Performance Evaluation of Rural Inclusive Financial Poverty Alleviation in Hebei from the Perspective of Targeted Poverty Alleviation Based on Experimental and Mathematical Statistics Analysis

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Abstract. Performance evaluation is an important means to test the effectiveness of rural financial precision poverty alleviation. This paper uses the panel data of 21 provinces and cities in the central and eastern economic zone of China from 2010 to 2020 to evaluate the impact of inclusive financial development on rural poverty alleviation. Based on the spatial Durbin model, the spatial spillover effect of rural inclusive financial poverty alleviation is empirically tested. The results show that the development of rural inclusive finance has both direct and positive spillover effects on poverty alleviation. Based on the fixed effect model, the direct impact of inclusive financial development on rural financial poverty alleviation is studied. The results show that the income increase effect of low-income farmers in various provinces and cities is significant, and the effect of targeted poverty alleviation is obvious. The analysis of the per capita disposable income index of farmers shows that the performance of rural financial precision poverty alleviation in Hebei Province is still insufficient compared with other provinces and cities in terms of the year-on-year growth of per capita disposable income of farmers. These empirical results show that promoting the development of inclusive finance should take into account the differences in the income level of farmers and provide new ideas for the policy direction of promoting farmers' income.

Keywords: Inclusive finance · Targeted poverty alleviation · Spatial Durbin model · Fixed effect model

1 Introduction

After 2020, the focus of China's anti-poverty work is to solve the problem of relative poverty. As a guarantee for poverty alleviation and sustainability, evaluating its targeted poverty alleviation performance will provide a reasonable reference for the next sustainable poverty reduction in Hebei Province.

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Hebei Province is located in the central and eastern economic zone of China. There are 21 provinces and cities in the economic zone of central and eastern China, such as Hebei. They are the main position of rural revitalization and an important market for economic development in China, and play an important role in the regional division of labor. They are suitable for developing industrial and agricultural production and are the more developed economic belt in China. In 2020, under the economic background of coordinated development and in-depth expansion of Beijing, Tianjin, and Hebei and the decisive victory of poverty alleviation in all provinces, the effectiveness of the poverty reduction of farmers in Hebei and its adjacent provinces and cities were related to whether inclusive finance benefits all farmers and the fairness and efficiency of inclusive finance in promoting rural development. Therefore, this paper takes 21 provinces in the central and eastern economic zone as an example to test the direct effect, the heterogeneity, channel effect, and the spatial effect of inclusive finance on rural financial poverty alleviation.

Some foreign studies have pointed out that inclusive finance helps families save and promote rural financial activities to expand consumption and support the development of a real rural economy [1]. Claessens and Feijen proposed that inclusive finance can help narrow the income gap, and inclusive financial institutions should actively carry out product innovation to promote the use of credit for families (especially low-income families) and small and medium-sized enterprises [2]. Maurer and Haber studied the Mexican banking system from 1888 to 1913. They found that the development of inclusive finance can't benefit the poor, but only the rich who provide mortgages and have good social relations [3].

Compared with the existing research, the contribution of this paper includes the following three aspects. First, the depth and contribution of inclusive finance are used to measure the development level of inclusive finance, which realizes the diversification of the measurement of the development level of inclusive finance. Secondly, based on the data and the spatial Durbin model of 21 provinces and cities such as Hebei, this paper tests the effect of inclusive finance development on increasing farmers' income. The results show that the depth and contribution of inclusive finance have a positive impact on economic growth and income distribution and answers the question of "whether inclusive finance can achieve rural financial poverty alleviation." Thirdly, it evaluates the development effect of inclusive finance in 21 provinces and cities in the central and eastern economic zone, which provides a reference for the policy-making of inclusive finance in 21 provinces and cities such as Hebei in the future. This paper analyzes the shortcomings of rural financial targeted poverty alleviation in Hebei Province compared with other provinces and gives reasons and countermeasures.

