Hindawi
Mathematical Problems in Engineering
Volume 2022, Article ID 9143080, 13 pages
https://doi.org/10.1155/2022/9143080

Research Article

Effect of Farmland Transfer on Poverty Reduction under Different Targeted Poverty Alleviation Patterns Based on PSM-DID Model in Karst Area of China

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Received 8 July 2022; Accepted 17 August 2022; Published 19 September 2022

Academic Editor: Wei Liu

Rural farmland transfer is a key factor in the successful implementation of targeted poverty alleviation strategies in China. In this paper, a multidimensional index system with 15 indicators from five dimensions, namely, natural, human, physical, financial, and social capital was established. It analyzed the effect of farmland transfer on poverty alleviation under four typical poverty alleviation models implemented in a karst area in China by using Propensity Score Matching (PSM) and Difference-in-Difference (DID) to analyze 467 rural households questionnaire responses from five representative villages in Guizhou Province. The results show that different models had different effects on poverty reduction. In the model of "three changes" + relocation for poverty alleviation + rural tourism + poor households, farmland transfer was the most effective in poverty alleviation, as attested by its average treatment effect on the treated (ATT) value of 0.44. Rural households' nonfarm income increased significantly to develop rural tourism after relocation from inhospitable areas. In the model of "farmland lease/shareholding" +cooperative + enterprise + poor households, farmland transfer had a moderate effect on poverty alleviation, with an ATT value of 0.06. Its effect on the total income of rural households was the lowest among the four models. This study's results can provide a theoretical reference for solidifying the benefits of poverty alleviation and rural revitalization strategies in karst areas.

1. Introduction

Farmland transfer is one of the main contents of rural land system reform and the core of rural development and the steady promotion of agriculture, rural areas, and farmers [1–3], essentially becoming one of the keys to the success of targeted poverty alleviation in rural areas of China [4–6]. The Third Plenary Session of the 18th Central Committee of the Communist Party of China first proposed to entitle farmer households to occupy use benefits and transfer the right of contracted land, and in November 2014, the General Office of the Central Committee of the Communist Party of China and the General Office of the State Council published the "Opinions on guiding the orderly transfer of rural land management rights to develop an appropriate scale of agricultural operations," which clearly defined the "three rights division" (i.e., division of ownership rights, contracting rights, and management rights) to rural land and provided guidance for the orderly transfer of land management rights [7]. In these policy contexts, whether the farmland transfer can be driven the farmer households to increase their income in a diversified way? Whether it can alleviate the poverty of farmer households.

Farmland transfer plays a more important role in poverty alleviation and development [8, 9]. Some studies have been conducted on the poverty reduction effect of farmland transfer from different perspectives. The transfer of farmland can significantly increase the family income because it will release surplus labor [10, 11]. A healthy and stable land rental market has a positive impact on the

increase of farmers' income [12, 13]. It also helps to reduce the poverty vulnerability of farmer households, and with the increase of the transfer area, the reduction effect is better [14]. However, some thought farmland transfer may lead to the polarization of land management scale; that is, the landless farmer households and a large grain of farmer households coexist, damaging the interests of small-scale farmer households and increasing the gap between the rich and the poor [15, 16].

An active response to the newly introduced national land policies in various locations throughout China resulted in the development of different targeted poverty alleviation models (e.g., "three changes" + farmland transfer + company + poor farmer households) based on farmland transfer [6]. Especially in the karst area of Guizhou Province, perfecting rural land property rights and encouraging farmland transfer are more effective ways to get rid of poverty [5, 17]. Studies have proved that large-scale farmland transfer can promote agricultural efficiency and increase farmer households' income [18–20]. However, the natural conditions, resource endowment, and economic development of different regions will affect farmland transfer and its effect [21, 22]. The difference in land quality [22, 23], geographical location [11], transaction cost [24], and farmer households' behavior [25] have an impact on the poverty reduction effect of farmland transfer.

In the karst area, a fragile eco-environment, high degree of land fragmentation, decentralized production and management, and a single livelihood model of farmer households directly restrict the local farmland transfer [26]. The excessive restriction and intervention of the local system on farmland property rights in karst mountainous areas make farmers control their enthusiasm in the capital, labor input, and farmland transfer [27, 28]. Farmer households' willingness and behavior also have a fundamental impact on the scale, speed, mechanism, and mode selection of land-transfer-in karst areas. Therefore, in recent years, Chinese policies have had a strong guiding effect on farmer households' land use behavior in rocky areas, especially targeted poverty alleviation policy has a very obvious effect on effective rural land transfer [29–31].

There are regional differences in the effectiveness of farmland transfer under targeted poverty alleviation strategies because of the impact of the natural and geographical environment, the abundance of resources, the local economic and social conditions, and other factors unique to each area [32, 33]. It is worthy of attention how to choose a suitable targeted poverty alleviation model to better guide farmer households' farmland transfer and how to reform the system of rural land transfer in coordination with the existing policies of benefiting farmer households. Therefore, this study examines the effect of farmland transfer under different models of targeted poverty alleviation in karst areas based on a comprehensive consideration of the unique background of five villages in Guizhou Province.

2. Research Data and Methods

2.1. Study Area. Guizhou Province is located in Southwest China, the transition area between the Eastern Yunnan Plateau and the Western Hunan Hilly in the east of Yunnan-Guizhou Plateau, with an average altitude of 1104m. It has a subtropical humid monsoon climate, with a land area of 176128 km^2, accounting for about 1.8% of China's land area, karst landform73%, plateau mountains 87%, hills 10%, and basins 3%. The total population will be 38,562,148 in 2020, and the urbanization rate will be 49.02%. The number of poor rural people was 9.23 million in Guizhou Province in 2013, and the incidence of poverty was 26.8%, which was about 3.7 times the incidence of rural poverty in China. The highest poverty rate was 37.7%, and the lowest was 0.7% in counties [33]. By the end of 2020, all 66 poverty-stricken counties in the province, 9.23 million people have been lifted out of poverty, 1.92 million people have moved out of the mountains and moved to other places for poverty alleviation and resettlement, 1.8327 million people have been included in the social assistance, and "no missing a poverty person or family" has been fully implemented to achieve the goal.

The cases selection is mainly based on the following two factors: ① The villages are mainly agricultural production with similar population density, and all of them boost poverty alleviation projects through land circulation, which has a certain demonstration effect in the local area; ② Each village is 5–10 km^2 away from the town center, the karst mountain area has obvious landform, similar resources, and traffic conditions, and the poverty characteristics of villages are representative of the region. The study area was selected and consisted of five typical villages in Guizhou Province in China: Machang Village in Guiyang City, Haiping Village in Liupanshui City, Luzhi Village, and Tangyue Village in Anshun City, Diba Village in Qiandongnan Prefecture (Figure 1).

