Study on the Impact of the Development of Scale and Efficiency of Financial Institutions on the Income Inequality in China

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Abstract—**Many scholars study the relationship between the financial development and the urban-rural income inequality, but there are few researches about the intra-urban and intra-rural income inequality. By empirical testing, this paper finds that there is no long-term co-integrations relationship between the efficiency or scale of financial institutions and urban-rural income inequality. As for intra-urban income inequality, efficiency of financial institutions will increase the intra-urban income inequality but the scale of financial institutions will reduce the intra-urban income inequality. As for the intra-rural income inequality, only development of efficiency of financial institutions will reduce the intra-rural income inequality. The openness level is critically important in reducing the intra-rural income inequality.**

Keywords: development of financial institutions, efficiency of financial institutions, income inequality

I. INTRODUCTION

Since the reform and open-door policy has been issued, China has maintained a relatively high rate of economic growth and become the second largest economy in the world. As a significant factor in promoting economic development, financial system has also developed continuously.

With the economic development of China, the income of the residents also constantly increases, but the condition of income inequality is not optimistic. Income inequality can be classified into the urban-rural, intra-urban and intra-rural income inequality. Li and Yue (2004) pointed out that the contribution of urban-rural income inequality to the national income inequality is 40%. Although to some degree, the urban-rural income inequality measured by the ratio of per capita disposable income of urban residents divided by the per capita net income of rural residents has reduced which leads to the decline of Gini Coefficient, the intra-rural and intra-urban income inequality has increased gradually.

A number of scholars proved that the financial development of China has impact on the urban-rural income inequality. However, whether the financial development of China has influence on the intra-urban and intra-rural income gaps worth

pondering. Therefore, this essay studies the impact of the financial development of financial institution on the urban-rural, intra-urban and intra-rural income inequality and puts forward corresponding policy proposals.

II. METHODOLOGY

A. Model

Because using Least Square Method may lead to spurious regression especially for the macroeconomic time series data and reduce the reliability of the conclusion, VAR model is more appropriate for this dissertation. The format of the model of VAR model is as follows:

$$y_t = A_1 y_{t-1} + \ldots + A_p y_{t-p} + \varepsilon_t, \quad t=1, 2, \ldots, T \quad (1)$$

y_t, p, T, A_p, ε_t, means the endogenous variable, lag intervals for endogenous, sample size, coefficient matrix and residue respectively. In this study, the endogenous variables are SCALE, EFF, URG, RG and UG.

VAR model pay more attention to the short term relationship, Co-integration test will also be needed to establish the Co-integration equation to discuss the long-term relationship. Johansen test is a procedure for testing co-integration of several time series in the long term (Johansen, 1991). Compared with the ordinary regression equation, co-integration can avoid the Pseudo-regression.

B. Variable

This paper involve in 8 indexes. The indexes of scale of financial institution and efficiency of financial institution are explanatory variables and expressed by SCALE and EFF. The indexes of the economic growth, trade openness and equalization of basic public service are control variables and expressed with LNGDP, OP and PUBD. The indexes of urban-rural, intra-urban and intra-rural income inequalities are the explained variables and expressed by URG, UG and RG. The following figure 4 shows what data needs for each index, where the data comes from and the relevant appendixes. The

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composition and formulas of indexes will be explained detailed in the following sections.

TABLE 1. THE RESOURCES OF DATA AND THE DATA NEEDED FOR EACH INDEX

Index	Data	Resources
Scale (SCALE)	Total loans of financial institutions	*Almanac of China's Finance and Banking*
	Nominal GDP	*China Statistical Yearbook*
Efficiency (EFF)	Total loans of financial institutions	*Almanac of China's Finance and Banking*
	Total deposits of financial institutions	
Economic growth (LNGDP)	Nominal GDP per capita	*China Statistical Yearbook*
	Indices of GDP per capita (preceding year)	
Trade openness (OP)	Export and import	*EPS database*
	Nominal GDP	*China Statistical Yearbook*
Equalization of basic public service (PUBD)	the number of exhaust gas treatment facilities, wastewater treatment facilities, population, the number of participants in basic endowment insurance, the number of participating unemployment insurance in the total population, number of ordinary primary school students, Primary school full-time teachers, number of ordinary secondary school students, Number of secondary school full-time teachers, Number of beds hospitals, Number of health technicians, direct loss from traffic accident, Number of patents authorized, Technical market turnover	*EPS database*，*China social and economic development database.*
Urban-rural income inequality (URG)	per capita disposable income of urban residents and per capita net income of rural residents.	*China Statistical Yearbook*
Intra-urban income inequality (UG)	Per Capital Net Income of Rural Households by Income Quintile	*China Statistical Yearbook*
Intra-rural income inequality (RG)	Per Capital Net Income of Rural Households by Income Quintile	*China Statistical Yearbook*

