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THE IMPACT OF INCLUSIVE FINANCIAL ON THE POVERTY VULNERABILITY OF FARM HOUSEHOLDS IN CHINA

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Abstract: Based on data from the China Family Panel Studies (CFPS), this study uses the propensity score matching (PSM) method to measure the poverty vulnerability of farm households based on the vulnerability theory of expectation poverty and to analyze their likelihood of falling into poverty in the future. The results of the study show that, firstly, in general, the effective implementation of inclusive financial policies has significantly reduced the poverty vulnerability of farm households, which has been reduced by about 6.8%. This shows that inclusive finance has a significant improvement effect on the poverty vulnerability of farm households, reducing the probability of farm households falling into poverty in the future. Secondly, in terms of regional location, inclusive finance improves the poverty vulnerability of farm households in the eastern region slightly more than in the central and western regions. In the eastern region, the implementation of inclusive finance reduced poverty vulnerability by about 8%; in the central region, it reduced poverty vulnerability by about 6.6%, and in the western region, it reduced poverty vulnerability by about 6.1%. Based on this, this study proposes appropriate policy recommendations to improve the level of financial development in poor areas and reduce the vulnerability of farm households to poverty, thereby promoting rural development.
Keywords: Poverty; Inclusive Finance; Poverty Vulnerability; China

1. Introduction

Eradicating poverty and improving people's well-being is the fundamental purpose of development. Inclusive finance has always been regarded as an important tool for poverty alleviation, based on the principle of equal opportunity and emphasizing the breadth and outreach of financial services, with the aim of providing adequate financial support to vulnerable groups such as the poor. Inclusive finance plays an important role in benefiting people's livelihood and contributing to new development.

At present, scholars at home and abroad have discussed inclusive finance. Most researchers have already argued the realization path of inclusive finance, the mechanism of influence, the effectiveness of poverty alleviation, and how to help poor families and poor groups to get rid of poverty and become rich from an ex post perspective, and analyzed the impact of inclusive finance on the current poverty situation (Chen & Jin, 2018; Zhang & Yan, 2020). However, the sustainability or durability of the effect of inclusive finance is yet to be examined in detail, that is,

the impact of inclusive finance on the vulnerability of farm households households or poor groups to poverty. It is clear that the vulnerability of farm households and poor groups in the face of risks arising from various uncertainties and external shocks is an important factor influencing their fall into poverty. In the process of implementing inclusive financial policies, it is important to not only focus on examining the mechanism of poverty eradication and the effectiveness of poverty eradication of farm households and groups, but also to predict and analyze the probability of their falling into poverty in the future. Therefore, by measuring the vulnerability of farm households and groups to poverty, it is conducive to identifying individuals and households that may fall into poverty in the future, and adopting targeted assistance and incentives to mitigate the extent to which they will fall into poverty in the future. In view of this, this study, based on analyzing the extent of the contribution of inclusive finance to the poverty eradication effect of farm households and families, attempts to assess the poverty eradication effect of inclusive finance from the perspective of poverty vulnerability.

Poverty vulnerability is the identification of individuals or households that are likely to fall into poverty conditions in the future, thus contributing to the adoption of targeted assistance and incentive initiatives to improve their ability to resist various risks. The examination of poverty vulnerability should be prospective and predictive, and since it cannot be measured at present or past nodes (or points in time), it can only be effectively assessed using specific methods. In the existing literature, the more widely used technique for measuring poverty vulnerability comes from the concept of Vulnerability to Expected Poverty (VEP) and analytical tools proposed by Chaudhuri (Chaudhuri et al, 2002), which is capable of portraying the vulnerability to poverty based on cross-sectional data or panel data with fewer years. He et al. (2020) used the VEP methodology to construct a poverty vulnerability index to study the poverty status of the rural elderly population, and examined in detail the extent to which the residence pattern affects their poverty vulnerability. Shen & Li (2022) measured the effect of digital inclusive finance on the relative poverty vulnerability of farm households under different poverty line standards and its optimal index interval, to reveal the structural differences and the mechanism of the effect of digital inclusive finance on the relative poverty vulnerability of different farm households. Therefore, this study also adopts VEP, a prospective measurement technique, to measure the poverty vulnerability of farm households and analyze the impact of inclusive finance on the effect of poverty eradication of farm households.

This study selects the relevant data of CFPS to measure the effect of inclusive finance on the poverty vulnerability of poor household families. This study adopts the propensity score matching method (PSM), based on the vulnerability theory of expectation of poverty (VEP) to examine the possibility of poor household families falling into poverty in the future.

