

Measurement of Rural Inclusive Financial Development and Analysis of Spatial Effects on Anti-poverty

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Abstract Based on two dimensions of supply and demand, we use six indicators to establish a rural inclusive financial development index and evaluate the development of China's rural inclusive finance. We use spatial panel data model to examine the relationship between financial inclusion and rural poverty. Results show that: (i) both the rural inclusive finance and rural residents' per capita consumption present spatial clustering feature and show significant spatial correlation; (ii) the development of rural inclusive finance has significant spatial effect on poverty alleviation along time and space dimensions. In this study, the paper puts forward policy recommendations on strengthening the rural financial resources flow and constructing diversified rural inclusive financial system.

Key words Inclusive financial, Rural finance, Anti-Poverty, Spatial effect

1 Introduction

Poverty has been a major issue in China's social and economic development and the rural areas are the high incidence areas of poverty. Since the reform and opening up, China has made great achievements in rural anti-poverty. The rural poverty population was reduced from 250 million in 1978 to 70.17 million in 2014. Meanwhile, the incidence of poverty declined from 30.7% to 7.2%. Under the new normal, significant changes have taken place in China's poverty issue. Economic growth has a diminishing marginal effect on reducing poverty, "Matthew effect" related to the regional economic development imbalance becomes more obvious, and the transformation of economic development modes performs weak ties with the poor. Particularly, poverty issues in China have the characteristics of centralization in nationality, social stratum and region. Scholars need to discuss and analyze the poverty problems in both depth and breadth, so as to provide more theories and policy recommendations on taking targeted measures in poverty alleviation. *China's Rural Poverty Alleviation and Development Program (2011 – 2020)* proposed "promoting the innovation of the financial product and service in poverty areas, making efforts to meet the demand of targeted groups on money to develop production in poverty alleviation". According to those successful anti-poverty practices in China, structural and inclusive poverty alleviation centered on the financial poverty alleviation, can largely improve the target accuracy and efficiency of poverty alleviation^[1]. The concept of inclusive finance, which aims to modify the deviation of "giving priority to efficiency rather than equality" in traditional financial theory, is reconsideration and improvement of the traditional financial system and development mode. The United Nations (2005) considers inclusive financial as an important way to effectively reduce poverty and accomplish the Millennium

Development Goals (the MDGs). Chinese government attaches great importance to developing inclusive finance. In 2013, developing inclusive finance was put forward clearly in the Third Plenary Session of the 18th Central Committee of the CPC. In 2015, *Report on the Work of the Government (2015)* pointed out "channeling great energy into developing inclusive finance". In January 2016, the State Council issued *Inclusive Financial Development Plan (2016 – 2020)*. Promoting the development of inclusive finance and improving financial inclusion has been regarded as the key strategic way of accomplishing fair economic growth, narrowing the income gap and eliminating poverty^[2-3]. Using the statistical data released by the authorities and focusing on the main line of inclusive financial development and poverty governance, from the perspective of inclusive finance, this paper dynamically characterizes the time-space evolution process of China's inclusive financial development and rural poverty, studies the time-space effect of inclusive finance on poverty governance through the empirical analysis and reveals the mechanism of inclusive finance in alleviating poverty.

2 Inclusive finance and poverty alleviation: theoretical explanation and empirical evidence

Generally, there are two main mechanisms of finance that work on alleviating poverty: direct mechanism and indirect mechanism. The Asian Development Bank (ADB, 2009) points out that the development of finance reduces poverty in two ways: promoting economic growth then achieving poverty reduction indirectly and increasing opportunities for accessible financial service to the poor then reducing poverty directly.

2.1 The direct mechanism of financial development on poverty alleviation The direct mechanism provides microfinance services and improves access to finance directly or indirectly to help the poor gain higher expected income and exit poverty. From different explanation of the poverty causes, this mechanism can be

studied from two aspects: capital and ability. The former is basic means of financial poverty reduction, while the latter gives higher requirements on it. Most empirical studies support the direct mechanism of finance poverty reduction. From a macro perspective, Beck *et al.* (2004) argue that the countries with better developed financial intermediation are better able to reduce poverty and improve the income inequality^[4]. Using the data from Indian banking sector, Burgess and Pande (2005) find that access to finance directly has a positive effect on the incidence of poverty^[5]. Jeanneney and Kpodar (2005) build a model of determination of aggregate poverty which integrates financial development and financial volatility^[6]. The results show that financial development is beneficial for the poor to get rid of poverty. Geda *et al.* (2006) examine the relationship between finance and poverty and show that access to credit plays a significant role in smoothing consumption and reducing poverty^[7]. Floro (2007) finds that microfinance risk-coping mechanism is able to improve the participant's ability to manage risk, thus reducing poverty and vulnerability^[8]. Imai *et al.* (2010, 2012) use the cross-country panel data and find that microfinance significantly lowers the incidence of poverty and its depth and severity^[9]. Sunia (2013) finds that there is a strong relationship between the microfinance and poverty alleviation by using collected data through questionnaire, and there are still some empirical studies indicating that the mechanism of financial development on poverty is nonlinear and has a significant threshold effect^[10]. Shi Rongrong, Xu Zhangyong, Zhao Yanjia (2013), Su Jing, Hu Zongyi (2013, 2014) confirm that there are significant nonlinear effect and threshold effect between financial development and poverty alleviation.^[11-12]