2.2. Data Collection. The data were collected through questionnaires and interviews to investigate five villages in Guizhou from July to September of 2020 in order to analyze better the difference in poverty reduction effect of farmland transfer under different targeted poverty alleviation models. The questionnaires were refined following a pilot survey. Multistage sampling was adopted to reduce variations and improve sampling efficiency [35, 36]. Study sites selection considered the typicality, spatial distribution, and land quality of various sites and selected villages in both flatland and mountainous areas. Systematic random sampling was used for sample selection to avoid systematic errors caused by subjective factors. A total of 500 questionnaires and conducted in-depth interviews, including 18 interviews with village cadres. Excluding duplicate and missing samples, 467 valid samples (an efficiency rate of 93.4%) collected information on farmland transfer, natural capital, human capital, physical capital, financial capital, and social capital of farmer household.

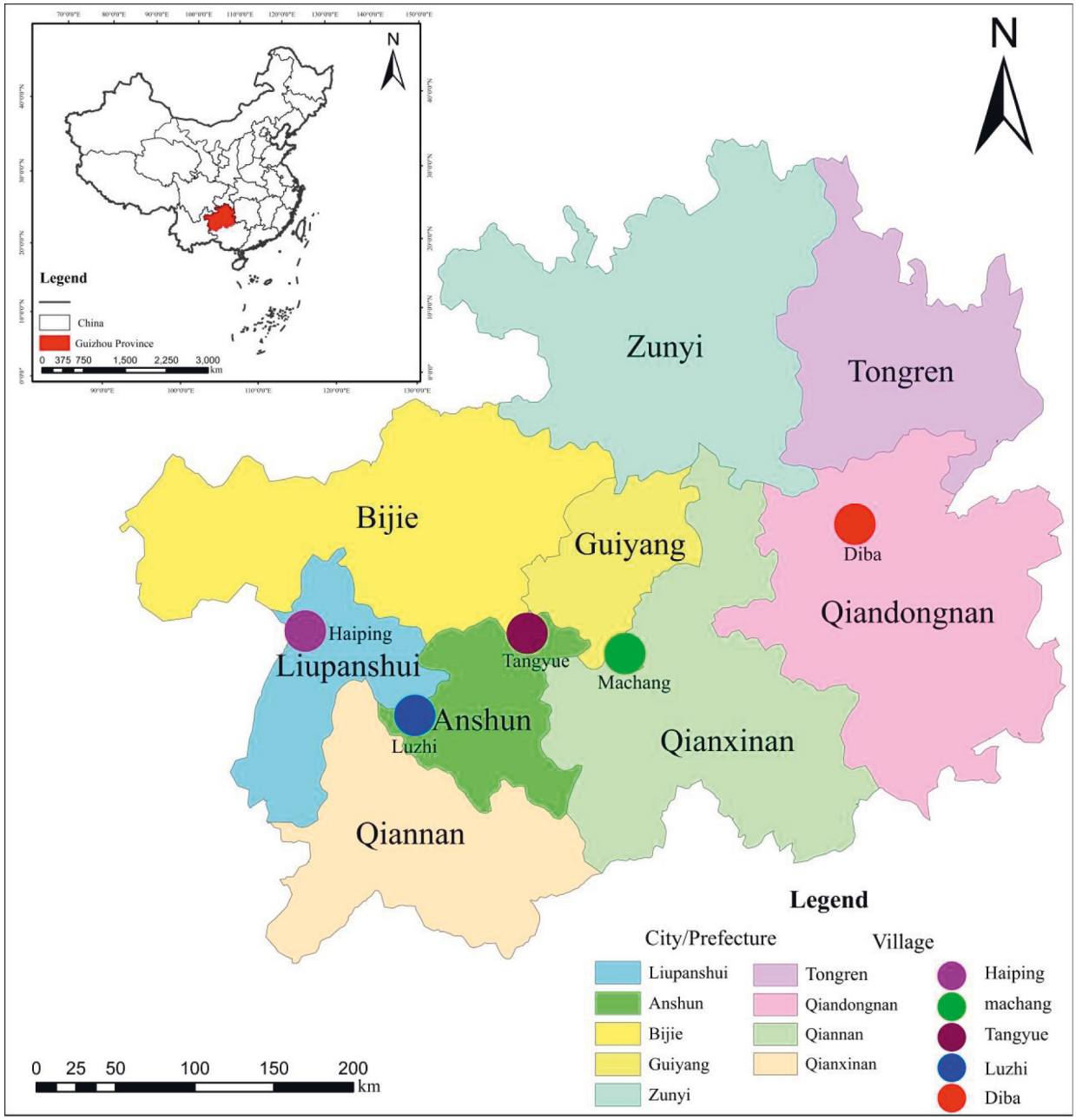

Figure 1: The study areas.

The statistical analysis of the selected samples shows that the proportion of men and women who were interviewed in this study was relatively balanced: men accounted for 54.6% of the respondents, and women accounted for 45.4%, which is quite representative of the studied population (Table 1). Among effective samples, interviews with village cadres accounted for 3.9% of all respondents. The proportion of farmer households with incomes below RMB 10,000 and above RMB 70,000 was relatively small, accounting for 12.6% and 12.2% of all respondents, respectively; most farmer households' incomes were distributed in the moderate ranges of RMB 10,000–25,000 and RMB 25,000–50,000. The survey also found that the education level of farmer households was low, with 60.4% having only elementary education or below; there were 253 respondents who had rented out (transfer-out) their land, 57 respondents who had rented land from others (transfer-in) and 167 who had not participated in farmland transfer. The proportion of respondents participating in farmland transfer was relatively high, accounting for 66.4% of all respondents.

The statistical data in Table 2 shows that the minimum and maximum per-capita area of arable land is 0.2 mu and 4 mu, respectively; the maximum farmland transfer was done by a group leader in one of the surveyed villages. The leader contracted out 80 mu of land for chili pepper cultivation; the average farmland transfer was 4.19 mu. In 2014 and 2019, the minimum per-capita net income was RMB 2300 and RMB 4050, respectively, the maximum per-capita net income was

Table 1: Questionnaire statistics ($N = 467$).

