

## EXAMINING THE IMPACT OF RURAL FINANCE DEVELOPMENT ON FARMERS' INCOMES IN BUSINESS CONTEXT. EVIDENCE FROM "THE BELT AND ROAD" FROM KEY PROVINCES

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### Abstract

The gradual increase in the world population has a significant impact on businesses, productivity, and financial development in the context of rural life. As the population continues to grow, there is increasing pressure on farming systems to produce more food to meet the growing demand. In addition, the growing population can lead to an increased demand for natural resources such as water, land, and forests. This can create challenges for rural communities that depend on these resources for their livelihoods. In this study, it was determined as a problem that the financial system deepened in regions where the savings base was not large enough and the level of savings was not at the desired level. In this context, since improving the management of the rural labor structure and increasing investments in science and technology can also increase farmers' incomes, the study aims to deepen rural financial reform and increase the efficiency of the financial system in business management. In the study, the key provinces of "The Belt and Road" (except Chongqing and Tibet) were considered as research objects and 2000-2015 annual panel data were used to analyze the threshold regression model. According to the research findings, when the threshold of financial development efficiency is variable, the growth of farmers' incomes in general is prevented, when the scale of financial development is variable, the effect on farmers' incomes gradually changes from negative to positive. In line with these findings, it is recommended to strengthen the quality of education of rural workers and promote the integration of urban and rural areas, increase investments in agricultural science and technology, and improve the service system of agricultural science and technology.

**JEL classification:** I38, J4, Q1

**Keywords:** discretionary The Belt and Road Initiative; financial development efficiency; financial development scale; panel threshold regression; agricultural technology investment, business, management

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## INTRODUCTION

Rural finance, one of the main drivers of rural economic development in the modern sense, has an important role in agricultural development. Developments in rural finance can provide financial support in agricultural, scientific, technological R&D and technological transformation (Wang, 2018; Liu et al., 2021). However, the development of rural finance directly affects agricultural production, increasing production and management (Trelogan et al., 1957; Liu et al., 2021) which is able to heal effectively (Attipoe et al., 2020; Liu et al., 2021).

Climate change is also important. Increasing temperatures cause an increase in extreme weather events such as droughts, floods, storms. These weather events can also cause serious damage to agricultural production and can also trigger food production negatively. In particular, the agricultural sector is a sector that is sensitive to climate change effects such as temperature increase, water scarcity, or landslides. In this context, the fight against climate change is important for the protection of food security. To this end, it is necessary to create insight and develop policies and take measures to reduce greenhouse gas emissions. These may include solutions such as the use of renewable energy sources, increasing energy efficiency, and more sustainable agricultural methods. In addition, it is urgent to support the agricultural sector by developing agricultural practices compatible with climate change. For example, improving the minimum purchase price policy, expanding the policy insurance framework to promote continuous agricultural production, and initiating training programs to improve risk management skills. (Frederick, 2013; as cited in Shi, 2021). "The No. 1 Document of 2017 by the CPC Central Committee" pointed out that against the background of agricultural supply-side structural reform, we must continue to deepen rural fiscal reform and innovation, take the initiative to adapt to farmers' needs, agricultural characteristics and rural conditions, and further promote financial resources to serve agriculture, rural areas and farmers. This document includes several measures to carry out structural reforms in the agricultural sector and accelerate the modernization of agriculture. The document also states that financial resources should be further encouraged to develop rural areas and serve farmers. For this purpose, various measures such as financial supports, credit and insurance facilities can be taken. Thus, it is aimed to increase investments in the agricultural sector, increase agricultural production and improve the living standards of farmers. This document constitutes an important roadmap for the realization of structural reforms in the agricultural sector and the acceleration of modernization. It also points out that the government should take various policies and

and measures for the development of the agricultural sector and the development of rural areas.

"The Chinese government aims to solve the three rural (or sannong) problem that concerns agriculture, rural communities, and farmers by expanding the scope of rural policy with its "Building a New Socialist Countryside" (NSC) that aims at agricultural productivity, land use, rural income, local governance reforms, and public service delivery. Spending on rural areas almost doubled nominally between 2004 and 2007. The largest part was achieved through agricultural policy measures (55% of the total in 2007), followed by social development combining rural infrastructure (23%) and support for rural areas, as well as education, health, reducing rural poverty and rural social security (20%)" OECD, (2009).

The "Belt and Road" strategy is a fundamental strategy of China's social and economic development and opening up to the outside world. The China Belt and Road Initiative is a state-sponsored development campaign that aims to reconnect countries and revive the prosperity of the historic Silk Road region, contributing to economic integration and infrastructure building in Eurasia and beyond (Xu, 2021).

"Today, the "Belt and Road" not only carries forward the entire historical heritage of the ancient Silk Road, but also goes far beyond the field and form of cooperation. The "Belt and Road" is considered an important strategic plan for China's opening up to the outside world in the new situation" (Baohong, 2016).

After the announcement of the "Belt and Road" strategy, it is clear that the promotion of China's agricultural modernization will initiate a new opportunity for historical development in the production and life of farmers and regional economic development.