2.2 The indirect mechanism of financial development on poverty alleviation This mechanism of financial development that influences the poor has two ways: the economic growth effect and income distribution effect of financial development. Most studies reach the same conclusion: owing to the trickle-down effect in economic growth and pro-poor growth, financial development reduces poverty greatly, while income inequality increases so much that the beneficial impact of growth is offset by the negative impact of rising inequality^[13-14]. A large number of studies support that the financial development affects economic growth and then leads to poverty reduction. Uddin *et al.* (2014) study that there is a long-term cointegration relationship between financial development and economic growth and poverty reduction, financial development can reduce poverty but this result is not linear^[15]. Relevant studies show that there has been a long controversy about the connection between income distribution and poverty alleviation. Some scholars, such as, Greenwood and Jovanovic (1990), believe the Kuznets's (1955) inverted-U hypothesis on the relationship between economic growth and the distribution of income. Studies suggest that financial development enables the poor to have access to financial services, thereby reducing the income distribution inequality and promoting poverty alleviation. Meanwhile, the impact of financial development on poverty reduction depends on

the level of financial development. Most of the benefits of financial development and financial deepening are obtained by the rich, thus accelerating the inequality of income distribution and hindering the poverty reduction. Compared with the non-developed countries, income inequality and poverty in developed countries decrease faster. It is found that imperfect credit market in rural areas expands the rural internal income distribution gap and does harm to poverty alleviation.

2.3 The endogenous mechanism of financial development on poverty alleviation Endogenous finance deeply rooted in micro-economic activities and financial transactions includes more complete financial incentives, innovation and restraint mechanisms and is able to meet the diverse demands of microfinance. It contains many informal financial transaction forms, such as private lending, private banks, and the money-loan association. The expansion of external finance is usually conducted by the government in a method from top to down, leads to micro-finance units who are often in a passive position, more exclusive and involves the poor in serious financial repression. Development of rural finance in China has a significant endogenous feature. The major strand of this thought is associated with the impact of informal finance and microfinance on poverty. The evidence from rural areas shows that microfinance institutions and projects are gradually replacing informal finance to become important tools for alleviating poverty in low-income countries^[9]. Lu Yongbin and Zhao Peipei (2014) empirically analyze the impact of informal finance development on farmers' income and rural poverty disparities in China^[16]. The development of informal finance has a significant impact on poverty alleviation and its contribution to poverty alleviation is more than that of formal finance. It is also found that microfinance reduces poverty by encouraging the development of the informal financial sector and creating social capital for the poor and then alleviating poverty.

2.4 Research on mechanism of inclusive finance and spatial analysis perspective However, few scholars examine the link between financial development and poverty alleviation from the view of financial inclusion. Chibba (2008) confirms the financial inclusion's capability of poverty reduction, noting that financial inclusion can promote pro-poor growth^[17]. British White Paper (2009) made the link between financial services and poverty reduction explicit and recognized the impact of finance inclusive development on poverty reduction. Andrianaivo & Kpodar (2012) study the relationship between financial inclusion and economic growth from a perspective of information and communication technology, and find that the application of mobile communication technologies can propel economic growth through promoting financial inclusion^[6]. Wang Xiuhua and Guan Jian (2014) study the measure of rural financial inclusion in China and evaluate the income distribution effects^[18]. Few studies investigate financial development and poverty alleviation from spatial perspective. Under the general theoretical framework of financial development, the real world is studied without the spatial dimension, time is consid-

ered the most critical factor and the space is ignored. Aimed at the missing consideration of the spatial effect in financial theory model, Gao Yuandong, Wen Tao and Wang Xiaohua (2013) construct a spatial model of poverty reduction effect of fiscal and financial policies and precisely measure the spatial spillover effects^[3,19]; Lu Yongbin and Ji Qianqian (2014) use spatial model to analyze the spatial effect of regional disparity of rural financial exclusion and show that regional farmers' income is affected by its neighboring regions' degree of financial exclusion^[16]. Gao Yuandong and Zhang Weiguo (2014) construct a spatial model of poverty reduction effect of informal finance and show that rural informal finance has a significant effect on holding back the incidence of poverty and its impact is stronger than that of formal finance^[19]. Zhang Bing and Weng Chen (2015) use spatial panel regression model and threshold panel regression model to study the nonlinear relationship between the rural finance development and poverty alleviation and argue that there is a spatial spillover effect on poverty reduction of rural financial development^[20].

2.5 Brief analysis on relevant research Based on current literature, the impact of financial development on poverty alleviation has already been acknowledged by several studies, which provides important theoretical reference and logical framework for this paper, but there are still shortcomings. Firstly, it lacks inclusive perspective. We believe that the idea of inclusive finance is aimed at modifying the deviation of "giving priority to efficiency rather than equality" in traditional financial theory and emphasizing the fair access to financial resources. Promoting financial inclusion is a key strategic way to achieve fair economic growth and reduce poverty. Secondly, the mechanism is unclear. The connection between financial development and poverty alleviation is complex, while most current literature considers it linear and only reveals some association. Thirdly, it ignores spatial factors. Related researches on spatial effect, spatial process and spatial mechanism of financial development and poverty alleviation are insufficient and there is a lack of modeling analysis.

