

Multi-dimensional Analysis of Inclusive Finance Based on Artificial Intelligence and Satellite Data Technology

Fengge Yao¹, Zenan Qin², Xiaomei Wang^{3*}

^{1,2}Finance of School, Harbin University of Commerce, Harbin, China

³School of Tourism and Culinary Arts, Harbin University of Commerce, Harbin, China

*Corresponding author: Xiaomei Wang, E-mail:gyuemeng@163.com

Abstract: At present, research on inclusive finance issues at home and abroad has made considerable progress, but as China is currently facing epidemics and other geological disasters, the financial industry is facing huge challenges. As the transitional development of China's electronic commerce has dealt a severe blow to China's physical manufacturing industry, the people's economy has been hit hard. The establishment of inclusive finance and its system has broadened the scope of traditional financial system services and has had a greater positive impact on disadvantaged groups and small and micro enterprises. This article uses data on inclusive finance, the development of rural financial institutions, and poverty alleviation of rural households in parts of China's flood-affected areas shown by satellite images in 2020 as a sample, and builds the level of inclusive finance development from two aspects: the depth and breadth, the measurement index system. On this basis, a model for inclusive finance promotion using satellite data combined with AI algorithms was designed, and then a static panel measurement model for rural household poverty, inclusive finance and rural financial institutions was constructed from the perspective of big data. According to two measurement models, it examines the effects of the development of different types of rural financial institutions on poverty alleviation and proposes the necessary conditions for achieving inclusive finance. The results of the study show that the growth rate of inclusive finance has increased by 19.8% in seven years. Therefore, although the financial demand of various cities is increasing year by year, the growth is still relatively slow. This is mainly caused by the imbalance of the supply side of inclusive finance, because as the financial demand of consumers continues to increase, the supply side cannot meet. The corresponding financial demand will inevitably lead to a decrease in demand growth rate.

Key Words : Inclusive Finance, Artificial Intelligence, Satellite Data, Google Earth Technology

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1. Introduction

In 2020, China's new crown pneumonia epidemic stabilized in June, but then a major flood occurred in central and southern China, and China's agricultural development was severely hampered. Under the multiple blows, the people are under great economic pressure. Chinese economic circles have conducted research on the theoretical and practical issues of China's macroeconomics, and published a large number of research results, especially on the realization mechanism and path of high-quality development, macroeconomic fluctuations, monetary policy and macroeconomics under the impact of uncertainty and risk. New progress has been made in the research of prudential policy coordination, fiscal policy effects and fiscal policy transformation, governance transformation and green development, income distribution equity and macro-efficiency, external shocks under an open economy, and macroeconomic stability. However, few studies have focused on vulnerable groups that have been severely impacted by epidemics and agricultural disasters, and few studies have explored how to use artificial intelligence calculation technology to implement financial compensation for vulnerable groups to achieve inclusive finance.

In terms of inclusive finance evaluation methods, the current mainstream evaluation methods include principal component analysis method, entropy weight method, analytic hierarchy process, and coefficient of variation method. Through previous studies, it is found that the choice of research methods should be related to the complexity of the index system and the application intention of the evaluation results. Therefore, according to the indicator system and application intention selected in this article, the principal component analysis method is selected to study the inclusive financial system. Many scholars have not considered the weight difference. This method gives equal weight to each indicator, which overcomes the failure of many scholars to consider. The defect of weight difference. King RG is based on data from the US Prosper lending platform. Research shows that relying on financial technology and other means, the lending platform can mine more comprehensive corporate information, reduce information asymmetry between

en borrowers and lenders, improve the quality of financial services, and promote the real economy. Innovation and development [1]. Based on Ant Financial's micro-loan data, De Me S has found that relying on artificial intelligence, big data and other means can promote the smooth progress of corporate innovation activities [2]. Samila S found through analysis that China's poverty alleviation work has achieved great results, and inclusive finance plays an important role in it [3]. Rosenthal S mainly studies inclusive finance from the aspect of service quality, and calculated the index that affects the quality of inclusive financial services [4]. Bellellamme P's research on the indicator system of financial inclusion is carried out from the four dimensions of penetration rate, availability, utilization rate and service quality [5]. Lazear E used principal component analysis to study the development of inclusive finance in various provinces in China [6].

In terms of the influencing factors of inclusive finance, Cagetti used the VEP model to empirically analyze the impact of inclusive finance on poverty eradication of farmers [7]. Glaeser E studied the positive impact of China's digital finance on the development of inclusive finance promoted by Internet development and digital economy in recent years [8]. Ahlstrom D mentioned that the focus of inclusive finance is to provide small and micro enterprises, farmers and other disadvantaged groups with their affordable financial products, and to provide people with more economic opportunities, thus pushing the economy onto the track of sustainable development[9]. In terms of factors affecting the development of inclusive finance, Aghion P's research believes that a good regulatory mechanism and a sound financial system can significantly promote the development of inclusive finance [10]. Elhorst JP examined the degree of influence of rural residents' financial literacy on the development of inclusive finance. In addition, the research integrates social enterprise embeddedness and digital finance into the conceptual model, and further studies how it affects the development of inclusive finance [11].

This paper takes into account the weight of indicators when choosing the measurement indicator system for inclusive finance. Therefore, the principal component analysis method is adopted. On this basis, the

poverty level of farmers in multiple provinces is measured from the three aspects of economic poverty, education poverty and social poverty. The static panel measurement models of rural household poverty, inclusive finance and rural financial institutions are developed. According to the econometric model, it examines the effects of the development of different types of rural financial institutions on poverty alleviation, and proposes the necessary conditions for achieving inclusive finance. The establishment of inclusive finance and its system has broadened the scope of traditional financial system services and has had a greater positive impact on disadvantaged groups and small and micro enterprises.

