# Analysis on the Factors Affecting Regional Financial Efficiency in China Based on Spatial Measurement*

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*Abstract*—**From spatial perspective, this paper applies spatial panel model to study the main factors affecting regional financial efficiency. Seven indices were selected from aspects of macroeconomic factors, financial factors and policy factors and analyzed to see the impact of those factors on China's regional financial efficiency. The results show that, on the basis of considering spatial effects, the factors affecting China's financial efficiency mainly include the level of economic growth, the level of financial scale, the degree of financial aggregation and the degree of government's financial intervention. By regions, there are large differences in factors affecting financial efficiencies in various regions of China as well as the influence degree and direction.**

*Keywords—regional financial efficiency; influence factors; spatial panel model*

## I. INTRODUCTION

China's financial industry has formed a relatively complete financial system, with rapid growth in the total amount of financial assets, the number of financial institutions, the types of financial instruments and financial practitioners. The role and status of finance in economic growth has become increasingly significant and improved. While regional finance serves regional economic development from various aspects such as financial accommodation, information transmission, risk dispersion and capital accumulation, regional economy's demands for financial accommodation also promotes the development of regional finance. However, along with the rapid growth of financial scale, financial and economic development has also experienced a series of problems, such as the downturn in the real economy, the hollowing out of the industry and the bubble of the financial real estate industry, so that the entire economic growth is slowed down. Therefore, in recent years, the focus of China's financial development has gradually shifted from expansion in financial scale to improvement of financial efficiency. Only by improving the quality of financial development can it be available to form a virtuous cycle of mutually promoted regional financial and economic growth. Then, how to improve financial efficiency and the factors affecting financial efficiency becomes the focus of research. However, in existing researches, there are relatively few researches on the factors affecting financial efficiency, and the researches are mainly made in linear regression method. There are even less literatures on research of financial efficiency from spatial perspective in combination with the characteristics of the regional economy. According to relevant research results, there are significant spatial correlations and differences among the financial efficiencies different regions in China. [1] Therefore in this paper, the influence factors of regional financial efficiency are researched in spatial econometrics method from spatial perspective.

## II. INFLUENCE FACTORS AND VARIABLES OF REGIONAL FINANCIAL EFFICIENCY

The level of regional financial efficiency is affected by many factors such as macroeconomic factor, internal factors of financial system, and intervention of national and regional economic policies. Macroeconomic factors affecting regional financial efficiency mainly include economic growth and economic structure. Financial factors affecting regional financial efficiency mainly include financial scale, financial structure, financial aggregation degree and financial marketization degree. In addition, the intervention of national macroeconomic policies and financial department has important impact on economic development of each region. However, China's financial market is relatively in low opening degree, and it is more affected by government financial intervention.

Based on this situation, this paper selects seven factors from aspects of macroeconomic factors, financial factors and policy factors as the influence factors of regional financial efficiency, and establishes the influence indicators. The variables are as follows:

Regional Financial Efficiency Index (FE): China's regional financial input and output efficiency is calculated in random non-parametric envelope method to reflect China's regional financial efficiency level[1].

Regional Economic Growth Index (GDP): Due to the unbalanced development of various regions in China, this paper adopts per capita GDP of various provinces and cities to measure economic growth and GDP price is deflated on the basis of fixed price in 2000 in order to reflect the real

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[1]    Ge Xiangyu, Wang Xia. Measurement of Regional Financial Efficiency and Analysis of Its Spatial Differences. Statistics and Decision. 2017.10. (in Chinese)

economic growth of each region and eliminate the influence of population factors.