## LITERATURE REVIEW

In foreign countries, most scholars reveal the relationship between financial development and farmers' income by studying that which is between financial development and the income gap. They study from different angles in both theory and empirical aspects, and the results are divided into three main types. The first conclusion is that financial development narrows the income gap. This conclusion is the study results of most scholars. Odedokun's empirical study of data from 71 developing countries from 1960-1980 found that 85% of the samples showed that financial development contributed to economic growth. This effect in low-income countries was significantly higher than in high-income countries (Odedokun, 1996). Prete pointed out that financial development strengthens the ability to take advantage of new investment opportunities, thus narrowing the income gap (Prete, 2013). Secondly,

financial development widens the income gap. Dollar and Kraay pointed out that although trade liberalization increased the income of the poor, inflation, government consumption and financial development aggravated income inequality (Dollar & Kraay, 2003). Sehrawat and Giri (2015) used the ARDL model to analyze the data of India from 1982 to 2012, and the results showed that financial development, economic growth and inflation aggravated the income gap in India in the long and short term (Sehrawat & Giri, 2015). The third conclusion is that the relationship between financial development and income growth is an inverted U. Representatives supporting this view are Greenwood and Jovanovic (1990). According to the "inverted U" theory proposed by Kuznets, they explained that financial development would widen the income gap at the early stage of economic development. However, when the economy develops to another stage, the social income gap begins to narrow, following the "inverted U" pattern (Greenwood & Jovanovic, 1990). Kim and Lin (2011) found a nonlinear threshold effect relationship between financial development and income gap. Only when a country's financial development level reaches the corresponding threshold would financial development be conducive to narrowing the income gap. However, before reaching the threshold, financial development aggravated income inequality.

In China, most early scholars studied the relationship between rural finance and income at the national level. The research conclusion of Tao et al., (2005) shows that the increase in economic securitization ratio and financial institution credit ratio hinders farmers' income. Chun-bin and Tie-zhu (2010) pointed out that there is a long-term balanced co-integration relationship between rural financial development, economic growth, education level and rural income distribution gap. It was proposed that the rural financial scale should be expanded and credit rationing increased to narrow the income gap. Zheng and Zhao-yang (2011) conducted a dynamic analysis of panel data from 28 provinces in China. They found that financial factors widened the income gap between urban and rural areas. They proposed to narrow the income gap by reasonably guiding the surplus rural labor force and enhancing the return of rural funds. Hongyan et al., (2013) empirically analyzed China's economic data from 1983 to 2009. They found that rural financial development is the Granger reason for expanding the income gap between urban and rural areas. At the same time, the increasing number of tertiary industries reduced the income gap between urban and rural areas (Hongyan et al., 2013). At the beginning of the 21st century, many scholars' empirical analyses of this problem turned to local research. Based on the economic data analysis of Zhejiang Province from 1980 to 2008,

Fen-fen (2010) concluded that farmers' income in the province had increased yearly with the increase of rural deposits and loans. That is to say, the development of rural finance has promoted the growth of farmers' income. Xiao-yan (2012) selected the data from Sichuan Province to make an empirical study using the C-D production function to establish a mathematical model and concluded that farmers' income increased with the expansion of the financial scale but decreased with the improvement of financial efficiency. Ming-xian and Wei (2015) set up Johansen co-analysis, VEC model and pulse response function analysis on the actual data of Hunan Province from 1992 to 2013. The research showed that in addition to the financial efficiency not conducive to the increase of farmers' non-farm income, the financial structure, scale and other control variables are conducive to improving non-farm income.

The following conclusions can be drawn based on the above research at home and abroad. Firstly, foreign literature mainly discusses the relationship between financial development and the income gap in many countries from the macro level and indirectly reveals the impact of financial development on farmers' income. The research scope of domestic scholars is mainly from the national level or specific provinces under certain economic conditions. However, few take a region with special significance as the research object. Secondly, according to the production theory of western economics, the input factors can be summarized into three major factors: capital, labor and technology. Changes in each input factor will have an impact on the output.

There are many factors affecting farmers' income. Furthermore, in existing literature in the process of empirical research, most of the scholars selected the relevant indicators of financial development as "capital elements" to study, or based on this, combined with indicators related to the rural labor force as "labor elements" from two aspects of research on the influence of farmers' income, not to join the control variable "technical elements". In practical analysis, it becomes imperative whether and how to select appropriate control variables. Thirdly, in the literature on this topic, the empirical analysis mainly uses the VAR model based on Johansen cointegration test, Granger causality and other methods to study the linear relationship between rural finance and farmer income in determining the impact on rural development causal relationship in order to finance income growth of farmers VAR models since causality testing is required between variables (Qianfei & He, 2015). However, in economic development, the variables have more of a nonlinear relationship than a relatively stable single linear relationship. Based on the above deficiencies, this paper takes the 16 provinces from "The Belt and Road" as the research



objects. It applies the panel threshold regression model proposed by Hansen (1999). It takes the financial development index as the threshold variable to find the internal relationship between different stages of financial development and the increase in farmers' income. At the same time, it joins a new index, "agriculture technological investment", as the control variable. Together with the indicators of financial development and rural labor transfer, it constitutes three elements: technology, capital and labor. We explored how these three elements affect farmers' income to discuss how to develop rural finance. Hence, as to policymakers, the relevant financial institutions in the service of "three agriculture" we explore the financial precision mode to provide the reference for poverty alleviation, increasing farmers' income and improving the rural financial market has practical value.