2. Inclusive Finance and Smart Technology

2.1 Current Status of Inclusive Finance

Since the introduction of inclusive finance into China, it has always been the development and deepening of traditional finance. If we want to redefine the positioning of inclusive finance in depth, we should clarify the current general classification of finance [12]. The current finance is divided into policy, commercial and cooperative finance, and different types of finance have different goals and value propositions [13]. If inclusive finance is positioned only to support small and micro enterprises and socially disadvantaged groups and to emphasize social popularity, there is a disadvantage in that, if support and sociality are overemphasized, then marketization principles and finance and profit. Sustainability will inevitably be ignored. For example, after the Indian Development Bank overemphasized policy, it led to the breeding of corruption and waste of resources. On the contrary, the real poor did not receive financial services [14]. Therefore, inclusive finance is not simply policy-based finance, nor is it a financial behavior that only relies on government support. Inclusive finance also requires market-oriented and invisible hands [15]. If inclusive finance is positioned as commercial finance, then behaviors such as "dislike the poor and love the rich", "mission drift" and information asymmetry will surely exclude the disadvantaged groups in society [16]. However, the development of inclusive finance is inseparable from the role of commercial banks. The ingestion of profits is for the sustainable development of

financial institutions, so its commercial nature should be taken for granted. Therefore, inclusive finance is not purely commercial finance. It should have the attributes of commercial finance and a form of "small profits but quick turnover" [17].

Cooperative finance refers to financial behavior based on the complementary and interactive goals of the first two. If inclusive finance is positioned as a financial behavior that supports socially disadvantaged groups and enables the sustainable development of commercial financial institutions, it is completely cooperative [18]. However, as mentioned above, the connotation of inclusive finance is not only the disadvantaged groups in society, it should also include non-vulnerable groups and informal financial institutions. If inclusive finance is positioned as cooperative finance, the non-vulnerable. Including groups and informal financial institutions, then the positioning of inclusive finance is more one-sided, not full and specific [19].

In fact, the positioning of inclusive finance is a form of shared sustainable development finance that highly includes the above-mentioned three kinds of financial distinctions, highly conforms to the Chinese development philosophy, and highly conforms to the socialist thinking with Chinese characteristics in the new era. First of all, its positioning height includes the three distinctions of the above-mentioned financial [20]. As far as the enterprise life cycle theory is concerned, when the enterprise is in the initial stage, at this time inclusive finance should be positioned as policy-based finance, because at this time the enterprise needs policy support, which can be described as "poverty alleviation"; when the enterprise is in the growth stage, at this time. Inclusive finance should be positioned as cooperative finance, because at this time companies can gradually realize their own profits and losses, which can be described as "poverty relief"; when the company is in a mature period, then inclusive finance should be positioned as commercial finance, because at this time the company can already. Fully achieve self-financing, it can be described as getting rich [21]. Therefore, the positioning of inclusive finance is not just a pure financial distinction, but a sustainable financial behavior that runs through the "life cycle" [22]. Inclusive finance breaks out of the framework of the original traditional

financial system and can be described as innovation; one of the main goals of inclusive finance is to transform the pyramid structure of society, which can be described as coordination; the connotation of inclusive finance includes all consumers and suppliers, and it can be described as open [23]. It can also meet the growing consumption needs of the people and promote the overall development of people. After redefining the connotation and positioning of inclusive finance, inclusive finance refers to a kind of financial institutions for all financial consumers, but more focused on vulnerable groups in society provide financial forms that can obtain financial products and services at low cost and realize the sustainable development of financial institutions, integrating policies, commerce and cooperation [24].

2.2 Satellite Data Collection Technology and Financial Services for Agricultural Disasters

At present, the application of big data, artificial intelligence and Internet of Things technology has transformed traditional agriculture into smart agriculture. With the full coverage of the earth by meteorological satellites, the accuracy of agricultural disaster prediction has also been greatly improved. At the same time, the widespread application of IoT sensors enables effective collection of all data in the agricultural production process. Machine learning, mining and analysis of climate data collected by satellites and agricultural data collected by Internet of Things technology can help agricultural producers provide correct production decisions and minimize the loss of agricultural production caused by agricultural disasters. The main application scenario of satellite data in smart agriculture is agricultural financial services. Satellite data provides technical support for rural financial institutions. Specifically, commercial banks can estimate crop yields in the region based on satellite data. First, they can determine reasonable credit lines for farmers to control the generation of non-performing loans. Second, it can promote the research and development of agricultural loan products and the optimization of financial services, and in-depth understanding of the use of funds of farmers, thereby improving customer experience. Insurance companies can also use satellite data to build mathematical models to assess losses in the affected

areas. To sum up, through satellite data and artificial intelligence technology, the availability, usability and service quality of inclusive finance can be improved in all aspects.