Regional Economic Structure Index (ES): Economic structure index is used for reflecting whether the regional dual economic structure is unbalanced. This paper uses binary contrast coefficient to measure the status of dual economic structure in various regions of China. The binary contrast coefficient is the ratio of the agricultural comparative labor productivity to non-agricultural comparative labor productivity. Comparative labor productivity is the ratio of the proportion of output value of the sector to the proportion of labor forces, as shown in the following formula:

$$ES_{it} = \frac{\text{Agricultural comparative labor productivity}}{\text{Non-agricultural comparative labor productivity}} = \frac{y_{it}^A / l_{it}^A}{y_{it}^N / l_{it}^N}$$

Regional Financial Scale Index (FIR): financial interrelation ratio (FIR) is often used for measuring the scale of regional financial development and is defined as the ratio of the value of all financial assets to the economic gross (GDP). In view of the availability and applicability of relevant data, this paper uses the balance of local and foreign currency deposits and loans of regional financial institutions instead of the value of all financial assets.

Regional Financial Structure Index (FS): There are many indices reflecting the status of financial structure, such as financial asset structure, financial organization structure, financing structure, etc. By region, financing structure can best reflect the financial support to regional economy and affect financial efficiency. In this paper, the ratio of direct financing to total financing is used as the index of regional financial structure.

Regional Financial Aggregation Index (LQ): There are many methods to measure the degree of financial aggregation. In this paper, the widely used location entropy index (LQ) is used for measuring the degree of financial aggregation. The formula is: $LQ_{ij} = \frac{q_{ij} / q_j}{q_i / q}$. Wherein, $q_{i,j}$ is the number of employed people in financial industry of region $j$; $q_j$ is the total number of employed people in the region; $q_i$ is the number of employed people in financial industry all over China; and $q$ is the total number of employed people in China.

Regional Financial Marketization Process Index (MOP): it is complicated to measure the marketization process and it is not available to reflect the true process of marketization by using a single index. For that reason, Chinese scholars measure the marketization process scores of China by constructing a multi-faceted index system. For instance, Fan Gang (2011) calculated the scores of China's marketization process in various regions from 1997 to 2009; Sun Xiaohua

and Li Mingshan (2014) [2] measured the marketization process scores of China from 2001 to 2012. Based on the latter score calculated and by using Cheng Rui's Incremental algorithm (2016) [3], this paper further estimates the marketization process score of various regions in recent three years, and uses this score as the index value of China's regional marketization process.

Regional Financial Intervention (GI): in this paper, the proportion of regional financial expenditure to GDP is used for measuring the extent of regional government's financial intervention.

## III. ESTABLISHMENT AND ESTIMATION OF SPATIAL PANEL MODEL

### A. Selection of Model

Considering the spatial dependence and spatial spillover of inter-regional financial efficiency and influencing factors, a spatial Dubin model including spatial dependent variables and spatial independent variables was established. In order to reduce the effects of heteroscedasticity and dimension, all variables adopted logarithmic values. The model is initially formed as follows:

$$y_{it} = \rho(I_T \otimes W)_{it} y_{it} + X_{it}\beta + (I_T \otimes W)_{it} X_{it}\theta + \delta_i + \gamma_t + \varepsilon_{it} \quad (1)$$

In the formula, $y$ is the financial efficiency of dependent variable; $X$ is the vector of independent variable [lngdp lnfir lnes lnmop lnfs lnlq lngi]; and $W$ is the geospatial weight matrix established by the ROOK proximity relation.

In order to determine the rationality of the model, firstly, Wald test and LR test were conducted on whether the above-mentioned spatial Dubin model (SDM) can be simplified into spatial error model (SEM) and spatial autoregressive model (SAR). The results show that the SAR and SEM models are both not suitable. Next, a selection was continuously made between spatial Dubin model and spatial autocorrelation model (SAC). SDM and SAC were respectively made maximum likelihood estimation. The larger the log likelihood value estimated is, the smaller the AIC and SC values are and the better the model fitting effect will be. The results show that SAC model is the most suitable spatial panel model for this research and is expressed as follows:

$$\begin{aligned} y_{it} &= \rho(I_T \otimes W)_{it} y_{it} + X_{it}\beta + \delta_i + \gamma_t + \varepsilon_{it} \\ \varepsilon_{it} &= \lambda(I_T \otimes W)_{it} \varepsilon_{it} + \mu_{it} \end{aligned} \quad (2)$$