3 Measurement and evaluation of rural inclusive financial index in China

3.1 Construction of indicators and descriptive statistics

3.1.1 Construction of indicators. From the supply and demand perspectives, this paper constructs rural financial inclusion index on two dimensions—scope of financial services and use of financial services. From the view of supply, the scope of financial services can be studied both from the point of geographical and demograph-

ic permeation. At first, financial services exclusion on the minority is seen from the geographic dimension. Financial institutions selectively establish basic outlets in particular areas and more basic outlets are set up in the rich areas than in poor areas. This phenomenon is more common in China's rural areas, therefore, the first consideration when we evaluate the degree of rural financial inclusive development of China is the geographical permeability. Secondly, the inclusion of financial institutions on the minority is also reflected in the demographic dimension which meets most financial service demands of the majority. Therefore, this paper from the service penetration of geographic dimension and the service availability of population dimension measures the two aspects of the scope of financial services. From the service penetration of geography view, we select two indicators—the amount of banking institutions per square kilometer and the amount of banking employees per square kilometer. From the service availability of population point, we choose the amount of banking institutions per 10000 people and the amount of banking employees per 10000 people. Considering the availability of data in rural areas, banking institutions mentioned above mainly refer to the agriculture-related financial institutions which dominate the rural financial service, such as rural credit cooperatives, rural banks and other new rural financial institutions. From the demand side, considering the fact that current demands on financial services in rural areas concentrate in deposit and loan business, this paper selects the proportion of the rural per capita deposit and per capita loans in per capita GDP to measure the borrowers' use of deposits and loans when building the inclusive financial index. Based on the analysis mentioned above, the main indicators for measuring rural inclusive financial development are shown in Table 1.

3.1.2 Descriptive statistics. Descriptive statistics of inclusive financial indicators are shown in Table 2. As we can see, values of index have large regional differences, no matter from the view of geography or demography, developed provinces which are located in the eastern coastal area and are densely populated, such as Zhejiang and Guangdong, have comparative high values in both the amount of agriculture-related financial institutions and banking employees, while developing provinces which located in a remote area and sparsely populated, have lower values, such as Qinghai, Xinjiang, Inner Mongolia, Yunnan. For example, the maximum value of the amount of financial institution basic outlets per square kilometers is 428.92 (Zhejiang Province, eastern of China) and the minimum value of it is 4.37 (Qinghai province, western of China).

Table 1 The evaluation index system of inclusive finance

Dimension	Explanatory variables	Indicators
The scope of financial services (supply)	The service penetration of geographic dimension	The amount of banking institutions per square kilometer
		The amount of banking employees per square kilometer
	The service availability of population dimension	The amount of banking institutions per 10000 people
		The amount of banking employees per 10000 people
The use of financial services (demand)	Use of deposit services	Rural per capita deposit/per capita GDP
	Use of loan services	Rural per capita loans/per capita GDP

Table 2 Descriptive statistics

Indicators	Max.	Min.	Medium	Mean	Sd. R
The amount of banking institutions per square kilometer	428.92	4.37	139.31	157.75	110.76
The amount of banking employees per square kilometer	5827.16	28.84	1336.83	1641.30	1276.29
The amount of banking institutions per 10000 people	2.33	0.58	1.13	1.19	0.36
The amount of banking employees per 10000 people	29.52	1.38	10.84	12.22	5.29
Rural per capita deposit/per capita GDP	5.48	0.25	1.07	1.38	0.95
Rural per capita loans/per capita GDP	2.91	0.09	0.58	0.68	0.43

3.2 Measurement of rural inclusive financial index in china

3.2.1 Evaluation methods. Drawing on the approach used by most scholars, this paper builds inclusive financial development index with the coefficient of variation method. The specific method of construction is: first, we use the coefficient of variation to measure the degree of difference in values of each indicator so as to solve the problem of different dimensions of different indicators, then calculate the mean \bar{x}_i and standard deviation σ_i of indicator. The coefficient of variation is $V_i = \sigma_i/\bar{x}_i$, next we calculate the sum of all the coefficient of variation $\sum_{i=1}^6 V_i$ and get the weight of

each indicators $w_i = V_i/\sum_{i=1}^6 V_i$, and finally calculate the dimension value $d_i = w_i \cdot \frac{A_i - m_i}{M_i - m_i}$, where A_i is the actual value of the dimension and M_i is the maximum dimension of and m_i is the minimum dimension of . Finally, the index of rural inclusive finance is as follows:

$$IFI = 1 - \frac{\sqrt{(w_1 - d_1)^2 + \dots + (w_6 - d_6)^2}}{\sqrt{w_1^2 + \dots + w_6^2}}$$