● Indexes of Scale and Efficiency of financial institutions

TABLE 2. THE COMPOSITION OF THE DEGREE OF DESPERATION OF BASIC PUBLIC SERVICE

First-level indicator	Second-level indicator	Third-level indicator	Fourth-level indicator
Degree of dispersion of Basic public service(34)	Public service index in province level	Social security	Number of people participating in unemployment insurance as a proportion of the total population
			Number of participants in basic endowment insurance as a proportion of the total population
		Public security	Direct loss from traffic accident
		Public hygiene	Number of beds in hospitals
			Number of health technicians
		Compulsory education	No. of Students/ No. of full-time teacher in primary school
			No. of Students/ No. of full-time teacher in secondary school
		Environment protection	Number of exhaust gas treatment facilities
			wastewater treatment facilities
		Science technology	Number of patents authorized
			Technical market turnover

As for the fourth-level indicator, each third-level indicator consists of two corresponding fourth-level indicators except for the public security indicator. Because the data about direct loss of fire accident is not complete and cannot be extrapolated with the EXCEL, therefore there is only one fourth-level indicator.

Because the unit of measurement and orders of magnitude differs for each fourth-level indicator, these fourth-level indicators cannot be compared and added directly. Gan (2013) used the non-dimensional treatment method to solve this problem. The formulas are as follows:

$$Z_i = \frac{x_i - \min(x_i)}{\max(x_i) - \min(x_i)} \quad (2)$$

$$Z_i = 1 - \frac{x_i - \min(x_i)}{\max(x_i) - \min(x_i)} \quad (3)$$

For the positive indicator, higher indicator means higher degree of the public service and the fomula (1) is used. On the contrary, the formula (2) is suitable for the negative indicator. In these two formulas, x_i represents the data of i-th province and min(x_i) and max(x_i) means the minimum value and maximum value from 1997 to 2016 in i-th province

The processed fourth-level indicators need to be composited into third-level indicators. Every third-level indicators are the average value of its sub-level or the fourth-level indicators. The second-level indicator is also the average value of all third-level indicators. The first level indicator is calculated as follows:

$$u_i = \sigma \div \bar{x} = \sqrt{\frac{\sum_{i=1}^{n}(X_i - \bar{x})^2}{n}} \div \bar{x} \quad (4)$$

$\bar{x}$ reflects average value of second-level indicators, u_i reflects coefficient of dispersion, X_i reflects the i-th second-level indicator, i reflects i-th province, N reflects the number

of provinces, σ reflects standard deviation, u_i reflects the degree of deviation and the lower the u_i is, the more representative of the average value is and the higher degree of the equalization of basic public service is.

Gu and Bai (2015) and Chao and Ren (2011) calculate Theil Index to reflect the urban-rural income inequality. Zhang et. all (2003) and Liu etc., (2013) select the following more simple index :

URG= per capita disposable income of urban residents/ per capita net income of rural residents.

As the Theil index is too complicated, the second index is used here.

Intra-urban and Intra-rural income inequality indexes

Wang and Kong (2011) take the ratio of the average income of 10% of the highest income households divided by the 10% of the lowest income households to represent the intra-urban and intra-urban income inequality. But this index only reflects the extreme value but ignore the internal difference in medium income group. This dissertation used the simplified method to calculate Gini Coefficient. The higher the Gini Coefficient is, the greater the income inequality is (Gini, 1921). The simplified method is invented by the Hu (2004) and formula is as follows. The disposable income and net income will be used respectively for the intra-urban and rural income inequality.

$$G_1 = P_5 - P_1 \qquad (5)$$

P_5 reflects Per Capital Income of 1 Households of highest income quintile group, P_1 reflects Per Capital Income of 1 Households of lowest income quintile group

III. DATA DESCRIPTION

This chapter mainly describes the statistic characteristics of variables. On the one hand, the maximum, minimum, average, standardization of each variable will be given. On the other hand, the line chart of the explanatory variables (SCALE, EFF) and explained variables (URG, UG and RG) will be analyzed.