In the formula, $y$ is the financial efficiency of dependent variable; $X$ is the vector of independent variable; $W$ is the geospatial weight matrix established by the ROOK

2    Sun Xiaohua, Li Mingshan. Differences in the Marketization Process of Regions in Our Country: 2001-2011 [J]. Reform. 2014, 06: 59-66. (in Chinese)

3    Cheng Rui. Marketization Process, Entrepreneurship and Regional Economic Development Gap [J]. Economist, 2016, 08: 19-28. (in Chinese)

proximity; $\rho$ is the spatial autoregressive coefficient; and $\lambda$ is the spatial error coefficient.

In order to test the differences in the factors affecting the financial efficiencies of East China, Central China and West China, the three regions were respectively established with spatial panel models for estimation while conducting spatial panel regression for the national panel data.

### B. Estimation on the Model

The maximum likelihood estimation (ML) was performed on the spatial autocorrelation model. The estimated results are shown in "Table I" and "Table II":

TABLE I.　RESULT OF ESTIMATION ON THE NATIONAL SPATIAL PANEL MODEL

| Variable | Coefficient | Standard deviation | Value Z | Value P |
|---|---|---|---|---|
| lnGDP | 0.2632333 | 0.0579445 | 4.54 | 0.000 |
| lnFS | 0.0006671 | 0.0013918 | 0.48 | 0.632 |
| lnFIR | -0.2607657 | 0.1321438 | -1.97 | 0.048 |
| lnES | 0.0264286 | 0.0282214 | 0.94 | 0.349 |
| lnMOP | -0.0736164 | 0.0575196 | -1.28 | 0.201 |
| LnLQ | 0.1530209 | 0.0723937 | 2.11 | 0.035 |
| lnGI | 0.677611 | 0.1023419 | 6.62 | 0.000 |
| $\rho$ | -0.422704 | 0.1771115 | -2.39 | 0.017 |
| $\lambda$ | 0.5458469 | 0.1390798 | 3.92 | 0.000 |
| $\sigma^2$ | 0.016722 | 0.0016108 | 10.38 | 0.000 |

TABLE II.　RESULT OF ESTIMATION ON THE SPATIAL PANEL MODEL OF EACH REGION

| Variable | East China Coefficient (standard deviation) | East China Test value (value P) | Central China Coefficient (standard deviation) | Central China Test value (value P) | West China Coefficient (standard deviation) | West China Test value (value P) |
|---|---|---|---|---|---|---|
| lnGDP | 0.30114 (0.1117686) | 2.69 (0.007) | 0.094374 (0.0674125) | 2.7 (0.007) | 0.317557 (0.0649657) | 4.89 (0.000) |
| lnES | -0.03003 (-0.0300282) | -1.14 (0.254) | -0.04573 (0.0263282) | -1.74 (0.082) | -0.10676 (0.035874) | -2.98 (0.003) |
| lnFIR | -0.1452 (0.1021256) | -1.42 (0.155) | -0.1731 (0.0668809) | -2.59 (0.01) | 0.024584 (0.0986323) | 0.25 (0.803) |
| lnFS | 0.00271 (0.0013195) | 2.05 (0.04) | -0.00137 (0.0012636) | -1.08 (0.279) | -0.00163 (0.0015912) | -1.02 (0.306) |
| lnMOP | 0.45436 (0.2432322) | 1.87 (0.062) | 0.124289 (0.1131113) | 1.1 (0.272) | -0.0223 (0.0537593) | -0.41 (0.678) |
| LnLQ | -0.20339 (0.0682325) | -2.98 (0.003) | 0.347679 (0.0733562) | 4.74 (0.000) | 0.035015 (0.163933) | 0.21 (0.831) |
| lnGI | 0.694578 (0.1028343) | 6.75 (0.000) | 0.250766 (0.1005502) | 2.49 (0.013) | -0.04194 (0.0982866) | -0.43 (0.67) |
| $\rho$ | -0.1241202(0.0374416) | -3.32(0.001) | 0.6066344 (0.0652907) | 9.29 (0.000) | 0.029678 (0.2136381) | 0.14 (0.089) |
| $\lambda$ | 0.2174609(0.0368656) | 5.89 (0.000) | -0.89805 (0.0250885) | -35.8 (0.000) | -0.21063 (0.2420111) | -0.87 (0.384) |
| $\sigma^2$ | 0.005703 (0.0008078) | 7.06 (0.000) | 0.003488 (0.0006049) | 5.77 (0.000) | 0.011496 (0.0012726) | 9.03 (0.000) |