Table 3 Provincial rural inclusive financial index during 2006—2013

Provinces/Year	2006	2007	2008	2009	2010	2011	2012	2013
Hebei	0.4745	0.4808	0.4336	0.4970	0.4738	0.5167	0.4575	0.4662
Shanxi	0.6979	0.6531	0.5823	0.6938	0.6818	0.6342	0.5973	0.6496
Inner Mongolia	0.2111	0.1952	0.2168	0.2636	0.2557	0.2679	0.2723	0.2684
Liaoning	0.4196	0.3774	0.3724	0.3988	0.3826	0.3886	0.3476	0.3823
Jilin	0.3168	0.2662	0.2564	0.2647	0.2761	0.2503	0.2221	0.2202
Heilongjiang	0.1217	0.1565	0.1957	0.1600	0.1461	0.1522	0.1349	0.1397
Jiangsu	0.3891	0.4774	0.4485	0.5244	0.5191	0.5779	0.5368	0.5735
Zhejiang	0.6935	0.7470	0.7109	0.7735	0.8083	0.8458	0.8650	0.8729
Anhui	0.3590	0.3102	0.2961	0.3320	0.3265	0.4055	0.3360	0.3614
Fujian	0.2603	0.2513	0.2434	0.2678	0.2714	0.2843	0.2653	0.2845
Jiangxi	0.2942	0.2473	0.2329	0.2681	0.2689	0.3018	0.2825	0.3018
Shandong	0.6256	0.5676	0.5167	0.5864	0.5847	0.6592	0.6028	0.6243
Henan	0.5099	0.4611	0.4225	0.4480	0.4794	0.5023	0.4868	0.5120
Hubei	0.2276	0.2127	0.1968	0.2076	0.1994	0.2254	0.1964	0.2166
Hunan	0.3180	0.2908	0.2679	0.3127	0.2965	0.3323	0.2922	0.3047
Guangdong	0.6469	0.5831	0.5246	0.6181	0.5842	0.6667	0.6133	0.6454
Guangxi	0.1687	0.1468	0.1501	0.1666	0.1672	0.1887	0.1775	0.1913
Hainan	0.1455	0.1355	0.1436	0.1447	0.1453	0.1838	0.1695	0.1857
Sichuan	0.2668	0.2185	0.2013	0.2469	0.2650	0.2953	0.2748	0.3057
Guizhou	0.1962	0.1846	0.1827	0.2320	0.2460	0.2712	0.2382	0.2633
Yunnan	0.1174	0.1488	0.1689	0.1994	0.2363	0.1911	0.1685	0.1654
Shaanxi	0.3279	0.2813	0.2600	0.3045	0.2638	0.3168	0.2898	0.3306
Gansu	0.1745	0.1460	0.1646	0.1933	0.1714	0.2054	0.1969	0.2339
Qinghai	0.0844	0.0744	0.0815	0.0726	0.0728	0.0876	0.0920	0.0943
Ningxia	0.3587	0.3044	0.2732	0.3176	0.3069	0.3047	0.2971	0.3090
Xinjiang	0.0755	0.0567	0.0811	0.0598	0.0488	0.0707	0.0563	0.0621

3.2.2 The evaluation of indicators. According to the method mentioned above, the paper calculates China's rural inclusive financial index from 2006—2013 as a measure of rural inclusive finance development in China. Considering the availability of data, we use provincial panel data of 26 provinces. Sources of data

are from *China Statistical Yearbook*, *China Agriculture Yearbook*, *China Rural Statistical Yearbook*, *Chinese Rural Financial Services Report*, *Regional Financial Operation Report*, *China Financial Yearbook*, *Statistical Yearbook of the Provinces*. Results of inclusive financial indexes of 26 provinces from 2006—2013

Table 3. Table 3 shows that as a whole, China's rural inclusive financial index of each province has been gradually increasing in recent years, meaning that each province's degree of rural financial development is getting higher. Specifically, some provinces like Zhejiang, Guangdong have high values and Zhejiang has the best inclusive finance; in addition, the provinces including Shanxi, Shandong, Henan have large values of inclusive financial develop-

ment index. However, remote and developing areas, such as Qinghai, Xinjiang, have lower inclusive financial development indexes and Tibet is in the lowest position. Relatively remote and larger areas, such as Yunnan, Heilongjiang, Hainan, Gansu, Inner Mongolia also have comparatively lower degree of inclusive financial development.

Table 4 Moran's I test and z-values of provincial rural residents' consumption per capita during 2006—2013

Year	2006	2007	2008	2009	2010	2011	2012	2013
Moran's I	0.3128	0.3085	0.2967	0.2758	0.2934	0.3150	0.3006	0.2423
z-value(0.05)	2.8353	2.8011	2.7061	2.5373	2.6793	2.8532	2.7371	2.2663

Table 5 Moran's I test and z-values of provincial rural inclusive financial indexes during 2006—2013

Year	2006	2007	2008	2009	2010	2011	2012	2013
Moran's I	0.2026	0.2371	0.2350	0.2178	0.2293	0.2760	0.2436	0.2488
z-value(0.05)	1.8038	2.0599	2.0445	1.9163	2.0021	2.3496	2.1082	2.1467

4.1 Exploratory spatial analysis

4.1.1 Global spatial autocorrelation test. Before the spatial empirical analysis, this paper firstly investigates the spatial correlation of variables. We select Moran's I index to measure the global spatial autocorrelation and use Moran scatter plot to estimate the local spatial autocorrelation. Tables 4, 5 show the provincial Moran's I index and z-values of rural residents' consumption per capita and rural inclusive finance index processed by MATLAB 7.