2. Theoretical Framework and Literature Review

The Vicious Circle of Poverty Theory (VCPT) identifies the lack of original capital in developing countries as a key factor in perpetuating poverty in the country. The Vicious Circle of Poverty Theory (VCPT) suggests that the lack of capital is the main reason why developing countries are vulnerable to poverty. On the one hand, from the perspective of capital supply, low income makes people spend most of their income on consumption, which reduces social savings, leads to capital scarcity, limits the scale of production of enterprises, and adversely affects the efficiency of output, and ultimately leads to low income. That is, the formation of "low income → high consumption → low savings → low capital → low output → low income" vicious circle. On the other hand, from the demand side of capital, low income level weakens people's desire to consume, reduces people's investment demand, hinders the formation of capital, reduces the total social output, and then reduces the income of the family, which makes the family unable to accumulate its own assets, increasing the risk of poverty, forming a vicious circle of "low income→decrease in the desire to consume→lower investment→insufficient capital→lower output→low income". The vicious circle of "low income → low desire to consume → low investment → low capital → low output → low income" is formed. The chain of vicious circle of supply and demand exacerbates the probability of falling into poverty, and suggests that large-scale, all-round investment and the implementation of a comprehensive growth investment program to increase income is the sword to break the vicious circle of poverty (Sun et al., 2023).

The lack of capital makes households' income levels low and prevents them from accumulating assets, which increases the difficulty of building livelihood capital, making them less resilient and exacerbating poverty vulnerability (Sun et al., 2023). As an effective external risk aversion tool, inclusive finance can help households build capital, increase household income, and promote the accumulation of assets by providing investment and financing services to the society and households, injecting liquidity, and using external capital interventions, thus playing a major role in enhancing the resilience of households and reducing their poverty vulnerability, thus jumping out of the vicious cycle of poverty (Yang & Wang , 2015). According to Yin & Zhang, 2020), inclusive finance can alleviate the situation of financial liquidity difficulties by providing services such as loans and insurance payouts, enhancing the liquidity of household funds, smoothing consumption and income curves, and strengthening resilience. In addition to this, inclusive finance can also provide diversified solutions for the asset allocation of households, which can utilize financial services such as savings, insurance and wealth management to gain income, enabling households to accumulate more financial assets and enhance their ability to withstand risks (Zhou & Wang, 2019). Therefore, inclusive finance can play a role in stabilizing poverty eradication by reducing the poverty vulnerability of farming households.

Whether a household has poverty vulnerability depends on its resilience in the face of risky events and negative shocks, and the worse the resilience, the more likely the household is to have poverty vulnerability. The size of a household's resilience depends on two aspects: first, it is the strength of the household's own sustainable development ability, which is manifested in the amount of accumulation of material, human and other livelihood capital and the amount of assets

held by the household (Song , 2021). Second, it is the use of exogenous tools such as inclusive finance (Wu & Wang, 2022).

On the one hand, as an exogenous tool, inclusive finance absorbs idle funds in the financial market at a lower cost and introduces financial assets into rural areas, thus expanding the supply of funds in the rural financial market. This not only provides more financing channels and financing methods for the majority of agricultural business entities, but also optimizes the breadth and depth of financial services (Zhang & Han, 2021), eases the environmental constraints on access to capital for farm families, and creates conditions for farmers to obtain financial support. On the other hand, innovative financial products have lowered the threshold of customer access, making financial services more civilian, breaking the information asymmetry between farmers and financial institutions for a long time, improving the accessibility of formal credit services for farming families, and showing unprecedented balanced effects on remote areas and vulnerable groups, realizing the "universal" and "beneficial" financial products. This has realized a truly effective combination of "universal" and "beneficial" financial products (Wu & Wang, 2022). As a result, farmers who have access to loan support can not only use the funds for non-farm employment and increase their income, but also use the funds for family education, health care, financial products and other investment behaviors, which promotes the accumulation of family assets, strengthens the ability of the family to withstand adversity, and broadens the social network of the farming family, and also presents a more significant value-added wealth compared to the traditional savings model, and the increase in income is more conducive to the family to jump out of the vicious cycle of poverty, which in turn effectively reduces poverty. The increase in income is more conducive to families jumping out of the vicious cycle of poverty, which in turn effectively reduces the poverty vulnerability of farming families .

The marginal contribution of this study is the introduction of poverty vulnerability into the analytical framework of inclusive finance, which examines the impact of inclusive finance on the poverty vulnerability of poor households' households in China, in an attempt to reevaluate the effectiveness of inclusive finance against poverty with a forward-looking perspective. This study focuses on the impact of financial inclusion on the poverty vulnerability of poor households' households and whether the implementation of financial inclusion policies helps to reduce the poverty vulnerability of farm households' households. Not only does it help relatively poor groups and rural residents to connect to markets, accumulate human capital and participate in financial development, but it also contributes to the further improvement of the inclusive finance policy system in the future.