As West China has not that obvious spatial effect, West China was directly conducted regression estimation regardless of the influence of spatial effect. The estimation result is as shown in "Table III":

TABLE III.　RESULT OF ESTIMATION ON THE MODEL OF WEST CHINA

| | Variable | Coefficient | Standard deviation | Value T | Value P |
|---|---|---|---|---|---|
| Before eliminating non-significant variable | lnGDP | 0.3225763 | 0.0523174 | 6.17 | 0.000 |
| | lnFIR | -0.0203523 | 0.1119098 | -0.18 | 0.856 |
| | lnFS | -0.0017329 | 0.0017864 | -0.97 | 0.334 |
| | lnES | -0.1038206 | 0.0400737 | -2.59 | 0.011 |
| | lnMOP | -0.044095 | 0.0555343 | -0.79 | 0.429 |
| | LnLQ | 0.051793 | 0.174796 | 0.3 | 0.767 |
| | lnGI | -0.016652 | 0.1097638 | -0.15 | 0.88 |
| After being optimized | lnGDP | 0.2986518 | 0.0260548 | 11.46 | 0.000 |
| | lnES | -0.1030401 | 0.0366599 | -2.81 | 0.006 |

The affecting effect of variable of each influence factor was broken down on the basis of the above estimation on spatial panel model. The breakdown result is as shown in "Table IV" and "Table V":

TABLE IV. BREAKDOWN OF SPATIAL EFFECT OF INFLUENCE FACTORS OF FINANCIAL EFFICIENCY

| Variable | Direct effect | Spillover effect | Gross effect |
|---|---|---|---|
| lnGDP | 0.2737232*** (0.0639012) | -0.0869228**(0.0429422) | 0.1868004***(0.0388174) |
| lnFS | 0.0006831 (0.0014493) | -0.0001798(0.0004712) | 0.0005033(0.0010196) |
| lnFIR | -0.2675821** (0.1266563) | 0.0775489*(0.0429805) | -0.1900332*(0.0998671) |
| lnES | 0.0269273 (0.0291846) | -0.0088984(0.0109238) | 0.0180289(0.0195507) |
| lnMOP | -0.0738803(0.0598797) | 0.0236579(0.0228742) | -0.0502224(0.040591) |
| LnLQ | 0.1584352***(0.0772167) | -0.049812(0.0324218) | 0.1086232**(0.0535803) |
| lnGI | 0.7113461***(0.1095841) | -0.2225702**(0.0929678) | 0.4887758***(0.0787638) |