In terms of technology, how to achieve accurate transmission of satellite data to financial institutions is a technical problem. Traditional real-time monitoring systems for agricultural disasters are often centralized systems, that is, operations such as data collection, calculation, and storage are all performed on a server [25]. With the automatic collection of agricultural disaster data, the rapid increase in the number of monitoring points, and the cross calculation between multiple monitoring points, traditional centralized systems can no longer meet the transmission and calculation of this amount of data. The analysis needs to be done by a more efficient processing method. The satellite system design is based on non-blocking input/output (NIO) data transmission service to solve the problem of high concurrency data transmission, and realizes the distributed real-time calculation of satellite data through the distributed data calculation service, and solves the massive satellite data under a large number of monitoring points. Real-time processing of problems can achieve accurate transmission of satellite data to financial institutions. The smart city module of the Beidou satellite system includes a city model, which can be used to visualize AI analysis and modeling of the financial system. Since the calculation of GNSS satellite data requires a lot of computing resources, the satellite system uses a distributed architecture to distribute the satellite solution data to multiple solution servers to run, which can not only reduce the cost of system operation, but also solve a large number of. At the same time, the massive data under the monitoring points are solved, which causes the whole system to slow down or even stop running. Satellite systems deploy data solution services in a distributed manner, and generally deploy them on multiple solution servers.

2.3 Dagum Gini Coefficient

The Dagum Gini coefficient can reflect the degree of income distribution difference. This article uses this coefficient to analyze the economic characteristics of local areas of inclusive finance. The Dagum Gini coefficient can avoid the limitations of the traditional

Gini coefficient and Theil index, fully reflect the distribution of sub-samples, and solve the problem of overlap between sample data. Its general form is as follows:

$$G = G_w + G_{nb} + G_t \quad (1)$$

$$G = \frac{\sum_{j=1}^k \sum_{h=1}^k \sum_{i=1}^{n_j} \sum_{r=1}^{n_h} |y_{ji} - y_{hr}|}{2n^2u} \quad (2)$$

The definition of the overall Gini coefficient is shown in formula (2), among them, y_{ji} is a city group j is the level of digital financial inclusion in any city within u is the average value of the development level of digital financial inclusion in urban agglomerations, n is the number of cities, k is the number of city clusters, h is a city group j is the number of inner cities. The local average sorting algorithm for urban agglomerations is as follows:

$$u_h \leq u_j \leq \dots \leq u_k \quad (3)$$

$$G_{jj} = \frac{\frac{1}{2u_j} \sum_{i=1}^{n_j} \sum_{r=1}^{n_j} |y_{ji} - y_{jr}|}{n_j^2} \quad (4)$$

$$G_w = \sum_{j=1}^k G_{jj} p_j s_j \quad (5)$$

In formula (3), the ranking is first based on the average value of the development level of digital financial inclusion in the urban agglomeration. Equations (4) and (5) respectively represent j gini coefficient in urban agglomerations i contribution of differences within urban agglomerations.

$$G_{jh} = \frac{\sum_{Z=1}^{h_j} \sum_{r=1}^{n_h} |y_{ji} - y_{hr}|}{n_j n_h (u_j + u_h)} \quad (6)$$

$$G_{nb} = \sum_{j=2}^k \sum_{h=1}^{j-1} G_{jh} (p_j s_h + p_h s_j) D_{jh} \quad (7)$$

$$G_t = \sum_{j=2}^k \sum_{h=1}^{j-1} G_{jh} (p_j s_h + p_h s_j) D_{jh} (1 - D_{jh}) \quad (8)$$

Equation (8) represents the hypervariable density. In this equation, $(j=1, 2, \dots)$, $(j=1, 2, \dots)$, are urban agglomerations j and urban agglomerations h internal unit digit financial inclusion development indicators. The relative influence of is defined as the formula (9)-(11):

$$D_{jh} = \frac{d_{jh} - P_{jh}}{d_{jh} + P_{jh}} \quad (9)$$

$$d_{jh} = \int_0^\infty dF_j(y) \int_0^y (y-x) dF_h(x) \quad (10)$$

$$d_{jh} = \int_0^\infty dF_h(y) \int_0^y (y-x) dF_j(x) \quad (11)$$

2.4 Kernel Density Estimation Method

This paper uses the kernel density estimation method to analyze the impact of digital financial inclusion on the innovation capabilities of small, medium and micro enterprises, thereby establishing an econometric model:

$$f(x) = \frac{1}{Nh} \sum_{i=1}^N k\left(\frac{X_i - x}{h}\right) \quad (12)$$

$$k(x) = \frac{1}{\sqrt{2\pi}} \exp\left(-\frac{x^2}{2}\right) \quad (13)$$

$$h_t = \tanh(w_c x_t + u_c (r_t \Theta h_{t-1}) + b_c) \quad (14)$$

$$h_t = z_t \Theta h_{t-1} + (1 - z_t) \Theta h_t \quad (15)$$

Among them, the explained variable h_t represents the innovation capability of an enterprise. It usually measures enterprise innovation in terms of innovation input and innovation output. Earnings management, outsourcing and other factors may affect the authenticity

of the enterprise's innovation input data, and the existing relevant databases for companies such as research expenses. There are errors and deficiencies in the statistics of innovation input data. The main verification methods of the convergence mechanism are the convergence model and the convergence model. Convergence refers to the dynamic change process of the dispersion of urban digital financial inclusion. Specifically, this paper defines the convergence model as follows:

$$\sigma_t = \frac{\sqrt{\frac{1}{n} \sum_{i=1}^n (FI_{it} - FI_{it})^2}}{FI_{it}} \quad (16)$$

$$u_{(j|i)} = w_{ij} A_i \quad (17)$$

$$s_j = \sum_i c_{ij} u_{(j|i)} \quad (18)$$

Among them, i represents the region, t represents the year, F represents the digital financial inclusion index in the i region in year t , and s refers to the average value of the digital financial inclusion index during the t period.