3. Research Methodology

This section explains the research design of the thesis. The China Family Panel Studies (CFPS) was selected to study the poverty vulnerability of farm households. Next, this section describes the variable selection and model setting.

3.1 Data Source

The main data used in this study come from the database of China Family Panel Studies (CFPS), a nationwide large-scale social tracking survey organized by the China Center for Social Science Research at Peking University. The CFPS is a nationwide large-scale social tracking survey, covering micro-data at the individual, family and community levels, and comprehensively reflecting changes in China's family dynamics, social relationships, economic activities, working conditions, population migration, educational achievements, and ideological concepts from multiple perspectives. In order to ensure the representativeness of the survey sample, CFPS uses a multi-stage, multi-level probability sampling method (PPS) proportional to the population size. The survey sample covers 25 provinces, municipalities directly under the central government, and autonomous regions in China (except for Hong Kong, Macau, Taiwan, Xinjiang, Tibet, Qinghai, Inner Mongolia, Ningxia, and Hainan), and the sample area covers 95 percent of the total population of the country, which is representative of the nationwide population. The CFPS baseline survey was officially launched in 2010, with a total of 14,960 households and 42,590 individuals interviewed in its baseline survey. Since then, CFPS has conducted comprehensive national tracking surveys every two years, with second, third, fourth, and fifth rounds of household tracking surveys conducted in 2012, 2014, 2016, and 2018, respectively. To date, CFPS has publicly released data from five rounds of tracking surveys, CFPS 2010, CFPS 2012, CFPS 2014, CFPS 2016, and CFPS 2018.

Based on research needs and data availability, three issues of micro-survey data from CFPS 2014, CFPS 2016, and CFPS 2018 were selected for empirical research in this study. We defined the study population as farm households, so households with rural household registration in this database were selected. However, the CFPS database does not give a direct indication of whether a rural household family is a poor household or not, and in response to this situation, this study follows China's standards for defining a poor household and considers a rural household family with an annual per capita net income lower than the standard of the national poverty line for that year as a poor household family. However, the CFPS database does not give a direct indication of whether a farm household is a poor household or not. In order to address this situation, this study considers farm households whose annual per capita net income is lower than the current year's national poverty line standard as farm households according to China's definition of farm households. The process of sample screening as well as variable processing is as follows: (1) the sample data of urban households are excluded, and only the sample data of rural households are retained; (2) only the head of household data are retained in each household data, and the agricultural households with annual per capita net income higher than the standard of the current year's national poverty line are excluded, i.e., the non-farm households among the households of rural households are excluded, and the farm households among the households of agricultural households are retained; (3) based on the key information needed for the research information, the relevant data in the individual, household, and village questionnaires are merged; (4) the data from the three periods of CFPS 2014, CFPS 2016, and CFPS 2018 are merged; and (5) some of the

sample households with serious missing data, containing outliers, and propensity scores that are not matched by the outcomes are excluded. Through the above data collation, we finally obtained 8,260 valid samples that meet the needs of the study.

3.2 Research Variable

In this study, the vulnerability of poor households to poverty is selected as the explanatory variable. This study takes "whether or not to participate in inclusive finance" of poor households as the core explanatory variable. This study selects the control variables from the three aspects of farm household characteristics, family characteristics and financial support. The study then analyzes the impact of the poverty vulnerability of inclusive financial households.

3.2.1 Variables of Poverty Vulnerability（Vul）

This study takes the poverty vulnerability of farm households as an explanatory variable and analyzes the probability that a farm household will fall into poverty in the future, in order to reassess the poverty alleviation effect of inclusive finance from a forward-looking perspective.

Poverty vulnerability enhances the risk-resistant capacity of farm households by identifying farm households that are likely to fall into poverty in the future and targeting the implementation of pro-poor policies. Due to the forward-looking characteristics of poverty vulnerability, it cannot be directly observed and can only be assessed using specific methods (Liu et al. 2019; Qi & Zhang, 2023). Therefore, this study uses VEP (i.e., the measure of expected poverty vulnerability) to calculate the degree of poverty vulnerability of the sample households and to portray the impact that inclusive finance has on poverty vulnerability. The equation for measuring poverty vulnerability is of the following form.

$$Vul_{i,t} = P(Y_{i,t+1} \le z) \quad (1)$$

In equation (1), $V\mathrm{ul}_{i,t}$ denotes the poverty vulnerability of individual or household *i* in period *t*, $Y_{i,t+1}$ represents the income of individual or household *i* in period *t+1*, and *z* denotes the poverty line.