8 from 2006—2013. As we can see, the two indicators' Moran's I index is significantly (5% confidence level) greater than zero. We come to the conclusion that the rural residents' consumption per capita and inclusive financial development have spatial autocorrelation in selective years, indicating that China's rural poverty level and inclusive financial development are not randomly distributed but affected by neighboring regions.

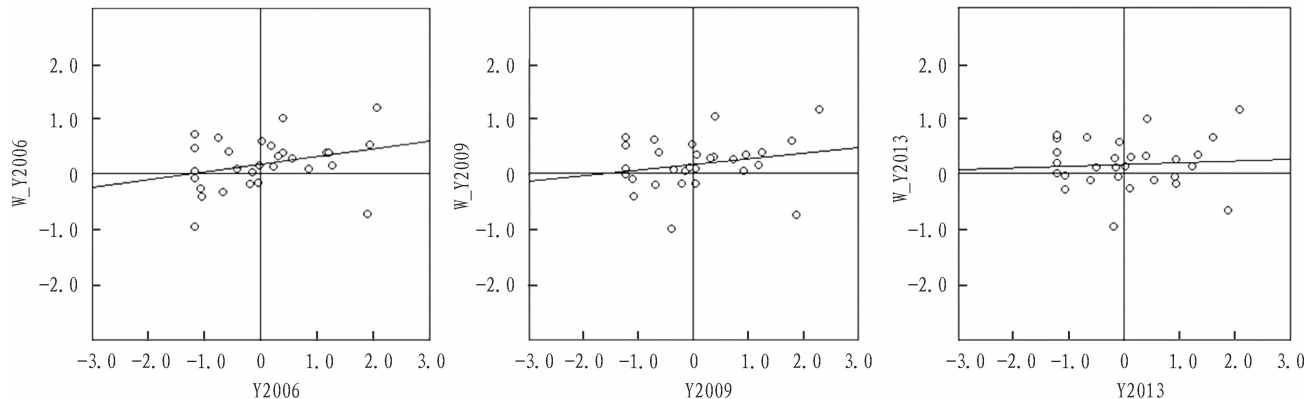


Fig. 1 Moran scatter plots of rural resident's consumption level

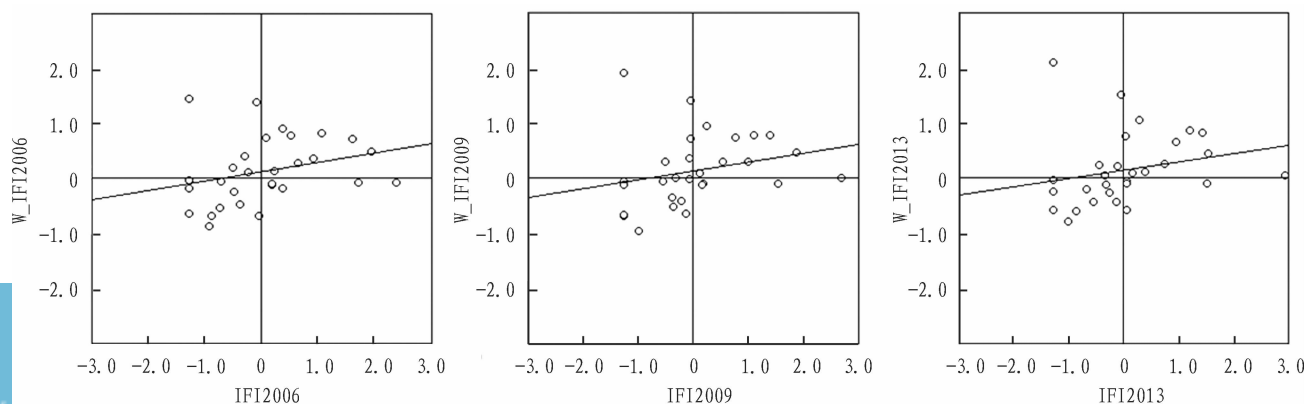


Fig. 2 Moran scatter plots of rural inclusive financial index

4 Spatial analysis of rural inclusive financial anti-poverty

4.1.2 Local spatial autocorrelation analysis. Fig. 1 is the Moran scatter plot of provincial rural residents' consumption per capita. Fig. 1 shows that most provinces are found in the first quadrant (HH) or the second quadrant (LH) and it means that provinces have similar spatial pattern (high-high and low-high) level of rural residents' consumption per capita in specific years, indicating that most provinces have positive spatial association in per capita consumption level of rural residents. Specifically, the upper right quadrant (HH) of the Moran scatter plot shows ten provinces (Henan, Zhejiang, Shandong, Hubei, Hebei, Liaoning, Anhui, Jiangsu, Fujian and Guangxi) with higher level of rural residents' consumption per capita and neighbors also with higher level of rural residents' consumption per capita (high-high). The upper left quadrant (LH) shows areas, such as Shanxi, Shaanxi, Jilin and Guizhou, with lower per capita consumption level surrounded by neighbors with higher per capita consumption level (low-high) and the lower right quadrant (HL) including Sichuan contains the reverse (low-high). Ningxia, Xinjiang, Qinghai, Inner Mongolia, Gansu and Heilongjiang are found in the lower left quadrant (LL) which shows that both provinces and its neighbors have the lower per capita consumption level of rural residents. Fig. 2 shows the Moran scatter plot of rural inclusive finance index. Most provinces are found in the first quadrant (HH) or the third quadrant (LL) and it means that provinces have similar spatial pattern (high-high and low-low) of rural inclusive financial index in specific years and reveals that most provinces have a positive spatial correlation in rural inclusive financial index. The upper right quadrant (HH) of the Moran scatter plot shows eight provinces (Henan, Shanxi, Shaanxi, Shandong, Hebei, Liaoning, Anhui and Jiangsu) with higher development level of rural inclusive finance and neighbors also with higher development level of rural inclusive finance (high-high). The upper left quadrant (LH) shows areas, such as Fujian, Inner Mongolia and Hubei, with lower development level of rural inclusive finance surrounded by neighbors with higher development level of rural inclusive finance (low-high) and the lower right quadrant (HL) including Guangdong and Hunan provinces contains the reverse (low-high). Xinjiang, Qinghai, Yunnan, Gansu, Guizhou and Heilongjiang are found in the lower left quadrant (LL) which shows that both provinces and its neighbors have the lower development level of rural inclusive finance.

4.2 Empirical analysis and results

4.2.1 The selection of variables. This paper studies the effect of rural inclusive finance on poverty alleviation. Learning from the idea of Jeanneney and Kpodar (2005)'s model^[6], the formula is set as follows:

$$Y_{it} = \alpha_0 + \alpha_1 IFI_{it} + \beta X_{it} + \varepsilon_{it}.$$

(i) Explanatory variable: levels of poverty Y_{it} in the above formula represent the poverty levels in rural areas. Generally, indicators, such as the incidence of poverty, poverty gap index and Sen index can reflect the poverty level intuitively. However, due to the deficiencies in provincial rural statistics data, we only get national statistics of the incidence of poverty or poverty depth and can't calculate provincial data of rural poverty incidence or poverty

depth. Meanwhile, owing to the change of statistics standard, traditional indicators, such as the incidence of poverty, might be not accurate in measuring China's rural poverty level. Some scholars select Engel's coefficient to reflect poverty directly, while others believe that Engel's coefficient is not an appropriate indicator to evaluate the poverty because of great proportion of medical and educational expenses in resident's expenditure in China. Hence, considering the availability of data as well as other scholars' approach, this paper uses the provincial rural residents' per capita consumption level to measure the poverty in rural areas. The statistics of rural residents' per capita consumption is more realistic and stable, and compared to the net income of rural residents, this indicator is more suitable for measuring multi-dimensional poverty level of rural residents. Household consumption, as comprehensive reflection of the living standards, can reflect the poverty level to some extent. Therefore, this paper chooses the household consumption to replace indicators related to the poverty rate. In general, the higher the residents' income, the higher the consumption level. This paper uses the consumption level of rural residents to represent the poverty level in rural areas. The higher the consumption levels, the lower the poverty levels. (ii) Explanatory variable; *IFI*. The method of the construction of *IFI* and the reason of selecting indicators are explained in last chapter, so we don't repeat them here. (iii) Other control variables. Causes of rural poverty in China are complex and diverse. In addition to inclusive financial indicators, China's rural poverty is associated with many factors, such as spatial and geographical factors, demographic factors and the factor of assets and resources possessed by the family. Hence, based on the indicators of capital and labor proposed in Douglas production function, this paper also adds some control variables and selects fixed assets investment of farmers, urban and rural income ratio, per capita GDP as the evaluation indicators. Moreover, rural funds can be created by the development of local finance; besides, fiscal support is also an important source of rural funds. Therefore, this paper also adds the fiscal expenditure on agriculture as control variable. The selected variables and explanations are shown in Table 6.

4.3 Model estimation

4.3.1 Model selection. In the spatial econometric analysis, spatial autocorrelation model (SAR), spatial error panel model (SEM) and spatial Durbin model (SDM) are three common spatial models. Examined by the Wald test, LR test, Hausman test and LM test, results show that SEM has a better fitting effect without the assumption of spatial and time fixed effects, while under the condition of spatial and time fixed effect, SAR has a better fitting effect.

