the reform itself.

571   In addition, the role of rural collectives played in using rural homestead resources should be

572   re-examined according to the results of impacting heterogeneity analysis in this study. In general,

573   decentralized rural households and centralized rural collectives can both be effective subjects to

574   reuse rural homestead resources, although they might generate different level of impacts on rural

575   development. The role of rural households has already been highlighted in current land use

576   policies in China because they are the specific users of homestead and their basic rights to use

577   homestead land should be guaranteed. However, the role of rural collectives in using rural

578   homesteads is not yet fully recognized. Rural collective is a typical organizational type of

579   community (Storey, 2009). As the owner, it should not only be the manager of homestead, but also

580   the capable subject to use and transfer homestead on the market. However, this study is not

581   intended to challenge the validity of decentralized rural households' participation and partnership

582   in using homesteads, but to provide empirical evidence for further understanding of the role of the

583   more powerful rural collectives, which has not been paid enough attention to in policy formulation

584   in China. With the development of urban-rural integration, increasingly tourism, manufactures,

585   and recreation have paralleled agriculture as dominant economic drivers in rural areas (Irwin et al.,

586   2010). The growing shift away from what have been referred to as landscapes of production to

587   landscapes of consumption and the apparent commodification of the countryside means we are in

588   an era where rural areas are increasingly endeavoring to reimagine themselves in order to deal

589   with the broader processes of rural change and rural restructuring (Mujumdar, 2002; Storey, 2009).

34

590   This shift could pose a series of challenges to rural economic and social system, stimulating

591   comprehensive rural restructuring (Qu et al., 2021). Under these circumstances, rural collectives

592   who have advantages in integrating with markets, taking risks and negotiating with other interest

593   groups should take the leading role of agglomerating land resources or transferring land use rights

594   to develop scale industries where decentralized rural households might not be so capable to handle

595   with (Osborne et al., 2004).

596   We draw two policy implications from the above analysis. First, top-down policies to

597   enhance the effectiveness of the RHDR reform on rural revitalization are need to be further

598   introduced. Such policies include promoting public participation, public willingness, and

599   information disclosure and the involvement of social capital. Second, more attention should be

600   paid to rural collectives in policy formulation of the RHDR reform, such as carrying out relevant

601   training to enhance the ability of collectives to coordinately using homesteads and other land

602   resources in rural areas. What is more, along with the deepening of rural property rights reform in

603   China, the RHDR reform needs to be coordinated with other related reforms to jointly promote the

604   sustainable development of rural areas, mainly including the "three rights separation" reform of

605   rural homestead, the increasing versus decreasing balance reform of urban-rural construction land,

606   collective operational construction land into market reform and regional-wide land consolidation

607   reform. Deininger (2003) specified that supporting infrastructure, access to credit, technology, and

608   markets are also essential in order to elevate asset returns of rural land resources. Given this,

609   further systematical institutional reform to coupling the factors of labor, land and capital is needed

610   to deal with different problems in the implementation of the rural revitalization strategy in China

611   (Han, 2020). Besides, communal land tenure is prevalent across many developing countries. It

612   usually implements a principle that allows owners to use their land but restricts their right to

613   transfer it (Gottlieb and Grobovšek, 2019). This might hinder the emergence and development of

614   the rural land market and induce rural poverty (Bardhan and Mookherjee, 2010). Transforming

615   and diversifying the rural economy based on rural construction land brings opportunities to village

616   renewal in the developing world (Haggblade et al., 2007). The findings in this study also provide

617   reference for reusing rural homesteads in developing countries where the land holds the key to the

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

6. Conclusions

620   The RHDR reform in China provides paths to fulfil the need for effective reuse of rural

621   homesteads and thus promoting rural revitalization in different aspects. Well-identified empirical

622   evidence on the impact of the reform on rural revitalization is still rare. This study is aimed at

623   synthesizing the understanding of the undergoing rural homestead system reform and providing

624   empirical evidence for identifying the impact of the RHDR reform on rural revitalization

625   performance. On the basis of applying property theory to China's rural homestead situation, a

626   theoretical framework to analyze how RHDR reform impacts rural revitalization is developed and

627   the RHDR reform is classified into two types according to the dominant implementing subjects, i.e.

628   the collective-oriented type and the household-oriented type. An index system for rural

629   revitalization performance evaluation is developed as well. Based on a panel survey data of

630   China's four typical provinces, this paper uses the empirical methods of propensity score matching

631   (PSM) combined with difference-in-difference (DID) model, and two-way fixed effects (Two-way

632   FE) model to explore the impact of RHDR reform on rural revitalization. The baseline empirical

633   results show that the rural revitalization performance of the treatment group with the RHDR

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634   reform is 0.172 higher on average than that of the control group without the reform. Further

635   impact heterogeneity analysis shows that both types of the RHDR reform have stable, significant

636   and positive impacts on total rural revitalization performance compared with the control group,

637   but collective-oriented RHDR reform has a stronger impact than household-oriented RHDR

638   reform on promoting rural revitalization. In addition, impact heterogeneity analysis also indicate

639   that collective-oriented RHDR reform has a greater impact on the sub-performances of rural

640   industries and rural environments, while household-oriented RHDR reform has a greater impact

641   on the sub-performances of rural culture, rural governance and rural income.

642   Rural homestead resources allocation is closely connected to rural development and has

643   generated comprehensive impacts on revitalizing rural areas in China. In this case, top-down

644   policies to strengthen the regulations of the RHDR reform need to be further introduced, and more

645   attention should be paid to rural collectives in policy formulation of the RHDR reform. Therefore,

646   the empirical findings of our study not only underpin the significance to further conduct rural

647   homestead system reform to comprehensively promote revitalization in China, but also shed light

648   on the validity of rural community as an effective organizational means to intensively use land

649   resources in most developing countries. Future studies could include the situation of cross-regional

650   transfer and transactions of RHDR and add more samples to the dataset to further diversify the

651   observations.

Conflict of interest declaration

653   The authors declared no potential conflicts of interest concerning the research, authorship and

654   the publication of this manuscript.

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