TALBE 3. STATISTIC CHARACTERISTIC OF SAMPLE

YEAR	SCALE	EFF	URG	UG	RG	LPGDP	PUBD	OP
MAX	1.433	0.909	3.333	0.341	0.391	10.340	0.314	0.642
MIN	0.940	0.651	2.469	0.252	0.360	8.842	0.083	0.315
AVEARAGE	1.109	0.735	3.024	0.316	0.377	9.614	0.184	0.462
STDEV	0.130	0.078	0.265	0.024	0.009	0.487	0.075	0.102

IV. DATA ANALYSIS

A. *Augmented Dickey–Fuller test*

TABLE 4. ADF TEST

Variable	Sequence form	t-Statistic	1% level	5%level	10%level	Prob
urg	(1,1,1)	-5.055	-4.728	-3.760	-3.325	0.006
ug	(1,1,1)	-4.402	-4.728	-3.760	-3.325	0.017
rg	(1,1,1)	-6.955	-4.572	-3.691	-3.287	0.000
eff	(1,1,1)	-4.988	-4.572	-3.691	-3.287	0.004
scale	(1,1,1)	-3.903	-4.616	-3.710	-3.298	0.036

Table 4 shows that under the 5 % significance level instead of 1% level, all the absolute value of T are greater than the critical value and meanwhile the probability is under 5%.It means the first order difference of above times series variables are stable and therefore the granger causality test and VAR model are accessible to take. Moreover, there is uniformity integrated with variable, co-integration test is available.

B. *Granger causality test*

TABLE 5. GRANGER CAUSALITY TEST FOR THE EFF, SCALE, AND URG

Null Hypothesis	Obs	F-Statistic	Prob
eff does not granger cause urg	19	7.28315	0.0158
urg does not granger cause eff	19	4.97411	0.0404
scale does not granger cause urg	19	17.6717	0.0007
urg does not granger cause scale	19	0.32962	0.5739

From table 5, it can be seen that when the lag order is one, only the P value of the first three hypothesizes are lower than 5%. Therefore, efficiency of financial institution and urban-rural income inequality are in reciprocal causation while scale of financial institution is the granger cause of the urban-rural income inequality. Based the result, VAR model can be established.

TABLE 6. GRANGER CAUSALITY TEST FOR THE EFF, SCALE, AND UG

Null Hypothesis	Obs	F-Statistic	Prob.
eff does not granger cause ug	19	2.64796	0.1232
ug does not granger cause eff	19	1.26933	0.2765
scale does not granger cause ug	19	0.01490	0.9044
ug does not granger cause scale	19	0.30644	0.5875

For the same principal, because all the P value is greater than 5%, there is no granger cause between efficiency or scale of financial institution and the intra-urban income inequality. Therefore, VAR is not available but co-integration test is available.

TABLE 7. GRANGER CAUSALITY TEST FOR THE EFF, SCALE, AND RG

Null Hypothesis	Obs	F-Statistic	Prob.
eff does not granger cause rg	19	4.00590	0.0626
rg does not granger cause eff	19	0.49132	0.4934
scale does not granger cause rg	19	0.27288	0.6086
rg does not granger cause scale	19	1.34876	0.2625

Table 7 proves that there is no granger cause between efficiency or scale of financial institution and the intra-rural income inequality as the P value is greater than 5%.Thus,the co-integration test needs to be implemented.

C. VAR model

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TABLE 8. IDENTIFY THE LAG ORDER OF VAR1: IMPACT OF THE EFF ON URG

Lag order	AIC	SC	Adj. R^2
Lag 1	-1.8919	-1.7435	0.3549
Lag 2	-2.1528	-1.9078	0.5312
Lag 3	-2.1840	-1.8460	0.5519
Lag 4	-2.1084	-1.6836	0.4974

Therefore there are 3 lag orders. The adjusted R of the formula is only 0.5519, it means the Goodness of Fit of the formula is not good enough.

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TABLE 9 IDENTIFY THE LAG ORDER OF VAR2: IMPACT OF THE URG ON EFF

Lag order	AIC	SC	Adj. R^2
Lag 1	-4.4587	-4.3103	0.0752
Lag 2	-4.3301	-4.0851	-0.0014
Lag 3	-4.6397	-4.3017	0.1068
Lag 4	-4.7436	-4.3188	0.2093

Figure 3. AR graph of the impact of the URG on EFF

Table 9 shows that the adjusted R is pretty low, all the lag orders are not available.