4.3.2 Analysis of static spatial panel model estimation results. (i) Spatial spillover effect analysis. By comparing the estimation results in Table 7 and Table 8, we can see that compared with the OLS model without spatial factors, the model with the spatial factors has a better fitting effect (the log-likelihood estimators are higher and the regression results are significant), revealing that after introducing the spatial factors into the analysis, the model achieves a better result. Results above confirm the judgment of Moran's I test and show that the estimation of model under the con-

sideration of spatial factors and the spatial spillover effect of neighboring regions are more reasonable. Meanwhile, it also verifies the argument in the theoretical part that spatial factors should be introduced into the study of poverty problem in rural areas and inclusive finance development. (ii) Analysis of inclusive finance anti-poverty effectiveness. Regression results in Table 7, 8 show that whether it is in the mixed OLS model or the static spatial panel model, regression coefficients of *IFI* which reflects inclusive finance rural development are significant (1% confidence level) and positive, suggesting that the development of inclusive finance

can effectively promote farmers' consumption levels and has a positive effect on poverty alleviation in rural areas, which also confirms the argument of the theoretical parts of this paper. As mentioned above, the index of rural inclusive finance can not fully reflect the level of rural inclusive financial development, but it can represent the level of rural financial development to some extent. Coefficients of the impact of *IFI* on rural residents' per capita consumption (also on the poverty reduction) show that increase of the level of rural inclusive financial development will significantly raise the level of rural residents' per capita consumption.

Table 6 Variables and explanations

Variables	Indicators	Explanations
Household consumption	<i>Y</i>	Rural household's per capita living expenditure
Inclusive financial index	<i>IFI</i>	Details as above
Fixed assets investment of farmers	<i>RGT</i>	Fixed assets investment of farmers/rural total population
Fiscal expenditure on agriculture	<i>RCZ</i>	Fiscal expenditure on agriculture/rural total population
Urban and rural income gap	<i>CJ</i>	Urban residents' average per capita income/rural residents' average per capita income
Rural per capita GDP	<i>RGDP</i>	Rural GDP/rural total population

Note: (i) The indicators of fiscal expenditure on agriculture in 2006 contained agricultural expenditure, forestry expenditure and the operating expenses of agriculture, forestry, water conservancy and meteorology, while in other years it included the sum of the spending of agriculture, forestry and water affairs; (ii) Considering the largest proportion of primary industry in rural GDP as well as the availability of data, the value-added of primary industry is selected to approximate the rural GDP, 26 provinces in China are taken as the study objects and data are from *China Statistical Yearbook*, *China Agriculture Yearbook*, *China Rural Statistical Yearbook*, *Chinese Rural Financial Services Report*, *Regional Financial Operation Report*, *China Financial Yearbook*, *Statistical Yearbook of the Provinces*.

Table 7 The estimated results of mixed OLS model

Variables	Coefficient	Probability
Constant	0.1439	0.1720
<i>IFI</i>	0.5036 ***	0.0000
<i>RGT</i>	0.7850 ***	0.0020
<i>RCZ</i>	0.2351	0.1002
<i>CJ</i>	-0.0300	0.1253
<i>RGDP</i>	0.0227	0.3453
R^2	0.5688	
<i>Log-lik</i>	152.4892	

Note: *** mean that the regression coefficients of variables are significant under 1%, 5%, 10% confidence level.

Table 8 The estimated results of SAR and SEM

Model	Spatial fixed effect		Time fixed effect		Time & spatial fixed effect	
	SAR panel	SEM panel	SAR panel	SEM panel	SAR panel	SEM panel
<i>IFI</i>	0.2409 ** (0.0360)	0.2373 * (0.0655)	0.4919 *** (0.0000)	0.5114 *** (0.0000)	0.2703 ** (0.0248)	0.2508 ** (0.0434)
<i>RGT</i>	0.0636 (0.7620)	0.0910 * (0.0670)	0.5010 *** (0.0097)	0.3442 ** (0.0327)	(0.1574) (0.4946)	-0.1340 * (0.0554)
<i>RCZ</i>	0.0778 (0.5208)	0.1871 ** (0.0280)	0.1768 (0.1247)	0.0917 (0.4028)	0.0651 (0.6390)	0.0614 (0.6824)
<i>CJ</i>	0.0228 (0.6028)	0.0209 (0.6987)	-0.0245 * (0.0942)	-0.0360 ** (0.0126)	(0.0365) (0.4502)	0.0484 (0.3520)
<i>RGDP</i>	0.0620 ** (0.0422)	0.0080 *** (0.0084)	0.0048 * (0.0784)	0.0541 *** (0.0016)	0.0116 (0.7791)	0.0024 * (0.0953)
ρ	0.7650 *** (0.0000)	0.8110 *** (0.0000)	0.2340 *** (0.0002)	0.5460 *** (0.0000)	0.3720 *** (0.0000)	0.3690 *** (0.0000)
<i>Log-lik</i>	261.7927	257.6459	226.3592	235.6307	287.3930	287.0024
R^2	0.8764	0.5830	0.7910	0.7636	0.8865	0.8720

Note: ***, **, * mean that the regression coefficients of variables are significant under 1%, 5%, 10% confidence level; the values in bracket are P values corresponding to the regression coefficients of variables.