## METHOD

The sample interval of the empirical study was 2000-2015, and the selected data were from the China

statistical yearbook of science and technology (2001-2016), China financial yearbook (2001-2016), the statistics bureau of the People's Republic of China and statistical yearbook of all provinces in 2016. In this study, it was determined as a problem that the financial system was deepened and the level of savings was not at the desired increase in regions where the savings base was not large enough. For this reason, the regions mentioned were determined as samples. The 18 provinces (cities) from "The Belt and Road" include Liaoning, Shanghai, Guangdong, Fujian, Zhejiang, Hainan, Jilin, Heilongjiang, Inner Mongolia, Yunnan, Guangxi, Qinghai, Ningxia, Shanxi, Gansu, Xinjiang, Chongqing and Tibet. Since China's finance yearbook does not collect rural financial data related to Tibet and only has data on Chongqing in a few years, the analysis in this paper does not include Chongqing and Tibet. The model was completed using Stata 13.1 software (2013), and the descriptive statistical results after taking the logarithm of each variable as shown in Table 1.

**Table 1: Descriptive statistics of variables**

Variable name	Mean	Standard deviation	Minimum	Median	Maximum
Net income per capita (Y)	8.2466	0.5632	7.2645	8.2212	9.6617
Efficiency of financial development (X <sub>1</sub> )	-0.3970	0.1633	-0.8577	-0.3873	0.4736
Scale of financial development (X <sub>2</sub> )	0.7000	0.8811	-0.8371	0.5595	4.2567
Labor transfer (Z <sub>1</sub> )	-1.2200	0.5803	-3.8347	-1.1873	-0.1951
Proportion of agricultural technicians (Z <sub>2</sub> )	-3.4364	0.6755	-5.4344	-3.3019	-2.5674
R&D input intensity (Z <sub>3</sub> )	-4.7944	0.6994	-6.5847	-4.8093	-3.2888

Source: Calculated by the authors.

## MODEL BUILDING AND VARIABLE SELECTION

### THE DEPENDENT VARIABLE (Y)

The dependent variable is the variable that is described or predicted in the regression model. This variable is assumed to be associated with the argument (Gültekin, 2013). The per capita net income of rural residents measures farmers' income index (Y). The so-called net income refers to the total income obtained from various sources after deducting the relevant taxes and fees, which can effectively reflect the income level of farmers. Considering the influence of price factors, the per capita income is uniformly adjusted to the price level in 2000 by the consumer price index of rural residents.

### THE INDEPENDENT VARIABLES (X)

The independent variable is the explanatory variable in the regression model; used to predict the value of a dependent variable (Gültekin, 2013).

(1) Efficiency of rural financial development (X<sub>1</sub>). The American economist Goldsmith's theory of financial development points out that the ratio of the loan balance to the deposit balance is the efficiency of financial development, which can be understood as the efficiency of financial institutions' allocation of funds. (Li & Hong-ming, 2010; Yu-Kui et al., 2014) and other domestic scholars also use this index to reflect the ability of financial institutions to convert deposits into loans. In this article, the rural loan-to-deposit ratio is selected

to represent the level and willingness of rural financial institutions to serve "agriculture, rural areas and farmers". The higher the value is, the higher the effective utilization rate of rural deposits will be, and the better it can show the service level in rural areas.

(2) Scale of rural financial development ( $X_2$ ). Goldsmith proposes a measure of the size of financial assets. This financial correlation ratio is the ratio of the money stock (M2) and loans (L) to the total value of securities (S) and the gross national product (GNP). Given the differences in the development of domestic credit in developing countries and other countries, combined with the reality of China's rural financial assets, FIR cannot fully reflect the development of the domestic financial market. China's rural finance mainly focuses on the deposit and loan business for a long time, and its financial performance is relatively simple. The total rural financial assets mainly consist of rural deposits and loans. Considering the research results of domestic and foreign literature and the actual situation of rural financial assets in China, this paper selects the ratio of the sum of rural savings and loans to rural GDP in the same period as the index to measure the scale of rural financial development. The larger the index value is, the greater the rural financial support for "agriculture, rural areas and farmers" will be.

### CONTROL VARIABLES

(1) Rural labor transfer ( $Z_1$ ). It is an important indicator to reflect the level of rural production development. The higher the value, the higher the degree of rural urbanization, the higher the allocation efficiency of production factors, and the better the rural employment structure.

In a narrow sense, investment in science and technology refers to the investment to support the development of science and technology activities, including the sum of human and financial resources. (2) Input of agricultural technical personnel ( $Z_2$ ) and input of fund input ( $Z_3$ ). Due to the need for appropriate research input data and relevant statistical indicators in the agricultural field in various provinces, this paper analyzes the contribution of agricultural science and technology input to increasing farmers' income. It plans to use the proportion of agricultural professional and technical personnel in the total professional and technical personnel and the intensity of R&D expenditure to reflect the status of agricultural science and technology input.