Future income is a function of the observable variable X_i and the random error term e_i. Substituting into equation (1) yields.

$$Y_{i,t+1} = f(X_i, \alpha_i, e_i) \quad (2)$$

$$Vul_{i,t} = P(Y_{i,t+1} = \mathrm{f}(X_i, \alpha_i, e_i) \le z) \quad (3)$$

Assuming that future income follows a log-normal distribution and based on the generalized least squares (FGLS) method, poverty vulnerability is calculated (Amemiya, 1977).

In the first step, the income equation is estimated.

$$\ln Y_i = X_i\beta + e_i \quad (4)$$

$$\hat{e}_i^2 = X_i\rho + \eta_i \quad (5)$$

In the above assortment, the observable variables X_i mainly include household head characteristics variables, household characteristics variables, and inclusive finance related variables (Fan et al., 2014).

In the second step, FGLS estimation is performed as follows Eq.

$$\hat{E}(\ln Y_i | X_i) = X_i \hat{\beta}_{FGLS} \quad (6)$$

$$\hat{V}(\ln Y_i | X_i) = \hat{\sigma}_{e,i}^2 = X_i \hat{\rho}_{FGLS} \quad (7)$$

In the third step, the poverty vulnerability of household i is estimated.

$$\hat{V}ul_i = \phi\left(\frac{\ln z - X_i \hat{\beta}_{FGLS}}{\sqrt{X_i \hat{\rho}_{FGLS}}}\right) \quad (8)$$

In this study, three poverty lines, including the national poverty line standard of 2300 yuan, the World Bank extreme poverty standard of $1.9 per person per day, and the low- and middle-income poverty standard of $3.1, were selected to portray the degree of poverty vulnerability of farm households in China (Yin& Zhang, 2020). Generally speaking, vulnerable households are those whose vulnerability is higher than the vulnerability line. There are two ways to select the vulnerability line: one way is to consider the incidence of poverty as the vulnerability line, which can be called the low vulnerability line; the other way is to consider 50% as the vulnerability line (when the probability of a household falling into poverty in the future is greater than 50%, the household is vulnerable), which can be called the high vulnerability line.

3.2.2 Other Variables

In this study, the core explanatory variable is “whether the poor household participates in inclusive finance”. Whether a poor household participates in inclusive finance is defined by

"whether the poor household has a loan and uses it for industrial production or investment". If a poor household has a pending bank loan or a pending loan from a friend or relative, and the loan or loan is used for industrial production or investment, the poor household participates in inclusive finance ($T=1$); otherwise, it does not participate in inclusive finance ($T=0$).

In this study, control variables were selected from three aspects: household head characteristics, household characteristics, and financial support. First, to avoid the influence of human capital on the analysis results, variables reflecting the basic characteristics of the household head such as age, gender, marital status, education and health level, medical insurance and pension insurance were included. Then, household characteristics variables were selected. Among them, the household size reflects the demographic status of the household, and households with a larger number of people are more inclined to participate in financial poverty alleviation; whether or not they have low insurance and whether or not they have major events reflects the basic conditions of farm households, and the local transportation cost indicates the locational conditions of farm households. Finally, financial support variables were added; information availability and work status reflect the skill level of the household head; preferred borrowing target and whether borrowing was rejected reflect the financial borrowing availability of farm households; the logarithm of household per capita bank deposit (10,000 yuan) was chosen to measure savings availability, and the logarithm of household human gift expenditure (10,000 yuan) was used to measure credit availability, reflecting farm households' use of financial savings services and credit (see Table 3.1 for descriptive statistics of each variable).

Table 3.1 Descriptive Statistics of Each Variable

Variable Category	**Variable Name**	**Variable Description**	**Average Value**	**Standard Deviation**
Poverty vulnerability	Poverty vulnerability V1	Poverty vulnerability under the $1.9 poverty line standard	0.2591	0.3291
	Poverty vulnerability V2	Poverty vulnerability under the national poverty line standard of 2300 yuan	0.2818	0.3359
	Poverty vulnerability V3	Poverty vulnerability under the $3.1 poverty line standard	0.3827	0.3455
Policy	Whether to participate in inclusive finance	Whether the farm households have loans and used for industrial production or investment	0.5016	0.5001
Household Characteristics	Household head characteristics variables			
	Age	Age of head of household	53.9647	12.1562
	Gender	Gender of head of household	0.6173	0.4861
	Marital status	Married = 1, otherwise = 0	0.8846	0.3195