Item	Variable	N	Proportion (%)
Gender	Male	255	54.6
	Female	212	45.4
Respondents	Nonregistered card Farmer household Holders	381	81.6
	Poor farmer household cardholders	86	18.4
Income level (RMB)	10,000 or less	59	12.6
	10,000–24,000	144	30.9
	25,000–49,000	143	30.6
	50,000–69,000	64	13.7
	70,000 or above	57	12.2
Education level	Elementary or lower	282	60.4
	Middle school	134	28.6
	High school and above	51	11.0
Farmland transfer	Transfer-out	253	81.7
	Transfer-in	57	18.3

Table 2: Sample statistical data.

Variable	Minimum value	Maximum value	Average value	Standard deviation
Per-capita arable land area (mu)	0.200	4.000	1.172	0.489
Arable land ratio	0.250	0.802	0.480	0.000
Transferred land area (mu)	0.000	80.000	4.190	5.280
Family members in the labor force	1.000	6.000	3.250	1.370
Average labor force age	1.000	4.000	2.663	0.706
Family savings (RMB)	0.500	6.000	0.892	1.425
2014 per-capita net income (RMB)	2,300.000	8,300.000	6,918.053	6,994.852
2019 per-capita net income	4,050.000	10,000.000	9,122.539	7,475.376
Agricultural income to total income ratio in 2014 (RMB)	0.300	1.000	0.464	0.335
Agricultural income to total income ratio in 2019 (RMB)	0.000	0.250	0.369	2.336
Frequency of participation in professional cooperatives (times)	0.000	2.000	0.148	0.403
Nonagricultural work time (Hour)	0.000	9.000	5.682	2.581

RMB 8,300 and RMB 10,000, respectively, and the average income was RMB 6918 and RMB 9122, respectively.

2.3. The PSM-DID Model. Propensity score matching (PSM) is a statistical analysis method used to process observational research data in a way that reduces the bias due to confounding variables between the experimental and control groups [34]. The DID model was used to evaluate the net effect of poverty alleviation policy implementation. There are significant differences between farmer households in the treatment group with farmland transfer and those in the control group without farmland transfer. The assessment results will be affected by selection bias if the Difference-in-Differences (DID) model is applied directly to evaluate the effect of the farmland transfer policy. The farmland transfer effect in the targeted poverty alleviation model is compared against a set of evaluation variables to eliminate the interference factors and hidden bias between different groups. The model contains some unmeasurable variables at different times. Therefore, the PSM method is simultaneously combined with DID model (PSM-DID).

Five dimensions were selected, namely natural capital, human capital, physical capital, financial capital, and social capital, with per-capita net income as the explained variable and farmland transfer as the predictor variable. DID model was used to perform multiple linear regression (MLR) on the selected indicators and calculated the propensity scores for three types of rural residents under different modes: farmland transfer, land in-flow, and land out-flow. The specific steps are as follows.

Estimate the propensity scores: The conditional probability of a farmer household participating in farmland transfer is estimated by the following:

$$PS_m = \Pr[L_m = \mid X_m] = E[L_m = 0 \mid X_m]. \quad (1)$$

PS_m is the propensity score, which represents the probability of the sample receiving a treatment given under a set of conditions X. When $L_m = 1$, which indicates participation in farmland transfer, then the propensity score is $P(X) = Pr(Lm \mid X)$. When the PSM assumptions are met, the average annual income of the experimental group E[experimental group $[Lm = 1, P(X)]$ and the average annual income of the control group E[control group $[L_m = 0, P(X)]$ can be compared in (1).

A multiple linear regression model was established in equation (2). The model is as follows:

$$y_{it} = \beta_0 + \beta_1 \mathrm{Tour}_{it} + \beta_2 \mathrm{Tour}_{it} + \beta_3 \mathrm{Tour}_{it} \mathrm{year}_{it} + \alpha x_{it} + \varepsilon_{it}, \quad (2)$$

where y_{it} is the multidimensional poverty index at time t; a dummy variable $\mathrm{Tour}_{it} = \{(0, 1)\}$ represents whether farmer household i participates in farmland transfer at time t

(yes = 1, no = 0); Year_{it} is a dummy variable for time, using the time of the targeted poverty alleviation implementation as a reference (0 if 2014 and 1 if 2019); β_0, β_1, β_2, β_3, and α are parameters; χ_{it} is a vector set of other unobservable variables that not only affect whether a farmer household enjoys the benefits of the targeted poverty alleviation policy but also affect the effectiveness of the policy's implementation; for farmer households in the control group and the treatment group, the two time period parameters are β_1 and $\beta_2+\beta_3$, respectively, where β_3 is the estimated value of the double difference, which is the net effect of farmland transfer-in the targeted poverty alleviation model under consideration on the multidimensional poverty alleviation of farmer households, and ε_{it} is the residual term.

The average treatment effect on the treated (ATT): the PSM results are used to calculate the difference in the effect of farmer households' poverty alleviation (expressed by demand intensity); that is, for the experimental and control groups of farmer households, so as to obtain the effect of farmland transfer (farmland transfer-in and farmland transfer-out) on farmer households' targeted poverty alleviation in different models as follows:

$$\text{ATT} = \frac{1}{n}\sum_{i} \in R_1 \cap \cup_p \left(y_i^1 - y_{i,t_0}^1\right). \tag{3}$$

The average treatment effect (ATE): the average treatment effect of the matching control group is calculated. The above PSM methods are used to calculate the ATE of the control group as follows:

$$\text{ATE} = \frac{1}{n}\sum_{j} \in R_0 \cap \cup_p \left(y_{j,t_1}^0 - y_{j,\,t_0}^0\right), \tag{4}$$

where t_0 and t_1, respectively, represent the years before and after the implementation of targeted poverty alleviation policy; y_i^1 and y_{i,t_0}^1 are outcome variables of a sample farmer household i in an area with targeted poverty alleviation at times t_0 and t_1, respectively; y_{j,t_1}^0 and y_{i,t_0}^1 are outcome variables of a sample farmer household j in an area without farm transfer at times t_0 and t_1, respectively.

The PSM-DID results (ATT) are as follows:

$$\widehat{ATT} = \frac{1}{N^T}\sum_{j} \varepsilon R_1\left(y_{i,t_1}^1 - y_{i,t_0}^0\right) - \sum_{j} \varepsilon R_0 \cap \cup_p W(i,j)\left(y_{j,t_1}^0 - y_{j,t_0}^0\right),$$
$$W(i,j) = \frac{F\left[\left(P_j - P_i\right)/D\right]}{\sum_m \varepsilon R_0 F\left[\left(P_m - P_i\right)/D\right]}. \tag{5}$$

w (i, j) is the weight vector; F (·) is the kernel density function; P_i is the propensity score of sample i in the control group; P_j is the propensity score of sample j in the treatment group; D is a bandwidth parameter.