### CONSTRUCTION OF PANEL THRESHOLD REGRESSION MODEL

According to views from Greenwood and Jovanovic (1990), in the early stage of economic development, financial development will widen the income gap. When the economy develops to another stage, the

social income gap begins to narrow, following the "inverted U" pattern.

According to the Environmental Kuznets curve (EKC) hypothesis, while per capita income increases in a country, environmental damage first increases and then decreases (Stern, 2004; as cited in Bilgili et al., 2019). The EKC relationship takes into account an inverse U-shaped curve that addresses the complex relationship between environmental degradation and income. An inverse U-shaped EKC hypothesis is defined in a more general sense as the low-income situation of a country where the economy is developing, first increasing environmental pollution and then slowing down to an income level threshold. After reaching this certain (threshold) income level, it turns out that this situation is an improvement in the environmental sense (Grossman & Krueger, 1995; Solarin et al., 2017; Stern, 2004; as cited in Bilgili et al., 2019).

This article proposes the hypothesis that different stages of financial development influence farmers' income. Specifically, in the primary stage, rural financial development is relatively backward. Due to severe information asymmetry and high transaction costs, farmers have low incomes and a lack of mortgage assets. Therefore, farmers have a high threshold for obtaining credit, which restricts income growth. In the medium term, with the development of the financial market, the financial scale gradually expands, farmers have more credit financing channels and lower borrowing thresholds, and financial exclusion gradually disappears. Farmers enjoy financial services, which help them to increase their income. In the mature stage, the financial market is further improved, the threshold of farmers' access to credit is minimized, and the role of financial development in promoting farmers' income is maximized.

The advantage of the threshold regression model is that it can capture the critical point or interval where the economy may jump, and the system's structural mutation point of the threshold variable is internally determined by the system, which avoids the subjectivity determined by a human. The analysis is relatively objective, and the fitting effect is more practical than ordinary linear regression (Qiang, 2014). Threshold regression models are a different, non-regular set of regression models, all of which depend on points of change or thresholds, so they are interpreted because they model specific nonlinear relationships between the outcome and the predictor (Fong et al., 2017).

Hansen (1999) put forward the independent sampling method to test the significance of the threshold effect. Based on this idea, this paper constructed the panel threshold regression model of the relationship

between rural financial development and farmer income.

$$Y_{it} = \mu_i + \alpha_1 X_{it} * I(q_{it} \leq \gamma) + \alpha_2 X_{it} * I(q_{it} > \gamma) + \beta Z_{it} + \varepsilon_{it}, \varepsilon_{it} \sim i.i.d(0, \sigma^2) \quad (1)$$

Where  $i$  is an individual;  $t$  is time;  $Y_{it}$  is the dependent variable, i.e., the per capita net income of rural residents ( $Y$ );  $X_{it}$  is the independent variable of rural financial development efficiency ( $X_1$ ) and scale ( $X_2$ ).  $Z_{it}$  refers to control variables, namely rural labor transfer ( $Z_1$ ), the proportion of agricultural professional and technical personnel ( $Z_2$ ), and R&D expenditure intensity ( $Z_3$ ).  $q_{it}$  is the threshold variable;  $\gamma$  is the threshold value of dividing the equation into two slopes  $\alpha_1$  and  $\alpha_2$ ;  $\mu_i$  means individual effect;  $\varepsilon_{it}$  is the random interference factor.

In order to estimate model threshold  $\gamma$  and parameter  $\alpha$ , individual effect  $\mu_i$  needs to be eliminated, let:

$$Y_{it} = Y_{it} - \frac{1}{T} \sum_{i=1}^T Y_{it} \quad (2)$$

Do the same for other variables, and the transformed formula is:

$$Y_{it} = \alpha_1 X_{it} * I(q_{it} \leq \gamma) + \alpha_2 X_{it} * I(q_{it} > \gamma) + \beta Z_{it} + \varepsilon_{it} \quad (3)$$

All observed values are overlapped, and the matrix form is expressed as:

$$Y = X(\gamma)\alpha + Z\beta + \varepsilon \quad (4)$$

For a particular threshold  $\gamma$ , an estimated  $\alpha$  value and the sum of squares of residuals are obtained by OLS estimation. Finally, it explored the method step by step by minimizing obtaining estimates of  $\gamma = \text{argmin} S1(\gamma)$ .

The first step of establishing a threshold regression model is to check whether there is a threshold effect, that is, to judge whether the model is linear or nonlinear. The original hypothesis of the model is that the threshold effect does not exist. If the  $p$ -value rejects  $H_0$ , it can be considered that the threshold effect exists, and threshold regression should be carried out. Based on the fixed effect, the self-sampling method of the repeated simulation was used to calculate the statistics and  $p$ -value to test whether the threshold effect exists. Considering the comparability of data and the econo-

mic significance comprehensively and to eliminate the heteroscedasticity between variables, this paper adopts the logarithmic form for the selected variables. Since there are two financial development indicators, two models are established with these indicators as threshold variables. If the threshold number in the model is two or more, the model can be adjusted appropriately.