Variable Category	Variable Name	Variable Description	Average Value	Standard Deviation
	Education level	Illiterate or semi-literate = 0, elementary school = 3, junior high school = 4, high school, junior college or vocational high school = 5, college = 6, bachelor's degree = 7, master's degree = 8, doctorate = 9	2.3965	1.3811
	Health level	Very healthy=1, very healthy=2, relatively healthy=3, Fair = 4, Unhealthy = 5	3.2778	1.2465
	Working status	Participation = 1, No = 0	0.8553	0.3518
	Medical insurance	Yes=1, No=0	0.95794	0.2009
	Endowment insurance	Yes=1, No=0	0.5123	0.4999
	Household Characteristics Variables			
	Family size	Total family size	4.0810	1.9107
	Whether or not low income	Yes=1, No=0	0.8469	0.3602
	Whether or not major events	Yes=1, No=0	0.1603	0.3669
	Local transportation costs	Average monthly local transportation costs	158.3925	333.7692
	Financial Support Variables			
	Information accessibility	Internet access = 1, no = 0	0.4114	0.4921
	Preferred borrowers	Relatives=1, friends=2, banks=3, Non-bank formal financial institutions = 4, private lenders and individuals = 5	2.0527	1.4098
	Whether the loan was rejected	Yes=1, No=0	0.2375	0.4256
	Savings availability	Logarithmic value of household savings per capita (million yuan)	7.4575	2.7460
	Credit availability	Logarithmic value of family gift expenses (million yuan)	7.3833	1.5734

3.3 Model Construction

In assessing the effects of public policy implementation, more attention is paid to the net effect of that policy. However, the existence of fixed effects leads to the inability to measure them accurately. One is the individual effect, the difference between the individuals who participate or do not participate in the policy itself, and if the individuals who participate and do not participate in the policy are compared directly, the results will be biased. Second, the time effect, due to the indirect intervention of other policies, will measure the results with bias, so the impact of the policy being evaluated needs to be separated out. To address this issue, a "quasi-natural experiment" state is generally simulated by setting up a treatment and control group to obtain consistent estimates. Therefore, this study adopts a "quasi-experimental" approach to measure the difference in the effect of participation in inclusive finance between the two groups by setting up a treatment group and a control group, and then accurately measure the effect of inclusive finance implementation.

3.3.1 Propensity Score Matching Method（PSM）

Propensity score matching (PSM) makes policy evaluation more reasonable by controlling for between-group differences and matching based on propensity values to exclude sample selection bias and endogeneity to a certain extent (Rosenbaum & Rubin, 1983). The essence of the propensity score matching method is "dimensionality reduction", using a probability model to condense the multidimensional covariates that are unbalanced between groups into one-dimensional propensity scores, achieving the effect of "dimensionality reduction". In this study, the individual, family and community factors that affect the poverty status of farm households are selected, and the propensity score matching method is used to analyze the influence of inclusive finance on the explanatory variables and measure the effect of inclusive finance policy implementation. As in equation 9, the average treatment effect of inclusive finance is expressed. Where, the propensity score value is $P(X_i)=\Pr(T=1|X_i)$. $T=1$ indicates that farm households participated in inclusive finance, Otherwise, farm households are not participating in inclusive finance, $T=0$. And X_i indicates the other variables.

$$ATT = E_{P(X)|T=1}\left\{E\left[Y^T|T=1,P(X)\right]-E\left[Y^C|T=0,P(X)\right]\right\} \quad (9)$$

4 Result and Discussion

The section includes detailed data tests and data analysis to measure the impact of inclusive financial on the vulnerability of farm households to poverty. In addition, this section conducts robustness tests to ensure the robustness of the assessed effects and the reliability of the results.

4.1 Results of Poverty Vulnerability Analysis Based on Propensity Score Matching Method (PSM)

In this study, the propensity score matching method is selected to measure the impact of inclusive financial on the vulnerability of agricultural households to poverty. First, the balance test is conducted to derive the propensity score value based on Probit model. Secondly, based on the results of Probit model analysis, appropriate covariates are selected to make the matching effect more reasonable. Then, based on the k-nearest neighbor matching method (1:1), k-nearest neighbor matching method (1:4), radius matching method and kernel matching method, the average treatment effect (ATT) of the implementation of inclusive finance policies on the effect of poverty alleviation is calculated, and the average treatment effect of the implementation of inclusive finance policies on the effect of poverty alleviation in different regions is compared and analyzed. Finally, robustness tests are conducted.

4.1.1 Balance Test

This study combines the Probit probability model to calculate the propensity score value. In order to further verify the effect of inclusive finance on the poverty alleviation effect of farm households, a balance test is required, which requires that farm households participating in inclusive finance and those not participating in inclusive finance are not significantly different in each characteristic variable, excluding sample selection bias, as shown in Table 4.1. The vast majority of the variables were significantly different before matching, and after matching, there were no significant differences, and the standardized bias rates of the matched covariates were all below 10%, proving that the test results were good (Rosenbaum et al., 1985). Therefore, the sample matching passed the equilibrium test.