Assess the significance of the poverty alleviation effect: using the average consumption level as a measure of poverty in rural areas and based on the field investigation results of rural conditions, we derived a set of significance assessment intervals (Table 3) to illustrate the effect of farmland transfer on farmer households' income under different targeted poverty alleviation models.

2.4. Independent Variables. Based on the principles of the sustainable livelihood framework, a multidimensional poverty alleviation index system with the following categories of variables was established: natural capital (*N*), human capital (*H*), physical capital (*P*), financial capital (*F*), and social capital (*S*). The specific meaning and values of each variable as they relate to the studied areas and farmland transfer conditions were assigned based on the field investigation results and were shown in Table 4.

3. Results

3.1. Farmland Transfer-in Targeted Poverty Alleviation Models. Driven by the targeted poverty alleviation policy, Guizhou has formed various models of farmland transfer, among which the following four models are typical.

3.1.1. Farmland Shareholding + Enterprise + Village Collective/Cooperative + Alluvial Plain Farming + Poor Farmer Household (Model 1). Model 1 is the primary model of farmland transfer-in Machang Village (Figure 2). In this model, farmland transfer allows for the expansion of the scale of operations to achieve industrial scale, thereby aiding targeted poverty alleviation. In 2020, about 250 mu of Machang's land was subject to farmland transfer. Under the government's guidance, various companies and cooperatives in the village have contracted with the local farmer households to pay RMB 1500/year/leased mu. After the farmland transfer, farmer households have been able to work as seasonal labor to obtain additional income, and this further promotes poverty alleviation.

The farmland transfer-in Machang mainly involved local enterprises. The contract period ranged from five to 15 years. The implementation of this model has allowed for the consolidation of the entire village's idle land resources into large-scale farms for cultivating green onions, ginger, and other industrial crops. After the implementation of farmland transfer policies, the economic conditions in the village improved. The village has become a base for blueberry farming and a sight-seeing destination for mountain tea farm tours. In addition, a rural-ecosystem sight-seeing garden and a 500-mu alluvial plain green-onion farm have been established in the village. These developments have led to the opening of the "Yunxia Nonggeng," an agritourism farm and guesthouse, where the superiority of the locally grown green onions, tea, and rice is further promoted. The current per-capita annual income of the village is about RMB 18,000 yuan. Local farmer households have been encouraged to participate in the construction of a 3000-mu alluvial plain farm planned for 2020 so that they can obtain income from nonagricultural labor.

3.1.2. Farmland Shareholding + Village Party Organization + Enterprise + Poor Farmer Household (Model 2). Model 2 is a model in Tangyue Village (Figure 3), in which the village party organization effectively took the lead in a large-scale farmland transfer while actively supporting the development of modern agriculture and promoting the

Table 3: Significance level.

Significance level	Farmland transfer-in	Farmland transfer-out	Farmland transfer
Highly significant	>0.010	>0.030	>0.040
Quite significant	0.006 ~ 0.010	0.021 ~ 0.030	0.026 ~ 0.040
Moderately significant	0.003 ~ 0.005	0.011 ~ 0.020	0.016 ~ 0.025
Weakly significant	0 ~ 0.002	0.006 ~ 0.010	0.006 ~ 0.015
Not significant	<0	<0.005	<0.005

Table 4: Evaluation index system.

	Variable	Variable meaning
Natural capital (N)	Per-capita arable land area (N_1)	Total arable land area of interviewed households/family size
	Proportion of arable land (N_2)	Arable land area/total land area
	Transportation conditions (N_3)	Local transportation convenience of interviewed households, 4 = very good, 3 = good, 2 = fair, 1 = poor
Human capital (H)	Number of family members in labor force (H_1)	Total number of household members in labor force/person
	Average age of labor force (H_2)	The actual average age/years of labor force of the interviewed family
	Average education level of labor force (H_3)	Average length-of-education/years of labor force of the interviewed family
	Registered poor household card holder (H_4)	0 = No, 1 = Yes
Physical capital (P)	Family Savings (P_1)	Interviewed household's amount of savings/RMB 10,000
	Average annual income per resident (P_2)	Total annual income of interviewed family members/RMB 10,000
Financial capital (F)	Agricultural equipment value (F_1)	Total value of machinery used by interviewed households for agricultural production/RMB 10,000
	Ratio of agricultural income to total income (F_2)	The ratio of households' agricultural income to total income
Social capital (S)	Participation in professional cooperatives (S_1)	Participation frequency of interviewed family in professional cooperatives/times
	Participation in agricultural training (S_2)	Participation frequency of interviewed family in agricultural training/times
	Nonagricultural profitable working hours (S_3)	The total time of nonagricultural profitable employment carried out by the interviewed household/months

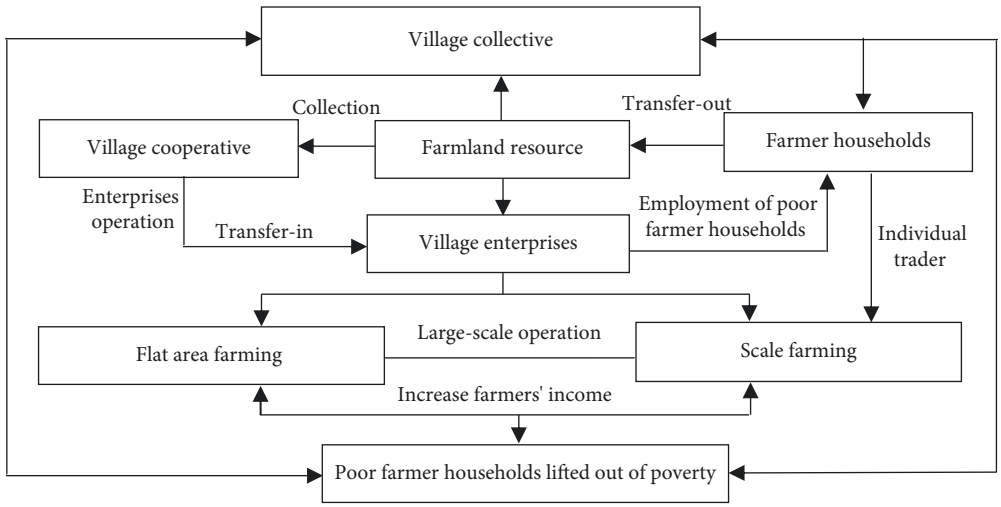

Figure 2: Farmland shareholding + enterprise + village collective/cooperative + alluvial plain farming + poor farmer household.