Model 1: the single-threshold regression model with financial development efficiency as the threshold variable is:

$$Y_{it} = C + \alpha_1 X_{1it} * I(X_{1it} \leq \gamma) + \alpha_2 X_{1it} * I(X_{1it} > \gamma) + \beta_1 X_{2it} + \beta_2 Z_{1it} + \beta_3 Z_{2it} + \beta_4 Z_{3it} + \varepsilon_{it} \quad (5)$$

Model 2: the single-threshold regression model with financial development scale as the threshold variable is:

$$Y_{it} = C + \alpha_1 X_{2it} * I(X_{2it} \leq \gamma) + \alpha_2 X_{2it} * I(X_{2it} > \gamma) + \beta_1 X_{1it} + \beta_2 Z_{1it} + \beta_3 Z_{2it} + \beta_4 Z_{3it} + \varepsilon_{it} \quad (6)$$

## EMPIRICAL PROCESS AND ANALYSIS

### THRESHOLD EFFECT TEST AND ESTIMATION

The step of establishing a threshold regression model is to test whether there is a threshold effect and, if there is, to test the threshold number. The null hypothesis of the threshold regression model is that there are 0, 1, and 2 thresholds... If  $n$  ( $n = 0, 1, 2, \dots$ ) exists,  $n+1$  slope exists in the threshold variable corresponding to the model. Using Hansen's (1999) Bootstrap method, the asymptotic  $p$ -value can still be calculated when the distribution of  $F$  statistics is uncertain.

First, the unit root test of the panel shows that all variables are stable in the same order. A threshold effect test was then carried out, and the results of self-sampling 400 times are shown in Table 2. When financial development efficiency ( $X_1$ ) is taken as the threshold variable, the  $p$ -value does not accept the null hypothesis with 0 and 1 threshold values at the significance level of 10% and 5%, respectively, but accepts the null hypothesis of the third model. When the financial development scale ( $X_2$ ) is taken as the threshold variable, the  $p$ -value rejects the null hypothesis of the first two models successively at the significance level of 5% and 1%, respectively but accepts the null hypothesis of the third model. Therefore, both models have a threshold effect, and the threshold number is 2.

**Table 2: Threshold effect test of threshold variables**

Threshold variables	Threshold	Estimated value	95% Confidence interval
$X_1$	Single	11.673*	0.070
	Double	7.449**	0.050
	Triple	3.335	0.365
$X_2$	Single	34.598**	0.040
	Double	27.920***	0.010
	Triple	5.646	0.120

Note: \*, \*\*, \*\*\* means significant at the levels of 10%, 5% and 1%, respectively

Source: Calculated by the authors.

After determining the threshold number, estimate the threshold value. As shown in Table 3, when  $X_1$  is the threshold variable, the first threshold value is -0.553, and the corresponding 95% confidence interval is [-0.617, -0.420]. The second threshold value is -0.200, the corresponding 95% confidence interval [-0.502,

0.100]. When  $X_2$  is the threshold variable, the first threshold value is 0.688, and the corresponding 95% confidence interval is [0.151, 1.342]. The second threshold value is 1.073, and the corresponding 95% confidence interval is [1.060, 1.195].

**Table 3: Threshold value estimation of threshold variables**

Threshold variables	Threshold	Estimated value	95% Confidence interval
$X_1$	Threshold 1	-0.553	[-0.617, -0.420]
	Threshold 2	-0.200	[-0.502, 0.100]
$X_2$	Threshold 1	0.688	[0.151, 1.342]
	Threshold 2	1.073	[1.060, 1.195]

Source: Calculated by the authors.

**PANEL THRESHOLD REGRESSION ANALYSIS OF FINANCIAL DEVELOPMENT EFFICIENCY**

After determining the threshold value and number, the regression results in Table 4 are obtained. Firstly, threshold variable  $X_1$  was observed. When the financial development efficiency was at a low stage, i.e.,  $X_1$  was less than -0.553, its coefficient was significantly negative, indicating that financial efficiency inhibited farmers' income increase at this stage. Financial institutions fail to well serve rural funds for the construction of "agriculture, rural areas and farmers", so it is difficult for farmers' income to increase. When the financial development efficiency crosses the first threshold but

is lower than the second threshold, its coefficient is still significantly negative, and the absolute value is greater than the low-level stage, indicating that the phenomenon that the increase of financial efficiency inhibits the income increase of farmers in this stage is further worsened. When the financial development efficiency is at a higher stage, when  $X_1$  is greater than -0.200, its coefficient changes from negative to positive, indicating that the financial development efficiency starts to play a role in promoting farmers' income. Although the coefficient is not statistically significant, it at least indicates that financial development no longer inhibits farmers' income.