$$\ln\left(\frac{FI_{it}}{FI_{it}-1}\right) = \alpha + \beta \ln FI_{it} - 1 + v_i + \mathfrak{I}_t \quad (19)$$

$$c_{ij} = \frac{e^{b_{ij}}}{\sum_k e^{b_{ik}}} \quad (20)$$

When the bank agrees to the loan, the investment project is successful and the small, medium and micro enterprise has the willingness to repay, the bank can successfully recover the loan and obtain the expected return, but whether the small, medium and micro enterprise investment project can be successful, whether it has the ability and willingness to repay belongs to the bank. Exogenous variables of decision-making behavior. In order to further study the adjustment effect of corporate financing constraints, this paper constructs the following model:

$$r = \frac{\alpha}{1-\beta} \quad (21)$$

$$\theta = -\frac{1}{T} \ln(1+\beta) \quad (22)$$

$$\tau = \frac{\ln(2)}{\theta} \quad (23)$$

In formula (23), τ index is used to measure the degree to which companies face financing constraints. When multiple companies control some economic characteristic variables, the development of digital financial inclusion in different regions will eventually converge to their respective steady-state levels. Expressed by an equation:

$$\ln\left(\frac{FI_{it}}{FI_{it}-1}\right) = \alpha + \beta \ln FI_{it} - 1 + \phi X_{it} - 1 + v_i + \tau_t \quad (24)$$

$$k_{t1}[i] = \sum_j \cos(w_i^1, w_j^2) \quad (25)$$

Among them, X represents the external influencing factor variable matrix as the corresponding coefficient matrix. If it is significantly less than 0, the regional digital financial inclusion tends to converge, that is, conditional convergence exists.

3. Research and Design on the Development of Digital Inclusive Finance in Urban Agglomeration

3.1 Research Model and Data

This paper uses data related to inclusive finance, the development of rural financial institutions, and poverty alleviation of rural households in central China in 2020 as samples, and constructs an indicator system for measuring the development level of inclusive finance from two aspects: the depth and breadth of inclusive finance. On this basis, this article uses the Python language Scrapy framework to obtain image data in Google Earth, central and southern China, and then uses Baidu's artificial intelligence AI Studio platform (updated on November 19, 2020). China's agricultural

disasters and the implementation of inclusive finance. Then, the poverty degree of farmers in multiple provinces was measured from economic poverty, education poverty and social poverty, and a static panel measurement model of farmers' poverty, inclusive finance and rural financial institutions was constructed. In the selection of the index system of inclusive finance, this paper uses the IFI index proposed by MandiraSarma to measure the development level of inclusive finance, and generally selects indicators from the two dimensions of supply and demand. This paper uses principal component analysis to establish an index system for inclusive finance.

3.2 Research Content and Steps

Use existing literature research ideas and research methods for reference to construct a measurement model, Model I and Model II:

$$Y_{it} = \alpha_0 + \alpha_1 AF_{it} + \alpha_2 IFI_{it} + \alpha_3 IFI_{it}^2 + \alpha_4 GOV_{it} + \alpha_5 PI_{it} + \alpha_6 RM_{it} + \alpha_7 AM_{it} + \alpha_8 FG_{it} + \alpha_9 FP_{it} + \alpha_{10} FR_{it} + \alpha_{11} FM_{it} + \varepsilon_{it} \tag{26}$$

$$Y_{it} = \beta_0 + \beta_1 NAF_{it} + \beta_2 TAF_{it} + \beta_3 (NDNAF)_{it} + \beta_4 (DTAF)_{it} + \beta_5 GOV_{it} + \beta_6 PI_{it} + \beta_7 RM_{it} + \beta_8 AM_{it} + \varepsilon_{it} \tag{27}$$

Model I is used to examine the effect of the overall development level of rural financial institutions on poverty alleviation, where Y is the explained variable, which represents the poverty level of rural households; AF is the explanatory variable, which is calculated by the above method; factors for alleviating rural poverty. The control variables GOV, PI, RM, and AM are set in the model to indicate local fiscal expenditure, agricultural development level, rural transportation infrastructure, and agricultural modernization level.

In order to capture the characteristics of poverty alleviation by the level of inclusive finance development, IFI2 is set in the model. Whether α_3 is significant or not can determine whether the nonlinear relationship exists; if the result of the model estimation shows that α_3 is significant, and $\alpha_1 > 0$, $\alpha_3 < 0$, indicating that the impact of inclusive finance on the poverty level of rural households first increases and then weakens, and the effect of poverty alleviation is first weakened and then strengthened, and has a "U" relationship with the poverty alleviation effect of rural households; The effect of benefit

finance on poverty alleviation is to first strengthen and then weaken, and the relationship between the two is "inverted U". FF, FG, FP, FR, and FM respectively represent the interaction items between rural finance and inclusive finance, the interaction items with local fiscal expenditures, the interaction items with the development of the primary industry, the interaction items with the transportation infrastructure, and the level of agricultural modernization. The purpose of setting the set of variables is to analyze whether the control variables will affect the poverty reduction effect of rural financial institutions.

Model II is used to examine the effects of the development of different types of rural financial institutions on poverty alleviation. NAF and TAF are explanatory variables, respectively representing the development level of new rural financial institutions and traditional rural financial institutions; DNAF and DTAF are dummy variables used to reflect the development level of inclusive finance, DNAF and DTAF respectively represent inclusive finance and new rural. The interaction item of the development level of financial institutions and the interaction item of the development level of inclusive finance and traditional rural financial institutions. The purpose of setting these two variables is to distinguish the difference in poverty reduction between new rural financial institutions and traditional rural financial institutions at different levels of inclusive finance. Other variables in Model II are consistent with Model I.