Table 4.1 Balance Test

Covariates	Sample Category	Average Value		Deviation Rate (%)	Rate of change of deviation (%)	T-test	
		Experimental group	Control group			t-value	P>|t|
Age	U	56.522	51.391	43.2	95.7	19.62	0.000
	M	56.507	56.283	1.9		0.85	0.397
Gender	U	0.6142	0.6204	-1.2	73.8	-0.57	0.071
	M	0.6143	0.6158	-0.3		-0.15	0.882
Marital status	U	0.8747	0.8946	-6.2	87.0	-2.83	0.005
	M	0.8746	0.8772	-0.8		-0.36	0.722
Education level	U	2.3753	2.4178	-3.1	96.9	-1.40	0.163
	M	2.3751	2.3764	-0.1		-0.04	0.965
Health level	U	3.2556	3.3002	-3.6	69.2	-1.63	0.104
	M	3.2556	3.2418	1.1		0.50	0.616
Working status	U	0.8260	0.8849	-16.8	89.8	-7.63	0.000
	M	0.8261	0.8321	-1.7		-0.73	0.466

Covariates	Sample Category	Average Value		Deviation Rate （%）	Rate of change of deviation （%）	T-test	
		Experimental group	Control group			t-value	P>|t|
Medical insurance	U	0.9578	0.9580	-0.1	-86.6.8	-1.05	0.060
	M	0.9577	0.9611	-1.7		-0.79	0.432
Endowment insurance	U	0.4354	0.5898	-31.2	99.8	-14.20	0.000
	M	0.4358	0.4361	-0.1		-0.03	0.976
Family size	U	3.8173	4.3464	-28.0	85.5	-12.70	0.000
	M	3.8176	3.8941	-4.0		-1.85	0.065
Whether or not low income	U	0.8170	0.8769	-16.7	95.3	-7.57	0.000
	M	0.8174	0.8202	-0.8		-0.33	0.742
Whether or not major events	U	0.1301	0.1907	-16.6	94.4	-7.53	0.000
	M	0.1302	0.1336	-0.9		-0.46	0.648
Local transportation costs	U	125.13	191.87	-20.1	89.0	-9.13	0.000
	M	125.19	132.56	-2.2		-1.30	0.193
Information accessibility	U	0.3765	0.4464	-14.2	95.9	-6.47	0.000
	M	0.3768	0.3797	-0.6		-0.27	0.789
Preferred borrowers	U	2.2525	1.8516	28.7	83.0	13.05	0.000
	M	2.2505	2.1823	4.9		2.05	0.040
Whether the loan was rejected	U	0.1542	0.3214	-40.0	98.8	-18.20	0.000
	M	0.1544	0.1524	-0.5		0.25	0.801
Savings availability	U	7.8683	7.0545	30.5	92.4	13.86	0.000
	M	7.8662	7.9277	-2.3		-1.03	0.304
Credit availability	U	7.3318	7.6212	-20.9	99.9	-9.5	0.000
	M	7.3343	7.3345	-0.0		-0.01	0.996
Joint testing		Ps R2		LR chi2		p>chi2	
U		0.100		1142.84		0.000	
M		0.001		10.96		0.859	

Note: U means unmatched, M means matched.

4.1.2 The Average Treatment Effect on the Treated (ATT)

After passing the equilibrium test (the results of equilibrium test are the same as Table 4.1), the effect of inclusive finance on poverty vulnerability of farm households is measured based on different matching methods with poverty vulnerability as the explanatory variable, and the results are shown in Table 4.2. According to the results of PSM analysis, inclusive finance has a

significant reduction effect on poverty vulnerability of farm households. Specifically, using k-nearest neighbor matching (1:1), k-nearest neighbor matching (1:4), radius matching and kernel matching methods in the full sample case, the average treatment effects of inclusive finance on poverty vulnerability of farm households under the World Bank $1.9 poverty line criterion are -0.0656, -0.0686, -0.0685 and -0.0699, respectively, all significant at the 1% level of significant at the 1% level, and the mean value of the average treatment effect under the four methods was -0.0682, indicating that the implementation of inclusive finance reduced poverty vulnerability by 6.82% on average. The average treatment effects of inclusive finance on poverty vulnerability of farm households when the national poverty line of 2300 yuan is used as the standard are -0.0695, -0.0683, -0.0674 and -0.0691, and all are significant at the 1% level of significance, and the mean value of the average treatment effect under the four methods is -0.0686, indicating that the implementation of inclusive finance has reduced poverty vulnerability by 6.86%. The mean treatment effects of inclusive finance on poverty vulnerability of farm households under the World Bank's $3.1 poverty line criterion were -0.0744, -0.0686, -0.0685, and -0.0693, all significant at the 1% level, and the mean value of the mean treatment effect under the four methods was -0.0702, indicating that the implementation of inclusive finance reduced poverty vulnerability by 7.02%. In summary, the direction and trend of the average treatment effect of the implementation of inclusive finance policies on poverty vulnerability of farm households under different measurement methods are consistent, all showing a significant negative effect ($ATT<0$, $p<0.01$), i.e., the implementation of inclusive finance policies significantly reduces the poverty vulnerability of farm households by about 6.8%.