**Table 4: Regression estimation results when  $X_1$  is the threshold variable**

Variable	Coefficient	Standard deviation	t-value
Scale of financial development ( $X_2$ )	0.1263**	0.0544	2.32
Labor transfer ( $Z_1$ )	0.4146***	0.0650	6.38
Proportion of agricultural technicians ( $Z_2$ )	0.4049***	0.1435	2.82
R&D input intensity ( $Z_3$ )	0.7429***	0.0689	10.78
Efficiency ( $X_{1t} \leq -0.533$ )	-0.4367***	0.1450	-3.01
Efficiency ( $-0.533 < X_{1t} \leq -0.200$ )	-0.7558***	0.1789	-4.22
Efficiency ( $X_1 > -0.200$ )	0.5261	0.4111	1.28
Constant (C)	13.3536***	0.6820	19.58

Note: \*, \*\*, \*\*\* means significant at the levels of 10%, 5% and 1%, respectively

Source: Calculated by the authors.



Secondly, another financial variable is observed. The financial scale includes the ratio of rural deposits and loans to rural GDP. The higher the total amount of deposits and loans, the more funds farmers can finance, which improves farmers' ability to resist risks and makes it easier to increase income through agricultural activities. The expansion of the financial scale has a significant positive effect on farmers' income; that is, it is conducive to increasing farmers' income.

Finally, by observing other control variables, it can be found that the coefficients of labor force transfer ( $Z_1$ ), agricultural technical personnel ratio ( $Z_2$ ) and R&D investment intensity ( $Z_3$ ) are all positive at the significant level of 1%. In the past two decades, with a large number of the rural labor force going out for work and the rise of township enterprises, the rural labor force has gradually shifted from the agricultural sector to other sectors, significantly changing the structure of the rural labor force, improving labor efficiency and creating more wealth. Therefore, with the acceleration of the urbanization process and the gradual development of township enterprises, the number of rural people who go out for work increases. Thus the increase in wage income accelerates. With the popularization of agricultural machinery products, agriculture's dependence on the labor force is significantly weakened. Therefore, improving the employment structure in-

creases farmers' income channels, and their income creases accordingly. At the same time, the government's investment in agriculture, including the increase in agricultural technicians employed by government agencies and enterprises, and the increase in the investment in R&D, has dramatically improved the efficiency of agricultural production and increased farmers' income.

**PANEL THRESHOLD REGRESSION ANALYSIS OF FINANCIAL DEVELOPMENT SCALE**

Regression results with the financial development scale ( $X_2$ ) as the threshold variable are shown in Table 5. Let us first look at the threshold variable  $X_2$ . When the scale of financial development is at a low level, that is,  $X_2$  is less than 0.688, its coefficient is significantly negative, indicating that the expansion of financial scale inhibits farmers' income increase at this stage. When the scale of financial development crosses the first threshold but is lower than the second threshold, its coefficient changes from -0.4116 to -0.1448, indicating that the phenomenon of financial scale inhibiting income increase at this stage has been alleviated. When the scale of financial development is at a higher stage, its coefficient changes from negative to positive, indicating that the expansion of the financial scale promotes the income increase of farmers at this stage.

**Table 5: Regression estimation results when  $X_2$  is the threshold variable**

Variable	Coefficient	Standard deviation	t-value
Efficiency of financial development ( $X_1$ )	-0.1217	0.1662	-0.73
Labor transfer ( $Z_1$ )	1.2080***	0.1213	9.96
Proportion of agricultural technicians ( $Z_2$ )	0.2030**	0.1531	2.82
R&D input intensity ( $Z_3$ )	0.8449***	0.0904	9.35
Scale ( $X_2 \leq 0.688$ )	-0.4116***	0.0990	-4.16
Scale ( $0.688 < X_2 \leq 1.073$ )	-0.1448*	0.0829	-1.75
Scale ( $X_2 > 1.073$ )	0.1261**	0.0605	2.08
Constant (C)	13.7443***	0.7977	17.23

Note: \*, \*\*, \*\*\* means significant at the levels of 10%, 5% and 1%, respectively

Source: Calculated by the authors.

In order to analyze the specific situation of each province, these provinces from "The Belt and Road" can be divided into low, medium and high levels according to the relationship between the historical financial development scale index value and the two threshold values. That is, the low level occurs when , the medium level occurs when, high level occurs when We can take 2000 year and 2015 year as examples. As shown in Table 6, in 2000, 12 provinces were lower than the first threshold, most of which were in the western region. One province is between two thresholds, namely Shaanxi province. Three provinces are higher than the second threshold value, namely

and Shanghai, which all belong to the eastern provinces. By 2015, seven provinces were lower than the first threshold, four were between the two thresholds, and five were higher than the second threshold. Among them, the financial scale of western provinces has developed rapidly in the past ten years. Moreover, Shanghai's financial development scale is much larger than other provinces, leading the way. On the whole, the scale of financial development in most provinces is expanding, and the scale of financial development in more and more provinces plays a positive role in the impact of farmers' income.