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TABLE 10. IDENTIFY THE LAG ORDER OF VAR3: IMPACT OF THE SCALE ON URG

Lag order	AIC	SC	Adj.R^2
Lag 1	-2.1292	-1.9808	0.4912
Lag 2	-2.1842	-1.9392	0.5457
Lag 3	-2.0721	-1.7341	0.4989
Lag 4	-1.8620	-1.4371	0.3570

Table 10 shows that AIC criteria and adjusted R is favorable when the lag order is 2.But the adjusted R is still low.

D. Co-integration test – Johansen test

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TABLE 11. CO-INTEGRATION TEST1: EFF ON THE URG

Variable	Trace	5% level	Prob.	result
Urg、eff	14.047	15.495	0.0817	0

Table 11 shows there is no co-integration relationship between the development of efficiency of financial institutions and rural-urban income inequality as the P value is greater than 5%.

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TABLE 12. CO-INTEGRATION TEST1: SCALE ON THE URG

variable	Trace	5% level	Prob.	result
Urg、scale	14.320	15.495	0.0746	0

Table 12 shows there is no co-integration relationship between the development of scale of financial institutions and rural-urban income inequality as the P value is greater than 5%.

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TABLE 13. CO-INTEGRATION TEST1: EFF ON THE UG

variable	Trace	5% level	Prob.	result
Ug、eff	29.194	3.841	0.000	2
Ug、eff、lngdp	1.305	3.841	0.254	2
Ug、eff、pubd	0.733	3.841	0.392	2
Ug、eff、op	7.472	3.841	0.006	3

The first line in table 13 shows that there are two co-integration relationships between the development of efficiency of financial institutions and intra-urban income inequality. Considering adding the control variables, only the introduction of the openness index makes the co-integration increases and the P value is less than 5%. Therefore, it will be added to the co-integration equation. It can be seen that the one unit increase

of EFF will increase the UG by 0.3602467 units but increase of one unit of OP will reduce it by 0.023275 units. Thus , one unit increase of the EFF and OP will increase it by 0.336972 unit.

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TABLE 14. CO-INTEGRATION TEST1: EFF ON THE UG

variable	Trace	5% level	Prob.	result
Ug、scale	0.106	3.841	0.7443	1
Ug、scale、lngdp	0.386	3.841	0.5342	2
Ug、scale、lngdp、pubd	-	-	-	Near singular matrix
Ug、scale、pubd	1.207	3.841	0.2719	2
Ug、scale、op	14.237	3.841	0.0002	3
Ug、scale、lngdp、、op	-	-	-	Near singular matrix

The table 14 shows that one unit increase of SCALE will decrease the UG by 0.125331 units but increase of one unit of OP will increase it by 0.018521 units. Thus, one unit increase of the EFF and OP will reduce it by 0.10681 unit.

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TABLE15. CO-INTEGRATION TEST1: EFF ON THE RG

variable	Trace	5% level	Prob.	result
rg、eff	2.215	3.841	0.1367	1
rg、eff、lngdp	13.212	3.841	0.0003	3
rg、eff、lngdp、pubd	-	-	-	Near singular matrix
rg、eff、pubd	7.628	3.841	0.0057	3
rg、eff、pubd、op	-	-	-	Near singular matrix
rg、eff、op	5.013	3.841	0.0251	3

According to the table 15, one unit increase of EFF and LNGDP will decrease the RG by 0.079998 and 0.01908 units respectively and thus, one unit increase both of them will reduce it by 0.099078 unit. One unit increase of EFF and PUBD will decrease the RG by 0.128801 and 1.183876 units respectively and thus, one unit increase both of them will reduce it by 1.312677 unit. One unit increase of EFF and LNGDP will decrease the RG by 8.377744 and 3.671108 units respectively and thus, one unit increase both of them will reduce it by 12.048852 unit. It can be seen the trade openness have great influence on the rural income inequality.

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TABLE 16. CO-INTEGRATION TEST1: SCALE ON THE RG

variable	Trace	5% level	Prob.	result
rg、scale	13.905	15.495	0.0856	0

Table 16 shows there is no co-integration relationship between the development of efficiency of financial institutions and rural-urban income inequality as the P value is greater than 5%.