In order to analyze the difference of the effect of inclusive finance on poverty vulnerability in different regions, this study examined the average treatment effect of inclusive finance by region, and the results are shown in Table 4.2. The results show that under four different matching methods, the mean values of the average treatment effect of inclusive finance on poverty vulnerability of farm households in the eastern, central and western regions under the World Bank's $1.9 poverty line criterion are - 0.0855, -0.0667, and -0.0640. under the 2300 yuan national poverty line criterion, the mean values of the average treatment effects of inclusive finance on poverty vulnerability of farm households in the eastern, central, and western regions are -0.0799, -0.0726, and -0.0615, respectively. under the World Bank's $3.1 poverty line criterion, the mean values of the average treatment effects of inclusive finance on poverty vulnerability of farm households in the eastern, central, and The mean treatment effects of inclusive finance on poverty vulnerability of farm households in the eastern, central and western regions are -0.0782, -0.0664, and -0.0591, respectively. The estimation results show that the implementation of inclusive finance has a significant effect on poverty vulnerability reduction in the eastern, central and western regions. In the eastern region, the implementation of inclusive finance reduced poverty vulnerability by about 8%. In the central region, the implementation of inclusive finance reduced poverty vulnerability by about 6.6%. And in the western region, the implementation of inclusive finance reduced poverty vulnerability by about 6.1%. Among which, inclusive finance has a higher degree of reduction on the poverty vulnerability of farm households in the eastern region, followed

by the central region, and a relatively lower degree of reduction on the poverty vulnerability of farm households in the western region. At the same time, it also shows that poverty vulnerability is affected by the level of regional economic development, and the effect of inclusive finance on poverty vulnerability reduction is slightly higher in economically developed regions than in less developed regions. Considering the complexity and environmental uncertainty of inclusive finance policy implementation, economically developed regions are relatively rich in resources and have higher employment opportunities and labor compensation than less economically developed regions. Therefore, economically developed regions reduce poverty vulnerability to a greater extent.

Table 4.2 Average Treatment Effect Based on PSM Method

Indicators	Matching methods	Full sample	Eastern	Middle	Western
$1.9 poverty line	K-Nearest Neighbor Matching（1:1）	-0.0656***（0.0113）	-0.1017***（0.0186）	-0.0667**（0.0197）	-0.0607***（0.0218）
	K-Nearest Neighbor Matching（1:4）	-0.0686***（0.0094）	-0.0869***（0.0151）	-0.0657***（0.0178）	-0.0648***（0.0162）
	Radius Matching（Radius=0.01）	-0.0685***（0.0086）	-0.0782***（0.0138）	-0.0682***（0.0166）	-0.0658***（0.0150）
	Nuclear matching（Window width=0.06 kernel function=normal）	-0.0699***（0.0084）	-0.0751***（0.0135）	-0.0659***（0.0156）	-0.0645***（0.0146）
	Average value	-0.0682	-0.0855	-0.0667	-0.0640
2300 yuan national poverty line	K-Nearest Neighbor Matching（1:1）	-0.0695***（0.0115）	-0.0923***（0.0187）	-0.0769**（0.0203）	-0.0580**（0.0223）
	K-Nearest Neighbor Matching（1:4）	-0.0683***（0.0096）	-0.0765***（0.0152）	-0.0755***（0.0166）	-0.0622**（0.0182）

Indicators	Matching methods	Full sample	Eastern	Middle	Western
	Radius Matching（Radius=0.01）	-0.0674***（0.0087）	-0.0755***（0.0155）	-0.0711***（0.0139）	-0.0636**（0.0170）
	Nuclear matching（Window width=0.06 kernel function=normal）	-0.0691***（0.0086）	-0.0753***（0.0151）	-0.0668***（0.0136）	-0.0622***（0.0160）
	Average value	-0.0686	-0.0799	-0.0726	-0.0615
$3.1 poverty line	K-Nearest Neighbor Matching（1:1）	-0.0744***（0.0117）	-0.0718**（0.0229）	-0.0740***（0.0182）	-0.0555**（0.0205）
	K-Nearest Neighbor Matching（1:4）	-0.0686***（0.0097）	-0.0781***（0.0189）	-0.0635***（0.0150）	-0.0618***（0.0172）
	Radius Matching（Radius=0.01）	-0.0685***（0.0089）	-0.0820***（0.0176）	-0.0656***（0.0138）	-0.0587***（0.0161）
	Nuclear matching（Window width=0.06 kernel function=normal）	-0.0693***（0.0087）	-0.0808***（0.0166）	-0.0623***（0.0135）	-0.0603***（0.0157）
	Average value	-0.0702	-0.0782	-0.0664	-0.0591