The explained variables in Model I and Model II are both the index Y reflecting the level of rural poverty. Poverty of rural households is mainly reflected in the aspects of economy, education and social rights. Therefore, the level of poverty is integrated from the above three aspects. Among them, economic poverty is expressed by the per capita net income of farmers. Social poverty is reflected by the degree to which farmers enjoy social services and communicate with the society, while considering the availability of data, the ratio of the number of rural broadband access households to the total number of broadband access users in the province is selected to represent. The core explanatory variable of Model I is rural financial institution AF. Here, the ratio of total assets of new rural financial institutions NAF and TAF of traditional rural financial institutions to total

assets of financial institutions is used to express. The core explanatory variables of Model II are as mentioned above. Five control variables are set in the model, namely GOV, PI, RM, AM and IFI.

4. Satellite Data Technology Analysis of Inclusive Finance Model

4.1Data Analysis of Inclusive Finance Measurement Model

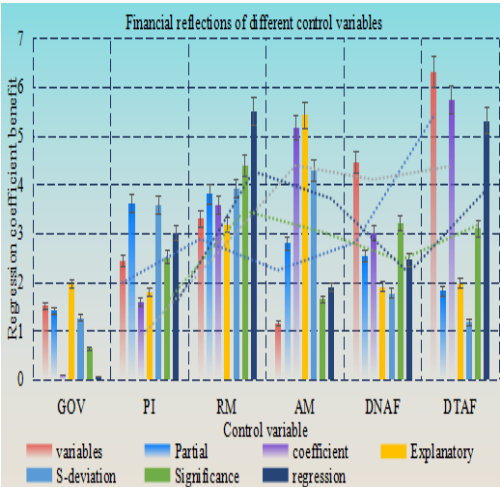


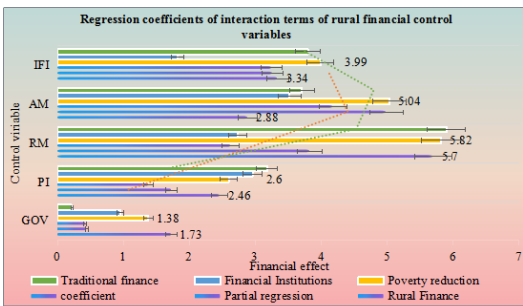
Table 1.Comparison of Agricultural Financial Index Knowledge Level

	Variables	Partial	Coefficient	Explanatory	S-deviation	Significance	regression
GOV	1.52	1.42	0.1	1.97	1.27	0.64	0.05
PI	2.44	3.63	1.6	1.81	3.59	2.52	3.02
RM	3.31	3.81	3.59	3.18	3.92	4.39	5.51
AM	1.16	2.8	5.18	5.43	4.29	1.65	1.9
DNAF	4.46	2.54	3.01	1.91	1.78	3.22	2.46
DTAF	6.32	1.82	5.73	1.98	1.18	3.1	5.32

As shown in Table 1, according to statistics from Baidu AI and Ant Financial, the level of financial knowledge of Chinese farmers is low, and this phenomenon is even more serious in ethnic autonomous areas. According to field surveys in central China, in ethnic and non-ethnic regions, farmers generally know simple financial services such as deposits and withdrawals, transfers and remittances, but have a relatively low share of financial services such as foreign exchange trading and third-party deposits. At the same time, as a whole, the financial literacy of farmers in non-national autonomous areas is higher than that in ethnic autonomous areas.

Figure 1.Financial reflections of different control variables

As shown in Figure 1, the partial regression coefficients of the control variables GOV, PI, RM, and AM are all positive, consistent with the expected results, indicating that they all have a positive effect on poverty alleviation, but the variable GOV reflecting government behavior failed the test, leading to. The reason for this phenomenon may be that the main expenditure object of this indicator is farmland water conservancy construction, especially emergency disaster prevention projects such as flood prevention and drought relief. It takes a certain period of time to promote the effect of financial poverty reduction, and its role has not been reflected in a short time.



Figure

2.Regression coefficients of interaction terms of rural financial control variables

As shown in Figure 2, the regression coefficients of the interaction terms between rural finance and the five control variables are all positive, indicating that these five variables play a positive role in promoting the poverty reduction effect of rural finance. The estimation

results of Model II show that the partial regression coefficients of new rural financial institutions and traditional rural financial institutions are both positive, and both have passed the significance test, indicating that both have significant positive effects on poverty alleviation. The regression coefficient of the interaction term between the new rural financial institution and the dummy variable representing the level of inclusive finance is positive, and the regression coefficient of the interaction term between the traditional rural financial institution and the dummy variable representing the level of inclusive finance is negative.