**Table 6: Financial development scale of "The Belt and Road" province in 2000 and 2015**

Year	Liaoning	Shanghai	Zhejiang	Fujian	Guangdong	Hainan
2000	0.6591	2.0816	1.2525	-0.2861	1.4355	-0.8127
2015	0.2882	4.2567	0.7210	0.3781	0.7123	0.3123
Year	Jilin	Heilongjiang	Inner Mongolia	Guangxi	Yunnan	Shanxi
2000	-0.2189	-0.0598	-0.4744	-0.2785	0.0876	0.8669
2015	-0.0017	0.3189	0.4899	0.7437	1.3830	1.2015
Year	Gansu	Qinghai	Ningxia	Xinjiang		
2000	0.2012	-0.4810	0.0413	-0.7974		
2015	1.2340	0.7791	1.0892	0.5878		

Source: Calculated by the authors.

Next, look at another financial variable, X1. As shown in Table 6, although the financial development efficiency has a negative effect on farmers' income, the value of this series is not statistically significant. However, combined with Table 4, it can be inferred that this variable inhibits farmers' income increase.

Finally, observe other control variables. As shown in Table 6, it can be found that both labor force transfer ( $Z_1$ ) and R&D input intensity ( $Z_3$ ) have positive effects on farmers' income at a significant level of 1%. In comparison, the proportion of agricultural technical personnel ( $Z_2$ ) positively affects income at a significant level of 5%. On the whole, the effect of these factors on farmers' income is consistent with Table 4.

## CONCLUSIONS AND SUGGESTIONS

### CONCLUSIONS

In this article, the panel data from 2000 to 2015 were used to study the nonlinear influence of rural financial development on farmers' income of provinces from "The Belt and Road". Two indicators, financial development efficiency and scale, were set as threshold variables, respectively, and their threshold regression models were established to study the relationship between them. The conclusions are presented below:

First, the test finds two thresholds in the model when financial development efficiency is taken as the threshold variable. These two values divide the efficiency of financial development into three different intervals. In the first two intervals, the efficiency of financial development inhibits farmers' income increase, and the second interval is worse than the first interval. In the third interval, its increase in farmer income expression is the stimulative effect. The coefficients of other control variables are significantly positive.

Second, when taking the scale of financial development as the threshold variable, the test found that the model also had two thresholds. When the value of the financial development scale is less than 0.688, between 0.688 and 1.073, and greater than 1.073, the impact

coefficients of this index on farmers' income are -0.4116, -0.1448 and 0.1261, respectively, indicating that the impact of financial development scale on farmers' income gradually turns from negative effect to positive effect, which is consistent with the results of the research hypothesis. The coefficients of other control variables are also positive.

Third, through comparative analysis of a financial development scale of various provinces in 2000 and 2015 years, we found that the financial development scale of provinces is expanding overall. Furthermore, the financial scale of most provinces is down relative to the negative influence on the farmers' income. Some effects in provinces have been negative to positive. It shows the rural financial market in benign development to a certain extent. At the same time, we must realize that in the current "The Belt and Road" nearly half of the provinces are at the low-level stage, financial development scale across the inflection point, the performance of increasing farmers' income has an inhibitory effect. Therefore, according to the allocation of regional financial resources at different stages of development in enterprises, increasing the efficiency of resource use is a problem that needs to be solved. The financial resources necessary for the development of enterprises often vary regionally. In some regions, financial resources are more available, while in other regions there may be a shortage of resources. Therefore, it is important that the allocation of regional financial resources in the process of development of enterprises is carried out fairly and correctly. However, it is not enough to allocate financial resources correctly. It is also necessary to use financial resources effectively and increase resource utilization efficiency for the development of enterprises. This allows businesses to achieve greater efficiency and profitability by making the best use of the resources they have. In order to increase resource utilization efficiency, enterprises need to plan, manage and monitor resources correctly. It is also important for businesses to invest in technological innovations and efficiency-enhancing methods.

## SUGGESTIONS

This paper analyzes the impact of rural financial development, rural labor transfer and agricultural technology investment on farmers' income from three aspects.

### DEEPEN RURAL FINANCIAL REFORM AND IMPROVE THE OPERATING EFFICIENCY OF THE FINANCIAL SYSTEM

In recent years, the loan-to-deposit ratio of rural credit cooperatives in all provinces has decreased yearly. This reflects the insufficient efforts of rural financial institutions to support agriculture, low efficiency of resource allocation and severe capital outflow, leading to the widening income gap between urban and rural areas. The reason is that profit-driven financial institutions, especially in the central and western regions and provinces, and the apparent phenomenon of "preferring the rich to the poor" exists in financial institutions, such as banks. It is difficult for farmers of low and middle-income groups to get loans, and their capital needs cannot be fully satisfied, which inhibits the increase of local farmers' income. In this regard, the government can spontaneously organize peasant households or rural enterprises to establish loan guarantee funds. The government can give appropriate support to ensure that peasant households or rural enterprises can smoothly obtain loans when they need significant funds for production and operation activities. Employing monetary and fiscal policy, the regulation of banks should be relaxed to reduce the risk of rural financial institutions. Adopt financial allocation, interest rate subsidies, reduce business tax, exemption from interest tax and other preferential policies to encourage banks to return funds to rural areas and improve the efficiency of capital use. It is stipulated that a sufficient proportion of the deposits absorbed by rural financial institutions must be retained for agricultural production loans to control the outflow of funds at the source.