TABLE V. BREAKDOWN OF SPATIAL EFFECT OF INFLUENCE FACTORS OF FINANCIAL EFFICIENCY IN EAST CHINA AND CENTRAL CHINA

| Variable | East China | | | Central China | | |
|---|---|---|---|---|---|---|
| | Direct effect | Spillover effect | Gross effect | Direct effect | Spillover effect | Gross effect |
| lnGDP | 0.30003*** (0.10911) | 0.025817 (0.09009) | 0.32585*** (0.12701) | 0.31282*** (0.31282) | 1.60505*** (0.31150) | 0.50378*** (0.12160) |
| lnFIR | -0.15313 (0.09545) | -0.18484 (0.12676) | -0.33797** (0.14789) | -0.22752*** (0.08332) | -0.21215** (0.08831) | -0.43967*** (0.16529) |
| lnFS | 0.002619** (0.00128) | -0.00104 (0.00179) | 0.001577 (0.00195) | -0.00176 (0.00156) | -0.00168 (0.00159) | -0.00345 (0.00313) |
| lnES | -0.03452 (0.02657) | -0.07202* (0.04118) | -0.10654** (0.05101) | -0.05971* (0.03305) | -0.05531* (0.03270) | -0.11502* (0.06466) |
| lnMOP | 0.460726* (0.24525) | -0.08296 (0.29067) | 0.377766 (0.35202) | 0.16937 (0.14642) | 0.155723 (0.14536) | 0.325092 (0.28909) |
| LnLQ | -0.22511*** (0.06530) | -0.3198*** (0.12064) | -0.54491*** (0.15386) | 0.45559*** (0.08190) | 0.424603** (0.09438) | 0.88020*** (0.15633) |
| lnGI | 0.66376*** (0.09736) | -0.46633*** (0.11089) | 0.19743*** (0.15185) | 0.33122*** (0.12451) | 0.30614*** (0.12078) | 0.63736*** (0.23690) |

## C. Analysis on the Empirical Results

*1) Main factors affecting financial efficiency:* First, seen from the estimation results of the spatial regression model of the factors affecting financial efficiency all over China, the spatial autoregressive coefficients and spatial error coefficients are both statistically significant and the spatial effect is significant. Among the seven influence factors of financial efficiency, the statistical results of economic growth lngdp, financial scale lnfir, financial aggregation degree lnlq and local government intervention lngi are significant, while the statistical results of economic structure lnes, financial structure lnfs and marketization process lnmop are not significant. This indicates that on the basis of considering spatial effects, the factors affecting China's financial efficiency mainly include the level of economic growth, the level of financial scale, the degree of financial aggregation and the degree of government's financial intervention.

Next, seen from the estimation results of the spatial regression model of influence factors of regional financial efficiency, the spatial autoregressive coefficients and spatial error coefficients of East China and Central China are statistically significant, and the spatial effects are significant, while the spatial statistical result of West China is not significant. Thereby, a panel regression model was established for eliminating spatial factors in West China to conduct the least square regression estimation again.

As shown in the statistical results of the spatial regression model of East China by regions, the variables such as lngdp, lnfs, lnmop, lnlq and lngi are statistically significant, that is, the factors affecting financial efficiency in East China mainly include economic growth, financial structure, the degree of financial marketization, the degree of financial aggregation and government fiscal expenditure. Like the statistical results of the national spatial regression model, most of those factors have a significant positive impact on financial efficiency in East China. As shown in the statistical results of the spatial regression model of Central China, the variables lngdp, lnfir, lnes, lnlq, and lngi are statistically significant, that is, the factors affecting financial efficiency in Central China mainly include economic growth, financial scale, economic structure, the degree of financial aggregation and government fiscal expenditure. Wherein, economic growth, the degree of financial aggregation and government fiscal expenditure have a significant positive impact on financial efficiency, while the financial scale and economic structure have a significant negative impact on financial efficiency. As shown in the statistical results of the spatial regression model of West China, only the variables lngdp and lnes are statistically significant, that is, the factors affecting financial efficiency in West China mainly include economic growth and economic structure. Other financial factors and policy factors have no significant effect on the financial efficiency.