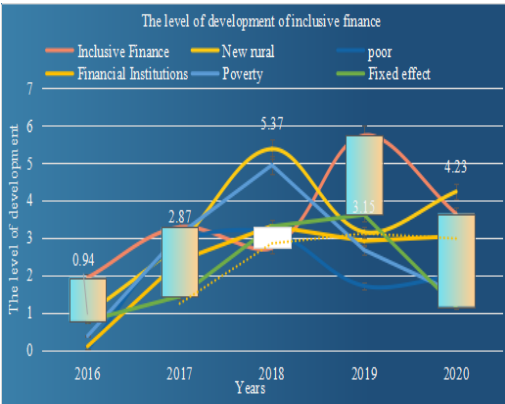


Figure 3.The level of development of inclusive

Table 2.Various financing channels and financing tools

Years	Inclusive Finance	New rural	poor	Financial Institutions	Poverty	Fixed effect
2016	1.93	0.94	0.01	0.09	0.37	0.77
2017	3.28	2.87	2.85	2.38	3.09	1.43
2018	2.73	5.37	3.13	3.31	4.94	3.3
2019	5.73	3.15	1.71	2.91	2.67	3.61
2020	3.64	4.23	1.99	3.04	1.51	1.15

As shown in Table 2, according to the 2016-2020 data on the acceptance of inclusive finance for the rural poor in China analyzed by Google Earth images, the popularity of inclusive finance in China’s coastal areas is much higher than that in the central Sichuan region, indicating that China’s inclusiveness. Financial development is not balanced. From the demand side, getting rich is inseparable from the large-scale use of funds. Therefore, in the stage of getting rich in ethnic areas, the top priority is to deal with financing. Therefore, one can vigorously innovate and develop various financing channels and financing tools; Develop the prestige rating market in prefectures and cities, thereby reduci

finance
As shown in Figure 3, for individuals whose development level of inclusive finance is higher than the sample median, the poverty alleviation effect of new rural financial institutions is relatively more obvious; for individuals whose development level of inclusive finance is lower than the sample median, the traditional. The poverty reduction effect of rural financial institutions is relatively obvious. Therefore, the problem of insufficient imbalance between regions still exists. This is mainly due to the financial exclusion caused by the above-mentioned "dislike the poor and love the rich" thinking of financial institutions, which has caused an imbalance in the supply of inclusive finance.

ng transaction barriers, reducing financing costs and expanding financing channels. Secondly, from the perspective of the supply side, financial institutions should be more targeted and comprehensive in the stage of getting rich in ethnic regions.

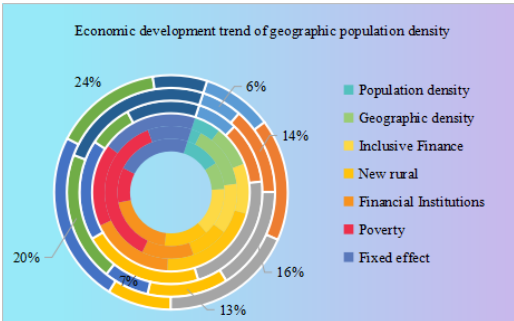


Figure 4.Economic development trend of geographic

population density

Use Google Earth to generate time axis data for central and southern China, and combine Baidu AI technology to calculate the distribution data of bank population density in different time periods to simulate changes in bank population density in recent years. According to Figure 4, the overall bank population density has risen from 10,920 per bank in 2017 to 12,300 per bank in 2020. From the perspective of the prefecture and city, the bank population density in Wuhan alone was in 2017. It has reached 18.81 million people/unit and 16.63 million people/unit, which are in the forefront. The overall geographic density of banks is also increasing year by year. Among them, Wuhan has the largest bank density and is much higher than the average level of the province. It has increased from 6.02 hundred square meters per bank in 2017 to 7.92 hundred square meters per bank in 2020, with a growth rate. It is 31.6%, but regardless of whether it is from an ethnic autonomous region or a non- ethnic autonomous region, with the exception of Wuhan and Yuxi, the geographic density of banks in most regions is lower than the average level of the province.

4.2 Inclusive Financial Service Quality

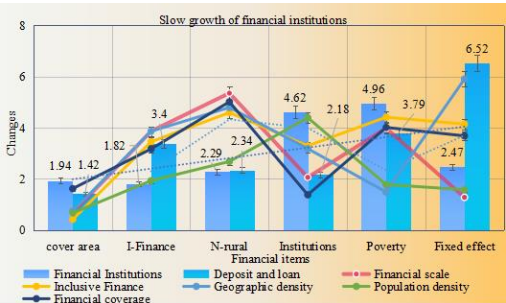


Figure 5.Slow growth of financial institutions

Due to the incompleteness of Google satellite data, this article uses Wayback technology to conduct a retrospective analysis of the Beidou satellite smart homeland financial data. As shown in Figure 5, the loan-to-deposit ratio of financial institutions is still

increasing year by year, but the growth is slow. Similarly, whether it is from the ethnic autonomous regions or non-ethnic autonomous regions, the financial scale of Wuhan is still much higher than that of the province. Therefore, based on the above analysis, the overall coverage and scale of inclusive finance are increasing year by year, but the growth rate is relatively slow, and Wuhan is much higher than other cities in terms of bank geographic density, population density, or loan-to-deposit ratio. By comparing ethnic autonomous regions and non-ethnic autonomous regions, we can also see that the financial coverage and scale of the two are increasing year by year, but the coverage and scale of ethnic autonomous regions are generally lower than that of non-ethnic regions.

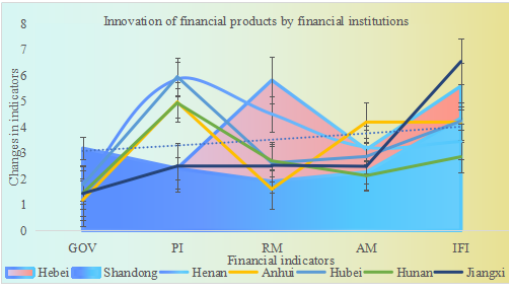


Figure 6.Innovation of financial products by financial institutions

According to field surveys in central China, the proportion of financial supply-side disadvantages between ethnic autonomous regions and non- ethnic autonomous regions is shown in Figure 6. It can be seen that due to the lack of financial resources in the ethnic regions, coupled with the defects of the geographical location, and the ethnic regions are also typical "long-tail regions", they have the characteristics of scattered consumption objects and large consumption differences, thus leading to insufficient financial marketization, inadequate product innovation, and difficulty in introducing financial talents have emerged. As a result, financial institutions in ethnic autonomous and non-autonomous regions have generally weakened financial product innovation, human resources, and high operating costs.