V. CONCLUSION AND RECOMMONDATIONS

In the short term, the development of efficiency and scale of financial institutions will reduce the urban-rural income inequality. But they will not influence on the intra-rural and intra-urban income inequality. According to the co-integration partnership, there is no long-term co-integrations relationship between the efficiency or scale of financial institutions and urban-rural income inequality. As for intra-urban income inequality, efficiency of financial institutions will increase the intra-urban income inequality but the scale of financial institutions will reduce the intra-urban income inequality. As for the intra-rural income inequality, only efficiency will influence it. The development of efficiency of financial institutions will reduce the intra-rural income inequality. Moreover, the openness level, equalization of basic public service and economic growth plays a favorable role in reducing the intra-rural income inequality. The openness level is critically important compared with other factors in reducing the intra-rural income inequality.

Improve trade openness. With the trend of the economic and financial globalization, it is supposed to improve the trade openness. Government needs to reduce trade barriers and allows for the free flow of capital.

Promote the degree of the equalization of basic public service. Government is supposed to establish the overall public service system and basic infrastructure in rural area. It needs to cover the national medical insurance, compulsory education social insurance and so on in all poor rural areas to improve equalization of financial service. In the meantime, the central government can increase the transfer payment to the poor and rural area.

Promote the financial deepening. Although in 2005, the China lifted the ceiling on deposit rates which means that China had finished the market-based reform of interest rates basically. It also needs hard work for the central bank to improve interest rate transmission mechanism, market interest rate pricing mechanism and relevant laws and regulations. Therefore, the market can fully play a role in allocating financial resources efficiently.

Take the differentiated deposit reserve policy. Government can take the differentiated deposit reserve policy to encourage the SMEs loans, start-up loans, student loans and agriculture loans. It means when the commercial banks have make above loans up to certain level, the central banks can reduce the deposit reserve ratio for them.

Improve financial inclusion. Financial inclusion requires financial system to provide the effective and overall financial service to the all groups and all strata of society. On the hand, the government should improve the accessibility of the financial service and provide more support to the SMEs and peasant households. On the other hand, it's better to reduce the transaction cost using the modern technology such as online banking and Fintech. It can provide a more convenient, cost-saving, timely and efficient service to the people.

REFERENCES

[1] Li, S. and Yue, X. M. (2004). China has Highest Urban-rural Income Inequality. China Economic Information, 04(6), 50-52

[2] Sims, Christopher (January 1980) [1977 (Working paper)]. Macroeconomics and reality. Econometrica, 48 (1),1–48

[3] Wang, W. and Kong, D. (2011). Impact of scale, efficiency and flow of loans of financial institutions on the income distribution. Financial Reference, 11(3), 1-18

[4] Yang, D. T. (1999).Urban-Biased Policies and Rising Income Inequality in China, American Economic Review Papers And Proceedings, 5, 306—310.

[5] Yao, Y. (2005). An Empirical Analysis of Financial Developmentand Urban-Rural Income Gap in China. Journal of Finance and Economics, 31(2), 49-59

[6] Yan, Y. (2017). A study on fiscal countermeasures about equalization of basic public service. China: Shanxi University of Finance and Economics

[7] Zhang, J., & Zhang, J. (2004). How does social security affect economic growth? Evidence from cross-country data. Population Economics, 17(3), 473–500

[8] Zhang, L. J. and Zhan, Y. (2006) The Influence of China Rural Financial Development on Urban- rural Income Gap. Journal of Central University of Finance and Economics, 5, 34-39

[9] Zhang, Q. & Chen, R. (2015). Financial Development and Income Inequality in China: An Application of SVAR Approach. Procedia Computer Science, 55, 774–781.

[10] Zhang, Q. Liu, M. X. and Tao, R. (2004). Financial institution increase in China and urban-rural income gap, China Finance, 04(3), 16-25

[11] Zhang, W., Xu, L. and Luo, Z.X. (2010). Financial Development and Income Inequity: Back to G-Z Hypothesis, Contemporary Finance &Economics. 10(11), 15 -25

[12] Zhu, Y. and Wang, X. (2009). Equalizing Basic Public Services and Narrowing the Income Gap between Urban &Rural Areas in China. Journal of Social Science Edition, 11(6), 15-18