*2) Spatial spillover effect of influence factors of financial efficiency:* From national point of view, the factors having significant gross effects include economic growth,

financial scale, financial aggregation degree and government fiscal expenditure. Those four factors have a significant impact on the financial efficiency of the region, showing a significant direct effect. In addition, economic growth, financial scale and government fiscal expenditure also showed significant spillover effects which have an impact on the level of financial efficiency in other regions, but the direction of impact is different. Economic growth and government fiscal expenditure have a positive direct effect on the region, but have negative spillover effects on other regions; the degree of financial aggregation has no spillover effect, indicating that the improvements of financial efficiencies of many regions more depend on the economic growth level and fiscal expenditure of the region and are more in competition relation with other regions, without financial aggregation effect.

By breakdown of effects on various regions, the economic growth, financial structure and marketization process in East China only have positive direct effect on the financial efficiency of the region and have no spillover effect on other regions. The degree of financial aggregation has significant negative direct effect and spillover effect on both the region and other regions, while government fiscal expenditure has positive direct effect on the region and has negative spillover effect on other regions. The above effect breakdown results show that the improvement of financial efficiency level of each province and city in East China mainly depends on the improvement of its economic growth level, the adjustment of financial structure, the deepening of marketization and the proportion of fiscal expenditure, while financial aggregation is the major factor hindering the improvement of financial efficiencies of each province and city and other provinces and cities in East China. The effects of various influence factors in Central China are completely the same. Economic growth, financial aggregation degree and government fiscal expenditure also have positive spillover effect on other regions while having a positive direct effect on the financial efficiency of the region. Financial scale and economic structure also have positive spillover effect on other regions while having negative direct effect on the financial efficiency of the region. This indicates that there is high correlation between the factors affecting the financial efficiency of each province and city in Central China and affects mutually among different provinces and cities, showing significant financial aggregation effect; and the improvement of its financial efficiency level mainly relies on economic growth, financial aggregation degree and government fiscal expenditure. There is no spatial effect in West China.

## IV. CONCLUSION

Through spatial panel analysis, it is found that the factors affecting the financial efficiency of each region in China as well as the degree and direction of the influence are different. On the basis of considering spatial effects, the factors affecting China's regional financial efficiency mainly include the level of financial marketization, the degree of financial aggregation and the degree of government's financial intervention in addition to economic growth and financial

scale. Each region should focus on the positive impact of those factors on regional financial efficiency, based on the actual situation. It is suggested to do the following practices: first, continuously and stably promote the marketization process; next, create a financial center in Central China having obvious aggregation effect and radiate the surrounding areas from this center so as to drive the financial and economic development in the entire Central China; finally, government may take indirect means such as economic policies to lead the flow and allocation of financial resources, improve financial efficiencies as well as try the best to reduce the direct intervention of financial funds in financial markets. Each regional government should actively take the opportunities supported by governmental policies and financial fund to promote the substantial development of regional finance.

REFERENCES

[1] C Gaetan, X Guyon. Spatial Statistics and Modeling. Springer New York, 2010, 40 (2).

[2] Yves Kuhry & Laurent Weill (2010). Financial intermediation andmacroeconomic efficiency, Applied Financial Economics, 2015, 1185-1193.

[3] Sun Xiaohua, Li Mingshan. Differences in the Marketization Process of Regions in Our Country：2001-2011 [J]. Reform. 2014, 06: 59-66. (in Chinese)

[4] Cheng Rui. Marketization Process, Entrepreneurship and Regional Economic Development Gap [J]. Economist, 2016, 08: 19-8. (in Chinese)

[5] Zhou Zejiong, Ma Yanping. A Study on the Differences and Influential Factors of China's Rural Financial Development from the Regional Perspective [J]. East China Economic Management, 2016, 07: 100-106. (in Chinese)

[6] Zheng Shaozhi, Huang Mengyun. An Analysis of Factors Influencing Regional Financial Development based on Bayesian Spatial Econometric Model [J]. Commercial Research, 2015,01:62-69. (in Chinese)

[7] Xie Jiazhi, Wang Wentao. Economic Growth Efficiency of Financial Development: Influence Factors and Transmission Mechanism [J]. Finance and Economics, 2013, 07: 59-67. (in Chinese)