The model shows that with the expansion of the financial scale, its negative effect on farmers' income weakens and even starts to produce a positive effect. After comparing the financial development scale of various provinces, it is found that most provinces are in the middle and low-level stages. Hence, their positive effect on farmers' income has yet to be exerted. Therefore, we should vigorously promote the reform of the rural financial system, expand the total financial assets, and improve service quality. Due to the apparent difference in economic development in different regions, corresponding countermeasures must be put forward according to the characteristics of each region. Liaoning, Shanghai, Zhejiang and other eastern regions enjoy rapid economic development, relatively developed

financial markets and sound financial infrastructure. Based on existing advantages, they focus on developing high-quality customers and providing preferential loans. For high-income farmers, they can develop medium- and short-term investment financial products and large credit products. For Jilin, Heilongjiang, Gansu, Ningxia and other provinces in the central and western regions, which are relatively backward in development, financial technology means such as mobile banking, online banking, telephone banking and POS machines are used to meet various needs. The bank card business has been developed, and ATMs have low cost and high efficiency. ATMs can be launched selectively according to the road setting and population distribution in rural areas to help farmers quickly realize small deposits and withdrawals, business inquiries, inter-bank transfers and remittances in different places and improve the service efficiency of the financial system.

### IMPROVE THE QUALITY EDUCATION OF RURAL WORKERS AND PROMOTE THE INTEGRATED DEVELOPMENT OF URBAN AND RURAL AREAS

The study found that the transfer of rural labor force to non-agricultural industries has a significant positive impact on farmers' income, so how to improve the quality of workers and transfer rural surplus labor is the key to improving income. To improve the quality of rural workers, we should first increase investment in education. We will provide job subsidies to teachers in rural areas in the central and western regions, encourage outstanding graduates to work as volunteer teachers in western regions, and build a team of high-quality teachers. We will reduce tuition fees for compulsory education for primary and secondary school students, invest in grants and subsidies for student loans, and increase the enrollment rate of rural children. We should strengthen adult vocational education, build long-term training bases, and carry out specialized skills training at different levels. It should be done according to the characteristics of the rural labor force and the needs of urban employers to create a comfortable and favorable environment for education and training. We will formulate relevant incentive policies, encourage enterprises to go deep into rural areas to hold training lectures for migrant workers, strengthen publicity efforts, stimulate their enthusiasm for learning, enable them to master the latest knowledge, enhance labor skills, adapt to new job requirements, and effectively transfer labor force from agriculture to other industries. We will improve labor legislation, attach importance to functional development, and eliminate employment discrimination. We will establish an employment service system with unimpeded information flow between urban and rural areas, achieve equal employment opportunities between urban and rural areas,

lower the entry threshold for specific posts, and enhance the living ability of rural migrant workers once they enter cities. We will deepen the reform of the household registration system and safeguard the legitimate rights and interests of rural migrant workers. We will gradually eliminate discrimination in policies concerning old-age care, medical care, social security and education in rural areas to narrow the gap in rights and interests enjoyed by rural and urban residents. We will improve the efficiency of rural labor market allocation, eliminate financial exclusion, and promote urban-rural integration.

#### **INCREASE INPUT IN AGRICULTURAL SCIENCE AND TECHNOLOGY AND IMPROVE THE SERVICE SYSTEM OF AGRICULTURAL SCIENCE AND TECHNOLOGY**

The results of panel threshold regression analysis show that the agricultural technical professionals and R&D investment drive the increase of farmers' income. Therefore, we should continue strengthening the input of human and financial resources in agricultural science and technology and give full play to its contribution to rural economic growth. The government should increase investment in science and technology funds, make clear the proportion of agricultural science and technology funds, increase fiscal expenditure in this regard, deepen the reform of the scientific research management system, strengthen supervision over the use of funds and project progress, attach importance to agricultural technology innovation, and ensure that funds are used in real terms. The essence of any competition is the competition of talents. It is the key to promoting the progress of agricultural technology to establish a high-level and high-quality team of scientific

and technological talents. In recent decades, the proportion of agricultural technical professionals in provinces from "The Belt and Road" has remained unchanged. Compared with developed countries abroad, agricultural research and development equipment needs to be more advanced, and the number is small, which has caused particular difficulties in the research and development and promotion of agricultural technology.

On the whole, China's agricultural research personnel welfare treatment is not high, and the working environment is challenging, exacerbating the loss of agricultural technical personnel. Therefore, the government needs to increase economic subsidies to agricultural technicians to improve the working environment. We should emphasize the re-education and training of technical personnel, establish a scientific and reasonable personnel management system, clarify the responsibilities of all staff members, strengthen supervision and management, and cultivate the consciousness of innovation, service and responsibility of scientific research personnel. We will support cooperation between research institutes, local colleges and universities and production enterprises to form an integrated supply and demand chain of technologies, encourage the spread and application of innovation, and contribute to the development of the agricultural economy. In summary, rural finance development can play a critical role in supporting the growth and development of rural businesses, including small farmers. By providing farmers with access to credit, savings and other financial services, rural finance initiatives can help increase incomes, increase productivity and improve livelihoods in rural communities.

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