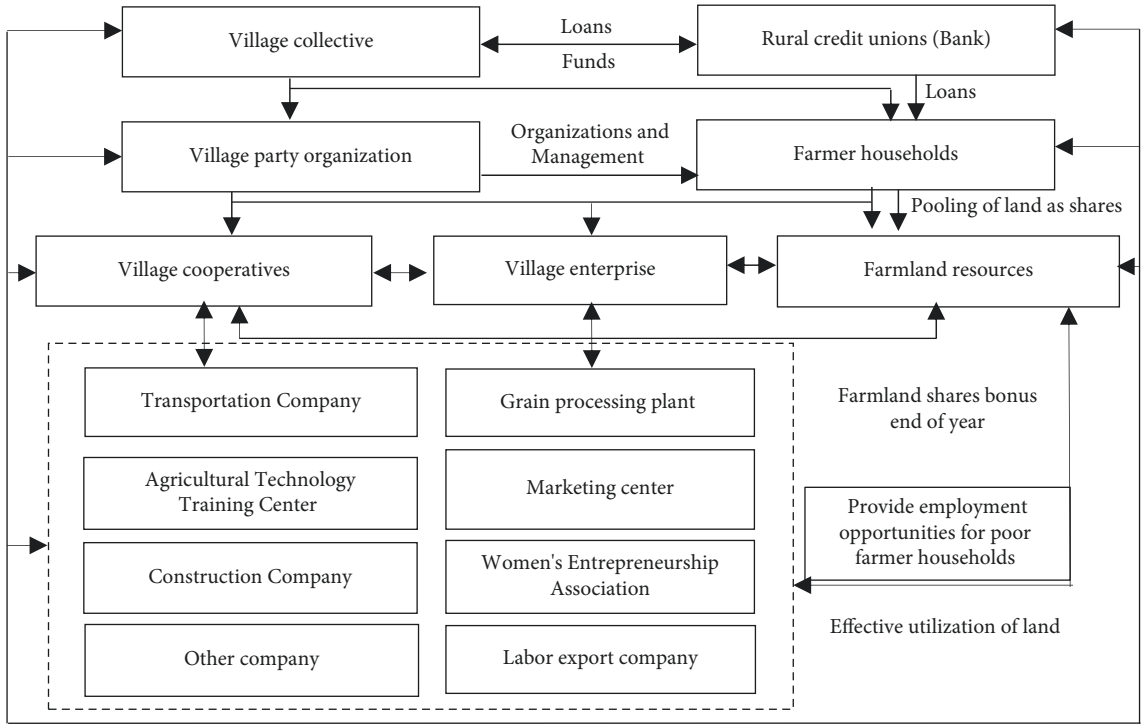

Figure 3: Farmland shareholding + village Party organization + enterprises + cooperative + poor farmer households.

village's self-governance reform. In this model, farmer households (including poor residents) receive dividends from the land they have contracted to the Golden Land Cooperative. In turn, the cooperative works with different enterprises to develop modern agriculture and build various grain processing plants, creating a rural economic powerhouse and spurring the development of other industries in the village. It has also established seven organizations, including a marketing center and an agricultural training center. The successful implementation of this model has helped to diversify farmer households' livelihood sources, improve the villagers' living standards, promote rural agriculture, and substantially reduce the number of migrant workers, thereby reducing the problem of "rural hollowing" and allowing poor residents to lift themselves out of poverty.

Based on statistical data, the total area of Tangyue Village is 4881 mu, and almost all of these have been invested in cooperative shares: 921 farmer households have become shareholders with a collective 5230 shares between them. The dividends obtained from land shareholding are split between the cooperative, the village collective, and the villagers using a 3 : 3:4 ratio, respectively. In 2016, the cooperative used three small-scale water conservancy projects and more than 400 mu of forest land to obtain mortgage loans from rural credit unions; the number of dividends received by the village collective and cooperative was RMB 1,214,700 yuan, and the members' dividends amounted to RMB 896,000 yuan, of which the highest amount was RMB 8,960, and the lowest was RMB 1840. By the end of 2019, the village's collective economy had exceeded RMB 6.38 million, and the per-capita disposable income had surpassed RMB 20,000.

3.1.3. "Three Changes" + Relocation For Poverty Alleviation + Rural Tourism + Poor Farmer Households (Model 3). In model 3, farmer households receive guidance on how to use their land resources for investment to transform their village into a unique tourist destination featuring the cultural heritage of the Yi ethnic group through the "three changes" reforms (i.e., resources changes into assets, capital changes into share capital, farmer household change into shareholder) in Haiping Village (Figure 4). The model also includes a relocation program for poverty-stricken individuals to facilitate their employment, offering guidance on how to start a business and ensuring a continuous sustainable source of income for rural households. The government grants subsidies to poor households as shares. The Yeyuhai Management Committee has used joint share construction to build a mountain tourism resort; the dividend income is divided between the resort management committee and the village collective based on a 7 : 3 ratio, with 50% of the 30% village collective dividend income being distributed to farmer households. Also, to ensure that poor households maintain basic income, several types of employment were provided, effectively integrating tourism development with poverty alleviation and creating a positive environment for both tourism and living. This distinctive model has become known as the Haiping model.

3.1.4. Farmland Shareholding + Cooperatives + Poor Farmer Household (Model 4). Luzhi Village has used model 4 to lease out consolidated land to local enterprises and cooperatives for agricultural industry projects, including Guanling Cattle Farms, Rosa roxburghii (Chestnut rose), or pearl

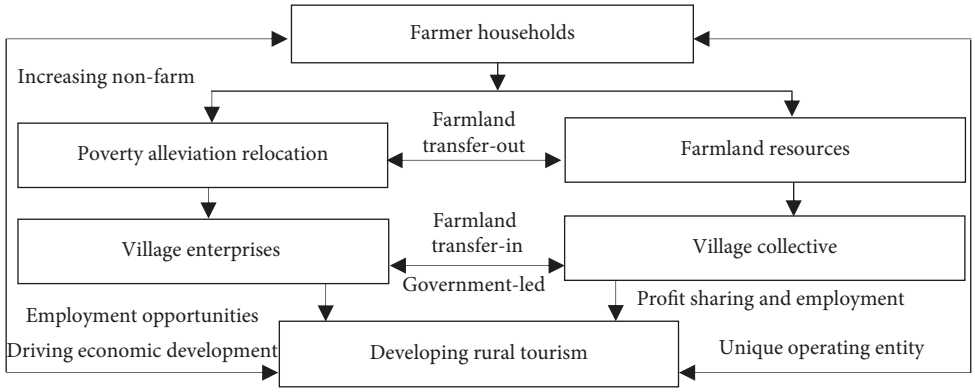

Figure 4: "Three changes" + relocation for poverty alleviation + rural tourism + poor farmer household.

barley plantations (Figure 5). These projects have involved 110 poor farmer households and 50 nonpoor farmer households. The village has effectively solved the problems of idle farmland and wasted land resources while providing farmer households with employment opportunities and reducing the number of migrant workers. Consequently, farmer households have a larger share of profits. In the barley cultivation project, barley seed was provided by the government and was planted on 60 mu (1 mu = 0.667 ha) of land provided by the village cooperative.