2 Data and Methodology

2.1 Descriptive Analysis

This paper will empirically test the impact of inclusive finance on rural poverty alleviation performance based on the panel data of 21 provinces and cities in the central and eastern economic zone, such as Hebei, from 2010 to 2020. The explained variable in the model is the per capita disposable income of farmers, and the consumption level of rural residents is used as the proxy variable of per capita disposable income of farmers for robustness

Table 1. Table of variable definitions

Variable	Describe	Measurement method
inc	Per capita disposable income of farmers	The consumption level of rural residents is used for the robustness test
ifc	Depth of inclusive finance	Agricultural loans/rural population
ifd	Contribution of inclusive finance	Farmer savings deposit balance + agriculture-related loan balance)/value added of the primary industry
eco	The rural economic growth level	Rural GDP/rural population, in which rural GDP is measured by the added value of agriculture, forestry, animal husbandry and fishery
gap	Income distribution indicators	The ratio of per capita disposable income of urban residents to per capita net income of rural residents reflects the income gap and income distribution

analysis [4, 5]. In addition, referring to the research of existing literature [6], we control other factors affecting farmers' income in the regression model, including the impact of variables such as the level of financial support for agriculture, the level of educational development and the level of rural fixed asset investment. The definition of variables is shown in Table 1.

The data comes from the China Statistical Yearbook, China Financial Yearbook, Statistical Bulletins of National Economic and Social Development of all provinces, and the wind database. To avoid and reduce the interference of heteroscedasticity and collinearity on the empirical process, this paper processes all relevant variables logarithmically and then carries out model test and estimation. For the missing data in individual years, the average value of the sample is used to replace it.

2.2 Empirical Model

First, to test the direct impact of financial inclusion on the performance of rural poverty alleviation, we set the following model:

$$\ln(inc_{it}) = \alpha_0 + \alpha_1 \ln(ifd_{it}) + \alpha_2 \ln(gov_{it}) + \alpha_3 \ln(edu_{it}) + \alpha_4 \ln(fai_{it}) + \alpha_5 \ln(eco_{it}) + \alpha_6 \ln(gap_{it}) + \varepsilon_{it} \tag{2.1}$$

$$\ln(inc_{it}) = \alpha_0 + \alpha_1 \ln(ifc_{it}) + \alpha_2 \ln(gov_{it}) + \alpha_3 \ln(edu_{it}) + \alpha_4 \ln(fai_{it}) + \alpha_5 \ln(eco_{it}) + \alpha_6 \ln(gap_{it}) + \varepsilon_{it} \tag{2.2}$$

where i represents 21 provinces, t represents time, ε_{it} represents error.

Further, to test the channel effect, we set the following model:

$$\ln(eco_{it}) = \alpha_0 + \alpha_1 \ln(ifd_{it}) + \alpha_2 \ln(gov_{it}) + \alpha_3 \ln(edu_{it}) + \alpha_4 \ln(fai_{it}) + \varepsilon_{it} \tag{2.3}$$

Next, construct the spatial Durbin econometric model:

$$\ln(inc_{it}) = \alpha_0 + \alpha_1 \ln(ifd_{it}) + \alpha_2 \ln(gov_{it}) + \alpha_3 \ln(edu_{it}) + \alpha_4 \ln(fai_{it}) + \alpha_5 \ln(eco_{it}) + \alpha_6 \ln(gap_{it}) + \beta_1 \mathrm{W}(\ln(ifd_{it})) + \beta_2 \mathrm{W}(\ln(gov_{it})) + \beta_3 \mathrm{W}(\ln(edu_{it})) + \beta_4 \mathrm{W}(\ln(fai_{it})) + \beta_5 \mathrm{W}(\ln(eco_{it})) + \beta_6 \mathrm{W}(\ln(gap_{it})) + \rho \sum_j W_{ij} \ln(inc_{it}) + \varepsilon_{it} \tag{2.4}$$