4.3.3 The estimated results of dynamic spatial panel model. This paper comparatively analyzes the estimated results of dynamic spatial panel model and spatial static panel model. The estimated results of dynamic spatial panel model are given in Table 9. Compared with static spatial panel model, the first-order lag of explanatory variables is added to dynamic spatial panel model to represent dynamic effects of explanatory variables over time. In Table 9 shows the effect and the value is 0.0478. However, the value is not significant, indicating that the spillover effect of rural residents' per capita consumption levels is not obvious. Seen from the entire regression results of dynamic spatial panel model, value which reflects the spatial effect is still significant (1% confidence level), revealing that spatial spillover effects of the variables are still significant after introducing the first-order lag of explanatory variables into the model. Comparatively, static spatial panel model has higher values in both goodness of fit and the log-likelihood estimation, reflecting that the introduction of the first-order lag of rural residents' per capita consumption level distinguishes the impact of independent variables and other potential factors. The result of dynamic spatial panel model shows that regression coefficient of the effect of rural inclusive finance index on rural residents' per capita consumption level is 0.2149 and (5% confidence level) significant. Compared with the static panel model, the regression coefficient of inclusive financial index and P value are smaller. As mentioned above, the introduction of the first-order lag of dependent variable separates the impact of other potential factors except the IFI and other control variables from the model, making the inclusive financial index smaller and less significant.

Table 9 The estimated results of dynamic SAR model with time and spatial fixed effect

Variables	Coefficient	Probability
Constant	-0.1847	0.408
<i>IFI</i>	0.2149 **	0.024
<i>RGT</i>	0.2039 **	0.046
<i>RCZ</i>	0.0968	0.422
<i>CJ</i>	-0.0311	0.191
<i>RGDP</i>	0.0179 *	0.067
τ	0.0478	0.397
ρ	0.9939 ***	0.000
R^2	0.5956	
<i>Log-lik</i>	47.2570	

Note: ***, **, * mean that the regression coefficients of variables are significant under 1%, 5%, 10% confidence level; the values in bracket are P values corresponding to the regression coefficients of variables.

5 Conclusions and policy recommendations

5.1 Conclusions Based on two dimensions of supply and demand, we use six indicators to establish a rural inclusive financial development index and evaluate the development of China's rural inclusive finance. We use spatial panel data model to examine the relationship between financial inclusion and rural poverty. Results show that; (i) both the rural inclusive finance and rural residents' per capita consumption present spatial clustering feature and show significant spatial correlation; (ii) the development of rural inclusive finance has significant spatial effect on poverty alleviation

along time and space dimensions.

5.2 Policy recommendations (i) It is necessary to strengthen the flow of financial resource between regions to promote the effect of inclusive finance on poverty reduction. The flow of rural financial resources between regions can enhance rural financial development and promote the inclusiveness of rural finance, meeting the rural residents' demands of financial services, therefore achieving the anti-poverty goals. (ii) It is necessary to build a diversified rural inclusive financial index. Conclusions of this paper demonstrate that the development of rural inclusive finance can significantly alleviate the rural poverty. For the moment, many financial institutions do not play a positive role in poverty alleviation. On the one hand, we should actively encourage and promote the innovation of rural financial organizations, increase the support to new forces in rural finance, such as village banks, credit union funds, community banks and other emerging financial institutions, and give them more policy guidance and support; loosen the restriction of rural financial market access conditionally, attract both state-owned capital and social capital to jointly set up various rural financial organizations and improve the composition of China's rural financial system. On the other hand, we should strengthen the construction of rural credit system and build a better rural finance environment, set up effective loan guarantee for farmers, gradually establish a mechanism of capital flow to rural areas, and make rural financial institutions serve rural areas effectively.

References

- [1] WANG SG. Exit poverty: Financial innovation and anti-poverty in rural China [D]. China Development Press, 2012.
- [2] MOOKERJEE R, KALIPIONI P. Availability of financial services and income inequality: The evidence from many countries [J]. *Emerging Markets Review*, 2010, 11(4):404-408.
- [3] WANG XH, WANG DX, WEN T. Effect of poverty reduction and economic growth about loan for rural resident in China [J]. *The Journal of Quantitative & Technical Economics*, 2014(9):40-55
- [4] THORSTEN B, ASLI DK, ROSS L. Finance, inequality, and poverty: cross-country evidence [N]. Policy Research Working Paper Series 3338, 2004.
- [5] BURGESS R, PANDE R. Can rural banks reduce poverty? Evidence from the Indian Social Banking Experiment [J]. *American Economic Review*, 2005, 95(3):780-795.
- [6] JEANNENEY SG, KPOFAR K. Financial development, financial instability and poverty [N]. CSAE Working Paper, 2005.
- [7] GEDA A, SHIMELES A, ZERFU D. Finance and poverty in Ethiopia: A household level analysis [N]. Working Papers RP2006/51, World Institute for Development Economic Research, 2006.
- [8] SWAIN RANJULA B, MARIA F. Effect of microfinance on vulnerability, poverty and risk in low income households [N]. Department of Economics, Working Paper Series, 2008.
- [9] IMAI KS, GAIHA R, THAPA G, *et al.* Microfinance and poverty - a macro perspective [N]. Discussion Paper Series DP2010-30, Kobe University, 2010.
- [10] SUNIA A. Impact of microfinance on poverty alleviation; A case study of NRSP in Bahawalpur of Pakistan [J]. *International Journal of Academic Research in Accounting, Finance and Management Sciences*, 2013, 3(1):119-135.

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