Diba Village used the same model to establish farming cooperatives for cultivating lucid Ganoderma, chili pepper, ginger, and tea. Poor farmer households can lease out their land for RMB 500 per mu per year to enter the cooperative and receive dividends of RMB 100~1500 per household each year, based on the invested land area. The entire village has transferred more than 1200 mu of land, of which 100 mu of forest land was used for Lizhi mushroom cultivation, 310 mu of forest land for chili pepper farming, 200 mu for tea, and 600 mu for ginger. Farmer households join cooperatives by leasing out their land for large-scale cultivation of ginger, chili peppers, lucid Ganoderma, and other cash crops. The cooperative buys crops from poor farmer households at market prices and sells them by order through different companies to outside markets. In the first half of 2020, tea sales reached RMB 130,000 and the sales of Lizhi mushrooms exceeded RMB 53,000.

3.2. The Net Effect of Farmland Transfer on Farmer Household Households' Income

3.2.1. The Influence Of Farmland Transfer On Farmer Household's Income. The net effect of farmland transfer on farmer household households' income is remarkable. Table 5 shows that the farmland transfer and nonfarm profitable labor time have a significant positive effect on the per-capita net income (given in logarithm form). Similarly, head of farmer household education, per-capita arable land area, number of family members in the labor force, household savings, and average annual household income have a significant positive effect on the per-capita net income. On the other hand, whether the resident is a registered poor cardholder and the ratio of agricultural income to total income has a significant negative effect on the per-capita net income. However, transportation conditions, the value of agricultural machinery, the superiority of social relations, the average age of the labor force, the proportion of arable land, the frequency of participation in professional cooperatives, and the frequency of participation in agricultural training had no significant effect on the per-capita net income.

3.2.2. The Influence Of Farmland Transfer On Farmers' Livelihood Capital. The indicators that affect farmer households' income are used as matching variables to analyze the poverty reduction effect of farmland transfer; the nontransfer households are used as the control group, and the farmland transfer households as the experimental groups. The ATT difference before matching is 2080.9, and the ATT difference after matching is 2085.8 s (Table 6). The poverty reduction effects of the five livelihood capitals are different. Farmland transfer has a significant effect on poverty reduction of physical capital, human capital, and social capital, 0.22,0.37, and 5.732, respectively. The effect of farmland transfer on natural and financial capital is not significant.

3.3. The Difference between Farmland Transfer-In and Transfer-Out.

The effect of farmland transfer is obvious (Table 7). The average income for farmland transfer residents (experimental group) and nontransfer residents was RMB 9993.381 and RMB 9934.427, respectively, with a standard deviation of 0.07% < 20% after matching, indicating a good match. The difference in the average treatment effect (ATT) between the two groups is 4.954, and the income level of land-transfer farmer households exceeds that of nontransfer farmer households by 88.568.

When the transfer-out farmer household is taken as the experimental group, and the nontransfer farmer household is taken as the control group, before matching, the average income of the experimental and the control group is 12100.600 and 9934.427, respectively, a difference of 2166.168; and after matching, the average income of the

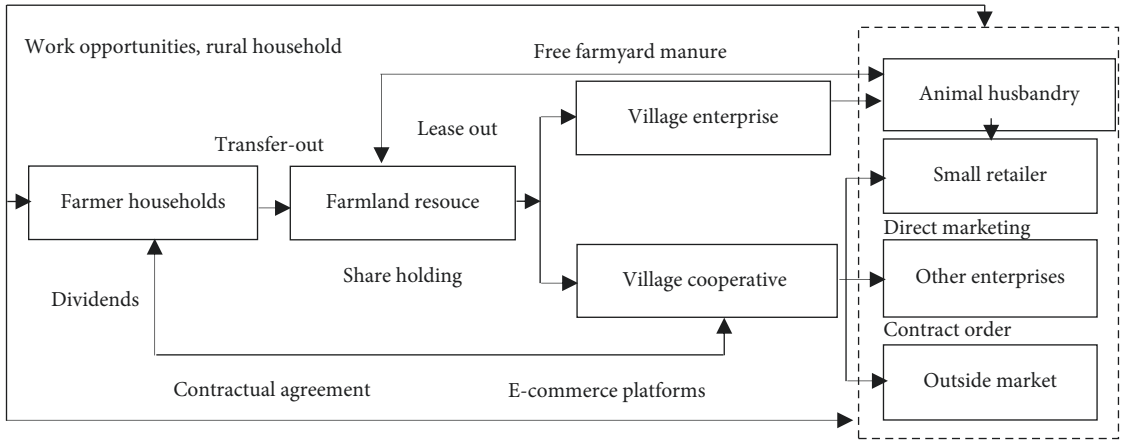

Figure 5: Farmland shareholding + cooperatives + enterprises + poor farmer households.

Table 5: The net effect of farmland transfer on farmer household households' income.

Variables	Unstandardized Coefficients		Standardized Coefficients	t	p	VIF
	B	SE	B			
	8.836	0.195	—	45.201	0.001	—
T	0.126	0.048	0.088	2.608	0.01**	1.198
N1	0.089	0.041	0.005	0.129	0.01**	1.398
N2	0.005	0.041	0.005	0.129	0.865	1.322
N3	−0.043	0.034	−0.039	−1.251	0.212	1.048
H1	0.305	0.025	−0.442	−12.23	0.001***	1.376
H2	0.03	0.03	0.035	1.006	0.316	1.274
H3	0.026	0.012	0.076	2.211	0.028**	1.24
H4	−0.028	0.013	0.046	1.201	−0.023**	1.524
P1	0.028	0.014	−0.07	−2.008	0.046*	1.27
P2	0.000	0.000	0.915	23.17	0.001***	1.644
F1	0.029	0.028	−0.342	0.782	0.321	1.052
F2	−0.027	0.013	−0.071	−2.178	0.03**	1.137
S1	0.072	0.051	0.044	1.419	0.157	1.027
S2	−0.01	0.048	−0.007	−0.218	0.828	1.023
S3	0.086	0.023	0.007	0.312	0.003***	1.257

*Note.****, **, * indicate significance levels under 0.01, 0.05, and 0.1, respectively.