3 Results

3.1 Inclusive Finance and Farmers' Income

Fixed effect model and random effect model were used to analyze the data, and Hausman test was used. It is found that the selection of the fixed effect model is more reasonable. Table 2 reports the test results of models (2.1) and (2.2). The results show that the depth and contribution of inclusive finance have a significant positive impact on farmers' poverty reduction. The contribution of inclusive finance increases by 1%, and income increases by 0.277%; For every 1% increase in the depth of inclusive finance, the income of farmers will increase by 0.215%. This shows that with the deepening of the contribution and depth of inclusive finance, farmers will achieve poverty reduction. At the same time, it can be seen from Table 2 that when combined with the contribution and depth of inclusive finance, the income will increase by 0.201% and 0.474% for every additional 1% of economic growth. Similarly, when the urban-rural income gap decreases by 1%, income increases by 1.37% and 1.528%, respectively.

3.2 Effect Analysis of Targeted Poverty Alleviation

Table 3 shows the results of the impact of inclusive financial development on the difference of income-increasing effects of farmers with different incomes. Column (1) (2) shows the regression results of the sample data of high-income farmers with income greater than 50%, and the column (3) (4) shows the regression results of the sample data of low-income farmers with income less than 50%. The results in column (1) show that for high-income farmers, the income decreases by 0.021% for every 1% increase in the contribution of inclusive finance; The results in column (2) show that for every 1% increase in the depth of inclusive finance, the income decreases by 0.041%, but the regression results are not significant. The results of columns (1) and (2) show that inclusive finance has no significant effect on increasing income for high-income farmers. The results in columns (3) and (4) show that for low-income farmers, the income of farmers increases by 0.638% for every 1% increase in the contribution of inclusive finance; if the depth of inclusive finance increases by 1%, the income of farmers will increase by 0.622%. Accurate identification, targeted assistance and effective management of poor farmers in different places and different situations are targeted poverty alleviation, which shows that the poverty alleviation effect of rural inclusive finance in Hebei is remarkable under the background of targeted poverty alleviation.

Table 2. Direct impact of inclusive finance on farmers' income

	(1)	(2)
The dependent variable	linc	Linc
Lifd	0.277***	
	(0.042)	
lifc		0.215***
		(0.049)
leco	0.201***	0.474***
	(0.060)	(0.044)
lgap	−1.370***	−1.528***
	(0.122)	(0.124)
Sample size	231	231
R^2	0.886	0.874
No. of individuals	21	21

Note: The brackets are standard errors. ***, ** and *respectively mean significant at the statistical level of coefficient 1%, 5%, and 10%, the same below

Table 3. Differences in poverty reduction effects of inclusive financial development on farmers with different incomes

	(1)	(2)	(3)	(4)
The dependent variable	linc	linc	linc	linc
lifd	0.021		0.638***	
	(0.067)		(0.054)	
lifc		−0.041		0.622***
		(0.073)		(0.071)
R^2	0.706	0.707	0.943	0.921

3.3 The Spatial Spillover Effect of Rural Inclusive Finance on Poverty Reduction in China

In general, by comparing the significance level and the relative size of the coefficient value, the contribution and depth of inclusive finance have not only a direct effect on increasing farmers' income, but also a spatial spillover effect. The spillover effect is more significant than the direct effect, that is, the poverty reduction of farmers in the province will greatly benefit from the improvement of financial development and economic development in neighboring provinces and cities (Table 4).

Table 4. Estimation results of spatial panel regression model for inclusive finance

	(1)	(2)	(3)
The dependent variable	Direct effect	Spillover effect	The total effect
lifd	0.064***	0.161**	0.226***
	(0.017)	(0.064)	(0.072)
lifc	0.047**	0.177**	0.224***
	(0.019)	(0.075)	(0.086)

4 Extensions

4.1 Channel Investigation

This part will explore the channel effect of inclusive finance to reduce poverty and test the channels of economic growth and income distribution in the income increase effect of inclusive finance.