Table 3.Estimated results based on the fixed effects model

Item	Hebei	Henan	Shandong	Anhui	Hubei	Hunan	Jiangxi
GOV	1.09	1.83	3.18	1.18	1.76	1.44	1.43
PI	2.4	5.85	2.4	4.96	5.94	4.93	2.49
RM	5.81	4.5	1.9	1.6	2.61	2.69	2.52

AM	3.13	3.22	2.26	4.19	2.86	2.12	2.48
IFI	5.58	3.44	4.34	4.2	4.23	2.85	6.53

As shown in Table 3, the estimation results based on the fixed effects model also show that there are individual differences in central China. From the intercept item of the regression results, it can be seen that the poverty levels in Anhui and Shanxi provinces are relatively low, while the poverty levels in Hunan Province are relatively high. Therefore, there is still a lot of room for the role of rural finance to reduce poverty.

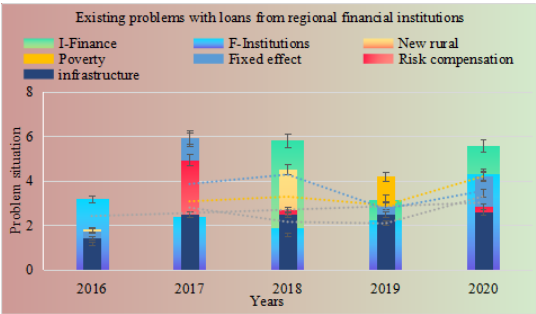


Figure 7.Existing problems with loans from regional financial institutions

Table 4.The poverty alleviation stage is the connecting stage of the ethnic regions

	I-Finance	New rural	F-Institutions	Poverty	Risk compensation	infrastructure
2016	1.09	1.83	3.18	1.18	1.44	1.43
2017	2.4	5.85	2.4	4.96	4.93	2.49
2018	5.81	4.5	1.9	1.6	2.69	2.52
2019	3.13	3.22	2.26	4.19	2.12	2.48
2020	5.58	3.44	4.34	4.2	2.85	2.6

As shown in Table 4, from 2016 to 2020, the gap between rich and poor in China has widened, and financial risks have also risen. The poverty alleviation stage is the connecting stage of the development of ethnic regions. At this stage, the inclusive financial market will undergo corresponding changes. The government should increase the intensity of government poverty alleviation policies, so as to strengthen the financial investment of financial institutions in ethnic regions. The cost of risks faced by institutions can enable the supply of financial resources to meet the increasing demand. And set up a relative financial protection agency to protect the interests of financial consumers and crack down on financial illegal and criminal acts, so as to ensure that consumers can enjoy the dividends released by inclusive finance in a fair and safe manner.

According to field surveys in central China, the existing problems of financial institutions in ethnic areas are shown in Figure 7. In the past five years, financial institutions in non-ethnic areas and ethnic areas have problems with existing loans, hindering the development of inclusive finance. This is mainly because most of the poverty alleviation funds allocated by the government to ethnic areas are fiscal funds, with a small amount of funds and a small proportion of risk compensation, and the financial ecological environment and other infrastructures in ethnic areas are poor, making financial institutions treat farmers. The loans also face high costs and high risks.

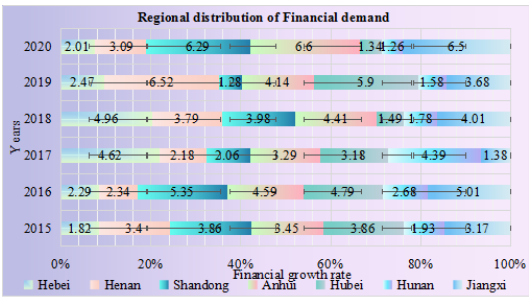


Figure 8.Regional distribution of financial demand

As shown in Figure 8, financial demand has increased year by year, but the growth rate is still slow. From the ratio of loans to GDP of financial institutions analyzed by the JD Finance AI data platform, it can be intuitively seen that the financial demand of Anhui is also much higher than that of other regions, and the financial demand of non-ethnic autonomous regions is comparable to that of ethnic autonomous regions. The demand is increasing year by year but the growth rate is slow. For

example, Pu'er in a non-national autonomous region, its loan-to-GDP ratio has increased year by year from 0.91 in 2017 to 1.09 in 2020, but its growth rate has only increased in seven years 19.8%. Therefore, although the financial demand of each city is increasing year by year, the growth is still relatively slow. This is mainly caused by the imbalance of the supply side of inclusive finance, because as the financial demand of consumers continues to increase, the supply side cannot meet. The corresponding financial demand will inevitably lead to a decrease in demand growth rate.