Table 6: The influence of farmland transfer on farmers' livelihood capital.

Status	Experimental group	Control group	ATT	N	H			P		F	S
				N1	*H1*	*H3*	*H4*	*P1*	*P2*	*F2*	*S3*
Before matching	12020.2	9934.4	2080.9	0.4	−0.2	0.02	0.18	0.05	2611.4	−0.8	6.58
After matching	12020.2	9939.3	2085.8	0.03	0.2	0.35	−0.2	0.22	1939.9	0.07	5.73

experimental and the control group is 10129.350 and 10069.021, with the ATT value of 60.325, which shows that significant changes occurred after matching. After farmland transfer-in, farmer households' income increased to a certain extent, but the magnitude of the increase was not large. When the transfer-out farmer households are taken as the experimental group and the nontransfer farmer households as the control group, the ATT value after matching exceeds 20% with a significance level of 5%, indicating a good match and a significant increase in income after matching.

3.4. The Effect of Farmland Transfer under Various Targeted Poverty Reduction Models. The modes of different targeted poverty alleviation have different poverty reduction effects of land transfer. Model 3 ("three changes" + relocation for poverty alleviation + rural tourism + poor household) has the highest effect on poverty reduction, ATT of farmland transfer effect, farmland transfer-out effect, and farmland transfer-in effect is 0.44, 0.032, and 0.012, respectively. ATT of farmland transfer-out effect in model 1 (Land lease/shareholding + enterprise + village collective/cooperative + alluvial plain agriculture +

Table 7: Differences in poverty reduction effect of farmland transfer-in and transfer-out.

Samples	Status	Experimental group	Control group	Standard deviation (%)	ATT	t-after	*p*-value
Entire sample group	Before matching	12020.3	9934.427	29.63	2085.869	2.035	0.044
	After matching	9939.381	9934.427	0.07	4.954	0.004	0.997
Transfer-in farmer household	Before matching	12100.6	9934.427	30.71	2166.168	2.086	0.039
	After matching	10129.3	10069.021	0.90	60.325	0.052	0.959
Transfer-out farmer household	Before matching	11131.28	9934.430	17.23	1196.85	0.606	0.551
	After matching	11131.28	9444.411	26.84	1686.866	0.710	0.484

Table 8: Differences in the effect of farmland transfer under different targeted poverty alleviation models.

Model	All samples			Transfer-out			Transfer-in		
	Experimental group	Control group	ATT	Experimental group	Control group	ATT	Experimental group	Control group	ATT
Model 1	8.476	8.466	0.010	8.483	8.466	0.007	8.470	8.466	0.003
Model 2	8.490	8.471	0.019	8.482	8.471	0.011	8.478	8.471	0.007
Model 3	7.979	7.935	0.044	7.967	7.935	0.032	7.947	7.935	0.012
Model 4	8.289	8.283	0.006	8.302	8.283	0.019	8.270	8.283	−0.013

farmer household/poor household) has the lowest effect on poverty reduction with 0.007. ATT of farmland transfer-in effect in model 4 (land lease/shareholding + cooperative + enterprise + poor household) is the lowest of all (Table 8).

3.5. The Effect of Poverty Reduction in Different Regions. Based on the comprehensive analysis of the effect of farmland transfer on poverty alleviation in five different dimensions of capital, we were able to examine the regional differences in poverty alleviation strategies and reveal the spatial distribution of the different poverty alleviation models selected in this study (Figure 6). In terms of the effect of different poverty alleviation models on different types of capital, based on their effect on natural capital, the models can be arranged as Luzhi > Haiping > Tangyue > Diba > Machang; in terms of the effect on human capital, the Machang model is the best and Diba model is the worst; in terms of the effect on physical capital, the difference between all five villages was not significant; in terms of the effect on financial capital, Luzhi was the worst and Haiping was the best; and in terms of the effect on social capital, Machang was the worst, and the difference between the remaining villages was not significant.

4. Discussion

The effect of different types of capital factors in farmland transfer has different effects on farmer households' income. The ATT of the influence of farmland transfer on farmers' livelihood capital is different before matching and after matching (2080.9 and 2085.8). Farmland transfer can help farmer households increase their income, provided there is no interference from other factors. The poverty reduction effect in terms of natural and financial capital factors is not significant. In karst mountain regions, the soil quality is poor, the degree of land fragmentation is high, and large-scale mechanized farming is difficult. Therefore, farmland transfer is mainly distributed in a small areas. In terms of human capital factors, the number of family members in the labor force and their education level significantly affect farmer households' income. The overall economic situation and the average annual income of farmer households increase in terms of physical capital factors, the poverty reduction effect is significant, and in terms of social dimension factors, the effect of farmland transfer on poverty reduction is significant due to the increase of nonagricultural profitable work time.

Compared with farmland nontransfer, the poverty reduction effect of farmland transfer is better, and the effect of transfer-out is more significant than that of transfer-in. On the one hand, Farmland transfer-out allows for a reasonable allocation of idle, inefficiently utilized, and wasted land so as to maximize the effectiveness of land resources, which is conducive to improving farmer households' income. Collective farming after farmland transfer has similar benefits to large-scale production because it allows for the optimized allocation of resources and improved production effectiveness, thereby increasing farmer households' income. On the other hand, the effect of transfer-in on poverty reduction is weak because transfer-in farmland requires adequate human resources, and with the limited labor force and low education level of farmer households [35]. It is difficult to form a large-scale agricultural industry, so poor farmer households' farmland allows them to lift themselves from poverty by transfer-out their farmland to agricultural cooperatives, companies, and village collectives. However,

