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 and intra-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:

\[ y_t = A_1 y_{t-1} + \ldots + A_p y_{t-p} + \epsilon_t, \quad t=1, \ldots, T \]  

\[ y_t, \quad p, \quad T, \quad A_p, \quad \epsilon_t \] 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
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                             | China Statistical Yearbook                     |
| Economic growth (LNGDP)              | Nominal GDP per capita                                              | China Statistical Yearbook                     |
|                                      | Indices of GDP per capita (preceding year)                          | China Statistical Yearbook                     |
| 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 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 participants in basic endowment insurance, 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 in province level | Social security | Public security | Number of people participating in unemployment insurance as a proportion of the total population |
| Public service index | Public hygiene | Direct loss from traffic accident | Number of beds in hospitals |
| EPS database (4)     | Compulsory education | No. of Students/ No. of full-time teacher in primary school | Number of students/ No. of full-time teacher in secondary school |
| China Statistical Yearbook | Environment protection | Number of exhaust gas treatment facilities | wastewater treatment facilities |
| China Statistical Yearbook | 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:

\[
Z_i = \frac{x_i - \min(x_i)}{\max(x_i) - \min(x_i)}
\]

(2)

\[
Z_i = 1 - \frac{x_i - \min(x_i)}{\max(x_i) - \min(x_i)}
\]

(3)

For the positive indicator, higher indicator means higher degree of the public service and the formula (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 composed 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:

\[
\bar{u}_i = \sigma \div \bar{x} = \sqrt{\frac{\sum_{i=1}^{n} (x_i - \bar{x})^2}{n}} \div \bar{x}
\]

(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, \( \bar{u}_i \) reflects the i-th province, \( N \) reflects the number
of provinces, \( \sigma \) 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 et., (2013) select the following more simple index:

\[
URG = \frac{\text{per capita disposable income of urban residents}}{\text{per capita net income of rural residents}}
\]

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 of provinces, \( \sigma \) 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.

\[
G_1 = P_5 - P_1
\]

\( P_5 \) 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.

| Variable | Sequence form | l-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 \( \Delta \) 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

null hypothesis Table 5. Null Hypothesis

| Null Hypothesis | \( b_s \) | F-Statistic | \( b \) | Prob |
|-----------------|---------|-------------|-------|------|
| eff does not granger cause urg | 9 | 7.28315 | 0.00 | 158 |
| urg does not granger cause eff | 9 | 4.97411 | 0.00 | 404 |
| scale does not granger cause urg | 9 | 17.6717 | 0.00 | 007 |
| urg does not granger cause scale | 9 | 0.32962 | 0.50 | 739 |

From table 5, it can be seen that when the lag order is one, only the \( b_s \) 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.

null hypothesis Table 6. Null Hypothesis

| Null Hypothesis | \( b_s \) | F-Statistic | \( b \) | Prob |
|-----------------|---------|-------------|-------|------|
| eff does not granger cause ug | 9 | 2.64796 | 0.12 | 32 |
| ug does not granger cause eff | 9 | 1.26933 | 0.27 | 65 |
| scale does not granger cause ug | 9 | 0.01490 | 0.90 | 44 |
| ug does not granger cause scale | 9 | 0.30644 | 0.58 | 75 |

For the same principal, because all the \( b_s \) 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                  | t | F- Statistic | P rob. |
|----------------------------------|---|--------------|--------|
| eff does not granger cause rg    | 9 | 4.005        | 0.0626 |
| rg does not granger cause eff    | 9 | 0.491        | 0.4934 |
| scale does not granger cause rg  | 9 | 0.272        | 0.6086 |
| rg does not granger cause scale  | 9 | 1.348        | 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

Impact of the development of efficiency of financial institutions on rural-urban income inequality

Table 8. Identify the Lag Order of VAR1: Impact of the EFF on URG

| Lag order | AIC  | SC   | Adj. R²  |
|-----------|------|------|----------|
| 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.

Impact of rural-urban income inequality on the development of scale of financial institutions

Table 9. Identify the Lag Order of VAR2: Impact of the URG on EFF

| Lag order | AIC  | SC   | Adj. R²  |
|-----------|------|------|----------|
| 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.

Impact of the development of scale of financial institutions on rural-urban income inequality

Table 10. Identify the Lag Order of VAR3: Impact of the SCALE on URG

| Lag order | AIC  | SC   | Adj. R²  |
|-----------|------|------|----------|
| 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

Impact of the development of efficiency of financial institutions on rural-urban income inequality

Table 11. Co-integration test 1: 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%.

Impact of the development of scale of financial institutions on rural-urban income inequality

Table 12. Co-integration test 1: 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%.

Impact of the development of efficiency of financial institutions on intra-urban income inequality

Table 13. Co-integration test 1: EFF on the UG

| Variable | Trace | 5% level | Prob. | result |
|----------|-------|----------|-------|--------|
| Ug, eff & pubd | 29.194 | 3.841 | 0.000 | 2 |
| Ug, eff & lnlgdp | 1.305 | 3.841 | 0.254 | 2 |
| Ug, eff & lnpubd | 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.

Impact of the development of scale of financial institutions on intra-urban income inequality

Table 14. Co-integration test 1: 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.

Impact of the development of efficiency of financial institutions on intra-rural income inequality

Table 15. Co-integration test 1: 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, 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.

Impact of the development of scale of financial institutions on intra-rural income inequality

Table 16. Co-integration test 1: SCALE on the RG

| variable | Trace | 5% level | Prob.   | result       |
|----------|-------|----------|---------|--------------|
| rg, scale | 13.905| 15.495   | 0.0057  | 1            |

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 RECOMMENDATIONS

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.
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