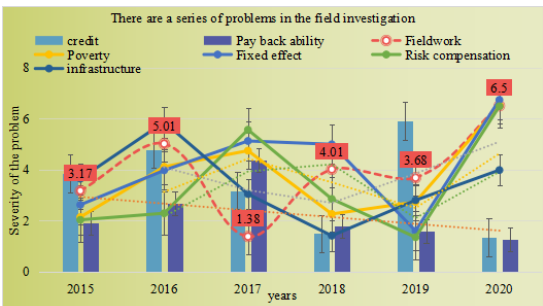


Figure 9.There are a series of problems in the field investigation

According to the data of DEM ETER and Google Earth in a rectangular range with (32°N, 107°E)-(23°N, 119°E) as the diagonal, combined with AI analysis, as shown in Figure 9. Most ethnic regions are frontier

regions. The natural resource endowment makes the economy level low, and the ethnic regions are mostly young people. This also makes it difficult to credit the ethnic regions. In addition, the ethnic regions generally rely on agriculture. For a living, and agriculture is an industry where natural disasters frequently occur. Once a disaster strikes, not only will the risk increase, but the repayment ability of farmers will also decrease accordingly. The main reason for this phenomenon is that most of the residents in ethnic autonomous areas live far away and have closed information, a high degree of aging, low cultural quality, and distrust of financial institutions, so it is very easy to produce in financial institutions. "Self-exclusion" at the level has led to a lack of financial knowledge. Inclusive finance is a systematic and complete sustainable financial project, and its connotation not only includes financial demanders, but also financial suppliers. According to the above theoretical analysis, the life cycle theory divides enterprises into three stages: initial, growth, and maturity. Similarly, socially disadvantaged groups in ethnic areas can also be divided into three stages: poverty alleviation, poverty alleviation, and prosperity. The positioning of inclusive finance is not just for a certain stage, but a diversified positioning that includes three stages.

Table 5.Fiscal Policy and the Trend of Economic Recession

	credit	Pay back ability	Fieldwork	Poverty	F-effect	compensation
2015	3.86	1.93	3.17	2.14	2.62	2.03
2016	4.79	2.68	5.01	4.11	3.97	2.29
2017	3.18	4.39	1.38	4.74	5.12	5.56
2018	1.49	1.78	4.01	2.26	4.99	2.85
2019	5.9	1.58	3.68	2.73	1.6	1.35
2020	1.34	1.26	6.5	6.52	6.73	6.48

As shown in Table 5, since the tax multiplier is at a relatively low level and has not led to a large-scale crowding effect, China's tax structure and tax policy are temporarily at a reasonable level. The government investment multiplier and government consumption multiplier are both positive, and expansionary fiscal policies can give priority to slowing down the economic recession. The development of inclusive finance plays a two-way role in promoting fiscal policies. On the one hand, the development of inclusive finance can improve the efficiency and effectiveness of fiscal policies, so that expands

ionary fiscal policies can play a stronger role in poverty reduction; on the other hand. The effective use of fiscal policies can also promote the development of inclusive finance. For example, expansionary fiscal policies can promote the development of inclusive finance in terms of promoting financial infrastructure construction, transfer payments, and government subsidies.

5. Conclusions

China's financial inclusion index is generally on the rise. The overall development level of financial inclusion in central China is relatively low, with a median of less

than 0.5, but the level of development is increasing, especially in Hunan and Anhui provinces. Secondly, the overall development of rural financial institutions in central China has a significant positive effect on increasing farmers' income and reducing poverty among farmers. At the same time, inclusive finance also has a positive effect on poverty alleviation, and presents a "U"-shaped characteristic that first weakens and then strengthens. Third, the development of new rural financial institutions and traditional rural financial institutions has a positive effect on poverty alleviation, but the effect is quite different. Specifically, in areas with high levels of inclusive finance development, the poverty alleviation effect of new rural financial institutions is relatively more obvious; while areas with low levels of inclusive finance development, traditional rural financial institutions have more obvious poverty reduction effects.

Based on the above research results, based on the actual situation in central China, the following countermeasures are proposed: comprehensive and sustainable development of inclusive finance, raising the level of rural finance, so as to effectively alleviate the poverty of farmers. To develop inclusive finance in an all-round way, we must first practice the concept of "inclusive finance". Financial institutions must widely publicize policies, services, products and processes related to inclusive finance, so that every farmer and agribusiness enterprise clearly understands the benefits of inclusive finance. Second, it is necessary to improve the development level of inclusive finance in breadth and depth, expand the business outlets and scale of inclusive financial institutions, increase financial service personnel, and vigorously develop digital finance. Strengthen the construction of the connotation of inclusive finance and improve the quality of inclusive finance for poverty alleviation. It is necessary to continue to develop inclusive finance, integrate with local industry poverty alleviation and industrial poverty alleviation, target target customers, continuously innovate financial products, and design humane and convenient finance service.

The level of development of inclusive finance has a "U"-shaped pattern that first weakens and then strengthens in alleviating the poverty of farmers, which shows that the poverty reduction effect of inclusive finance is a long-term process. To continue to promote

the development of inclusive finance, we cannot reduce the intensity of development just because we have achieved certain results. The government should guide and support the development of inclusive financial institutions for a long time, and gradually improve the sustainable development of inclusive financial system. Fully consider the level of rural economic development and improve the quality of rural economic and financial environment. Where the level of economic development is low, government funds should be biased towards the construction of public infrastructure to solve the problem of survivability, so as to achieve the desired effect of poverty reduction. Based on the differences in the poverty reduction effects of rural finance under different levels of inclusive finance, the poverty of rural households is essentially alleviated. Effective poverty alleviation by inclusive finance is not only financial assistance and policy subsidies for the disadvantaged groups in rural areas, but also ability poverty alleviation. "Teaching them to fish is not as good as teaching them to fish." Increasing the financial availability of poor groups only provides the initial impetus for their development. In the later stage, attention should be paid to the cultivation of the group's ability to improve its viability, production capacity, and market participation. Ability to achieve effective poverty reduction.

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