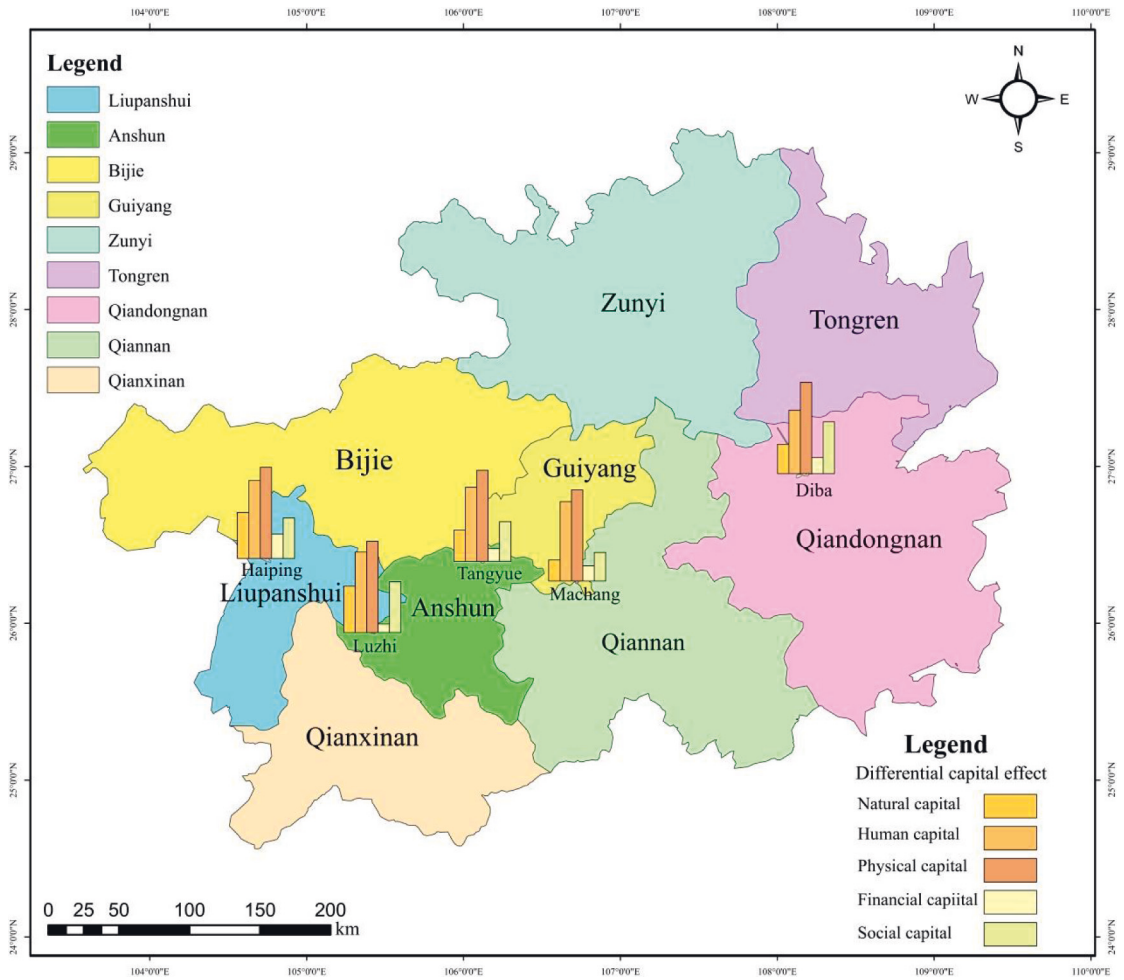

Figure 6: Spatial differences in poverty alleviation effect of different models.

farmland transfer-out is subject to market-related risks and fluctuations, which makes the farmer households' income from land lease relatively unstable.

The effect of different types of farmland transfer under different poverty alleviation models varies. The rapid development of tourism in karst mountainous areas has spurred the development of local cultural-tourism destinations, which has supported targeted poverty alleviation, resulting in effective poverty reduction. In model 2, poverty alleviation is achieved effectively through agricultural industry development based on land shareholding and by establishing training centers where farmer households can acquire new knowledge and skills required to continually improve their economic situation. However, model 4 reflects the lack of innovation in farmland transfer methods in economically underdeveloped areas. It is difficult for farmers to obtain income from farmland transfers. This study analyzes the poverty reduction effect of farmland transfer under different typical targeted poverty alleviation models so as to provide a reference for promoting land system reform, improving the land market, and increasing land use efficiency in karst mountain areas. This study has important theoretical and practical guidance for the successful implementation of poverty alleviation strategies and preventing the recurrence of poverty.

5. Policy Implications

To solve the issues of poverty reduction effect of farmland transfer-in different models, some policies can be proposed. Firstly, the system of farmland transfer should be improved. It promotes the redistribution of productive resources and income of farmer households and plays an important role in the reform of rural land property rights. It is also conducive to the reasonable and effective transfer of farmland use rights, solving the problems of agriculture, rural area, and farmer household, promoting the construction of agricultural industrialization and intensive management, and promoting farmland transfer to boost targeted poverty alleviation. Thus, comprehensively establishing and improving farmland transfer management agencies and free-style farmland transfer behavior should be standardized to increase the enthusiasm of farmland transfer business households. Secondly, the local government should fully mobilize farmer households to participate in the enthusiasm for farmland transfer. Arouse the initiative of leading

enterprises and professional cooperatives to develop industries to stimulate their vitality so as to increase the income of poor farmer households and achieve the goal of poverty alleviation by industry. Thirdly, the targeted poverty alleviation models should be optimized. Appropriate targeted poverty alleviation models are selected or adjusted according to the economic development and resource endowment of different regions. A sustainable targeted poverty alleviation model can effectively guarantee farmer households' income and prevent poor farmer households from falling back into poverty.

6. Conclusion

In this study, Propensity Score Matching (PSM) and Difference-in-Differences (DID) methods were used to analyze the effect of farmland transfer under different models of targeted poverty reduction from the aspect of five different types of capital. The results show that farmland transfer has a significant poverty reduction effect on farmer households that they transfer in and transfer out their land and that both types of transfer play an important role in promoting the growth of farmer households' property. However, the overall effect of farmland transfer-out on poverty reduction is more significant that farmland transfer effectively improves farmer households' nonfarm income. The model of "three changes" + relocation for poverty alleviation + rural tourism + poor household has the most significant effect on poverty reduction. The remarkable results in poverty alleviation are achieved through capitalizing on local natural resources and seizing opportunities to develop unique types of industries, which require a large-scale transfer of labor force, further promoting farmland transfer. Model of land lease/shareholding + cooperative + enterprise + poor household has an insignificant effect. Therefore, there are too many restrictive factors in some areas, and the poverty reduction effect is relatively weak. Some policy suggestions are also proposed: choose a suitable development model according to regional differences and resource endowment. The results of this study are limited by the lack of diversity in the selected poverty reduction models. At the same time, the study fails to fully consider how to reduce the regional differences in poverty reduction, so further research is recommended.

Data Availability

The data used to support the findings of this study are included within the article.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Acknowledgments

This research was funded by the National Social Science Foundation of China (File number: 19BGL180) and the Insight Grant from the Social Sciences and Humanities Research Council of Canada (File number: 435-2018-0953).

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