4.2 Robustness Test

By measuring the average treatment effect (ATT) of the implementation of inclusive finance policies on the poverty vulnerability of farm households, as shown in Table 4.2, the test results of the four different matching methods are similar and all show a significant positive effect (ATT>0, p<0.01), indicating that the treatment effect of inclusive finance on poverty vulnerability is robust.

In addition, further tests were aided by propensity score matching-dual difference method (PSM-DID) as shown in Table 4.3. According to the analysis results in Table 10, it can be obtained

that the direction and trend of the average treatment effect of the implementation of inclusive finance policies on poverty vulnerability of farm households under different poverty line criteria are consistent with the analysis results in Table 4.2, which all show a significant negative effect (ATT<0, p<0.01), again proving the robustness of the assessment effect.

Table 4.3 Robustness Test Based on PSM-DID

Indicators	Before Diff（T-C）	After Diff（T-C）	DID
$1.9 poverty line	-0.022*** （0.010）	-0.081*** （0.010）	-0.059*** （0.000）
2300 yuan national poverty line	-0.031*** （0.015）	-0.077*** （0.015）	-0.046*** （0.000）
$3.1 poverty line	-0.021*** （0.014）	-0.75*** （0.014）	-0.054*** （0.000）

5 Conclusions and Recommendations

The findings of the study are discussed in this section to determine the conclusions. Also, based on the findings, this section makes recommendations for future research.

5.1 Research Conclusions

In this study, data from the China Family Panel Studies (CFPS) are used to first measure the poverty vulnerability of farm households based on the vulnerability theory of expected poverty. Then, based on the probability of falling into poverty in the future using the double-difference method and propensity score matching method to analyze their future probability of falling into poverty, the poverty elimination effect of inclusive finance is reassessed from a forward-looking perspective. Finally, the assessment effect is tested for robustness. The results of the study indicate the following.

In general, the effective implementation of inclusive financial policies significantly cuts poverty vulnerability. On the one hand, with the implementation of inclusive financial policies, the risk-resistant ability of farm households gradually increases, i.e., the probability of falling into poverty in the future gradually decreases; on the other hand, the implementation of inclusive financial policies reduces the poverty vulnerability of farm households by about 6.8%, which also indicates that inclusive finance has a significant improvement effect on the poverty vulnerability of farm households and cuts down the probability of farm households falling into poverty in the future .

In terms of regional location, inclusive finance improves the poverty vulnerability of farm households in the eastern region slightly more than in the central and western regions. In the

eastern region, the implementation of inclusive finance reduced poverty vulnerability by about 8%; in the central region, the implementation of inclusive finance reduced poverty vulnerability by about 6.6%, and in the western region, the implementation of inclusive finance reduced poverty vulnerability by about 6.1%. The implementation of inclusive financial policies affects the effectiveness of poverty reduction to a greater extent in the eastern region than in the central and western regions. The relatively better resource endowment and economic conditions in the eastern region have a propulsive effect on the development of inclusive finance, which in turn leads to a slightly higher effect of inclusive finance on poverty eradication in the eastern region than in the central and western regions.

5.2 Policy Recommendations

In order to promote the effective implementation of the rural revitalization strategy, there is a need to further improve the level of financial development in China's rural areas, reduce the vulnerability of rural households to poverty, and thereby reduce the likelihood that they will fall into poverty in the future. Therefore, in the process of implementing inclusive financial policies, it is necessary not only to focus on the livelihoods and poverty characteristics of poor households, but also to pay special attention to poor households with high vulnerability to poverty, to continuously improve their ability to withstand various risks, and to reduce the likelihood of rural households falling into poverty in the future. On the one hand, promote the construction of digital inclusive financial infrastructure. Strengthening the publicity of inclusive financial knowledge and skills training for farming households, encouraging the active application of inclusive financial products by the majority of farming households, so that inclusive finance can play a greater role in poverty reduction. On the other hand, it has continuously strengthened the innovation of inclusive financial models. Relevant financial institutions in all regions are encouraged to improve their scientific and technological support capacity for rural financial poverty alleviation in accordance with their resource advantages, so as to accelerate the deepening of digital inclusive financial services for rural development.

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