Columns (1) and (2) of Table 5 show that inclusive financial contribution and inclusive financial depth increase by 1%, and the added value of rural economic growth level is 0.526% and 0.109%, respectively, indicating that inclusive finance has a positive role in promoting economic growth. Combined with Table 2, the economic growth channel of inclusive finance to promote farmers' income is verified.

As can be seen from Table 6, at the significance level of 1%, for every 1% increase in the contribution and depth of inclusive finance, the urban-rural income gap will decrease by 0.115% and 0.089%. The greater the income distribution gap, the less the income of farmers. Therefore, inclusive finance plays a positive role in narrowing the income gap. Compared with the regression coefficient of Table 5, the channel of inclusive finance in poverty reduction is largely attributed to rural economic growth.

4.2 Robustness Check

Next, we use the consumption level of rural residents to replace the explained variable per capita disposable income of farmers for robustness test. After replacing dependent variable indicators, the results of inclusive finance on farmers' poverty reduction are very stable. The test results of rural residents' consumption level show that the channel effect of rural economic growth and income distribution is still significant. The contribution and depth of inclusive finance have significant effects on the spatial variable coefficient, spillover effect, and the total effect coefficient of farmers' poverty reduction. It shows that inclusive finance has a spatial spillover effect on rural poverty alleviation performance.

4.3 Performance Evaluation of Rural Financial Poverty Alleviation in Hebei Province

From the year-on-year growth of per capita disposable income and per capita value index of farmers from 2010 to 2020, Hebei Province ranks 12th, accounting for 10.65%,

Table 5. Coefficient estimation results of the poverty reduction effect of rural economic growth

	(1)	(2)
The dependent variable	leco	leco
lifd	0.526***	
	(0.031)	
lifc		0.109
		(0.084)

Table 6. Income distribution channel test

	(1)	(2)
The dependent variable	lgap	lgap
lifd	−0.115***	
	(0.015)	
lifc		−0.089***
		(0.020)

indicating that inclusive finance has achieved success in promoting farmers' poverty alleviation.

Using the index of the average growth of rural residents' consumption expenditure in 2010–2020 year-on-year to rank the performance of rural financial poverty alleviation in 21 provinces and cities in the central and eastern economic zone, among them, Hebei Province ranks first, which is 13.98%. This is because Hebei Province adheres to local conditions, implements classified policy, and constantly innovates poverty alleviation methods, which makes the poverty reduction effect of farmers prominent, and the precise poverty alleviation policy has been well implemented. The continuous development of inclusive financial policy in Hebei Province has made the poverty reduction effect of low-income farmers obvious.

5 Conclusion

The results show that improving the degree of inclusive benefit can effectively promote the increase of farmers' income. The development of inclusive finance in 21 provinces and cities such as Hebei has different effects on rural residents at different income levels, showing the characteristics of dynamic changes. For low-income rural residents, the development of rural inclusive finance has a significant role in promoting high-income farmers, and the effect of targeted poverty alleviation is obvious, which reflects that inclusive finance has different economic conditions in achieving the goal of increasing farmers' income at different income levels. Further analysis shows that inclusive financial development has a significant spatial spillover effect on farmers' poverty reduction. From

the channel level, inclusive finance can affect farmers' poverty reduction through rural economic growth and income distribution channels, and the poverty reduction effect caused by rural economic growth plays a major role in the channel mechanism. Compared with other provinces, the performance of rural financial precision poverty alleviation in Hebei Province is still insufficient in terms of the year-on-year growth of per capita disposable income of farmers, mainly because financial institutions are not willing to lend to farmers to help the poor, the diversity of farmers' financing needs, the lack of innovation in financial products for benefiting farmers and the difficulty of controlling rural financial risks. Therefore, it is necessary to give preferential and subsidies to rural financial institutions, innovate the types of credit guarantees and collateral, support some guarantee institutions for helping farmers to help the poor and carry out inclusive financial education for farmers, and pay attention to the heterogeneity of farmers' income increase at different income levels.

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