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# *The Impact of Digital Financial Inclusion on the Income Gap between Urban and Rural Residents*

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***Abstract:*** This paper studies that the impact of digital inclusive finance on the income gap between urban and rural residents. Through a two-way fixed-effect regression model to analyze 2011-2011 data from 31 provinces in China, the study reveals that the significant impact of digital financial inclusion on narrowing the rural-urban gap. A higher level of education and a larger scale of economic liberalization also affect the income gap narrowing. It is suggested that the government need to continue promoting digital financial inclusion policies and optimizing investment in education as well as science and technology to further narrow the urban-rural income gap.

## 1. Introduction

Since the implementation of reform and opening up in 1978, China's economy has grown rapidly, with GDP soaring from 367.87 billion yuan to 126.060 billion yuan in 2023. People's living standards have improved significantly, and they have achieved a transformation from inadequate food and clothing to a moderately prosperous society in all respects. But behind this, the urban-rural income gap is widening year by year, which has become one of the challenges of a harmonious socialist society. In 1978, the income gap between urban and rural areas was 210 yuan, and by 2023 the gap had reached 30,130 yuan, 143.5 times that of 1978.

To address the problem, the government has rolled out a series of policies, including a rural revitalization strategy and targeted poverty alleviation, to narrow the gap between urban and rural areas. In 2021, the income ratio between urban and rural residents will be 2.50, 0.38 lower than that in 2012. Despite the reduction in data, further measures are needed to strengthen this achievement. Among them, digital financial inclusion, as an important tool, has played a significant role in narrowing the urban-rural gap. The government supports financial institutions and technology enterprises to develop digital financial services through incentive policies such as fiscal subsidies and tax incentives, especially extending to remote and low-income areas. At the same time, the government has strengthened supervision and regulations to ensure the compliance of financial services and protect consumer rights.

## 2. Literature Review

Digital financial inclusion is an important manifestation of changes in the global financial landscape. Lall et al. [1] pointed out that finance is expensive and restricted for the poor, which tends to lead to negative social effects. However, thanks to the impetus of scientific and technological innovation, the digital inclusive financial model has broken the time and space restrictions of traditional financial services, not only significantly improving the efficiency of services, but also significantly reducing the cost of services, so that residents in remote areas, low-income groups and small and micro enterprises can easily access efficient and low-cost financial services.

In the face of COVID-19, the isolation, blockade and closure of business activities required to slow the spread of the virus is expected to shrink the global economy by a sharp 3% in 2020, worse than the 2008 financial crisis. [2] At the same time, however, the unique advantages of digital financial inclusion have fully emerged. Despite the stay-at-home quarantine triggered by the pandemic, financial services have not been disrupted, but have inspired financial institutions to accelerate the pace of digital transformation. On the other hand, Antonio et al. [3] found that setting goals can improve the personal savings rate, thus enhancing residents' self-confidence and reducing financial risks, while Digital inclusive finance has the ability of financial planning. The estimation of tool variables by Hans et al. [4] and others also shows that the use of the Internet will also lead to a significant increase in stock market participation. These are all due to the popularity of digital inclusive finance to some extent. Through the online and intelligent service mode, it injects vitality into micro, small and medium-sized enterprises and provides key financial support for maintaining social stability and promoting economic recovery. In the process, digital financial inclusion has also had a positive impact on residents' health. Research by Liao et al. [5] has shown that increasing digital finance is positively correlated with residents' self-rated health status and reduces their likelihood of feeling depressed.

To sum up, digital inclusive finance is not only the product of the deep coupling of inclusive finance concept and digital technology, but also a key channel to achieve financial fairness and drive balanced economic and social progress. It will continue to lead the innovation and upgrading of the financial industry, injecting strong impetus to inclusive economic growth and social well-being in China and the world.

## 3. Model Construction

### 3.1 Model Setting

Based on the above research, the following models are constructed, in which the model is a two-way fixed-effect regression model.

$$THEIL_{it} = \alpha_0 + \alpha_1 \ln DIF_{it} + \sum_{n=1}^{4} \delta_n X_{nt} + \mu_{it} + \vartheta_{it} + \varepsilon_{it} \quad (1)$$

Note: In the model, i represents the city, t represents the time, $\varepsilon_{it}$ is the random disturbance term, and $\ln DIF_{it}$ is the pair value of the digital inclusive financial comprehensive index. $\mu_{it}$ and $\chi_{it}$ is the fixed value of the city and time in the data (two-way fixed effect regression). The third term is all the control variables in the model, which are respectively the degree of openness to the outside world (OPEN), the level of higher education (LEV), and the third term is the degree of openness to the outside world. Government Support Level (GOV), science and technology level expenditure (SCI).

## 3.2 Variable Selection

### 3.2.1 Explained Variable: THEIL Index

As a measure of income inequality, the Thiel Index has a unique advantage compared with the Gini coefficient in considering the impact of demographic changes on the results of income inequality measures. The Thiel Index focuses on the analysis of the gap between different income groups, which makes the Thiel Index more stably reflect the real state of income gap in the face of demographic changes, especially when the size or income level of the middle class changes, and will not be overly disturbed by these changes.

### 3.2.2 Explanatory Variable: Digital Financial Inclusion Index (DIF)

Since the birth of digital inclusive finance, scholars at home and abroad have paid close attention and been deeply studied. In this context, the Financial Research Center of Peking University launched the Digital Inclusive Finance Index in 2016, which constructs a set of scientific indicator system from the broad coverage, in-depth use and digital support services of Internet financial services, and comprehensively reflects the current development status of digital inclusive finance in China.

### 3.2.3 Control Variables

When collecting and sorting out relevant studies, the following four control variables were selected in the model to eliminate the interference of these factors, so as to make the research results more accurate and reliable, and enhance the explanatory power and accuracy of the model. The data are from China Statistical Yearbook and related databases, as shown in the Table 1.

(1) The degree of economic openness: It is often used to describe the degree of foreign trade, foreign investment, capital flow and other fields of a country or region. A higher degree of economic openness may bring more external investment and technology transfer, thus promoting economic growth, but it may also lead to differences in human capital level and economic development speed between urban and rural areas, thus affecting the income gap between urban and rural residents. For example, some studies have found that a higher degree of economic openness can boost urban development, but it can also exacerbate the urban-rural income gap, as cities are generally better able to attract foreign investment and technology, while rural areas are relatively backward.

(2) Higher Education level (LEV): Higher education level is usually closely related to an individual's skill level, knowledge reserve and career development opportunities. Urban areas usually have more higher education resources, including universities, research institutes, etc., which makes it easier for urban residents to access higher education. In contrast, higher education resources in rural areas are relatively scarce, which can lead to lower skill levels and career development opportunities for rural residents, thus affecting their income levels. Therefore, the difference in the level of higher education may be an important factor leading to the urban-rural income gap.

(3) The degree of government intervention (GOV): It is measured by the proportion of the general expenditure of government finance divided by the gross regional product (GDP), so as to reflect the degree of government activity in the macro-economy. Since the intensity of the government's economic intervention is often reflected in the amount of fiscal expenditure, this indicator is suitable for measuring the easing or tightening state of the government's overall policy intensity, so this paper may use it to generalize and reflect the intensity of the government's support for digital financial inclusion.

(4) Science and technology level expenditure (SCI): Science and technology expenditure/general government financial expenditure. This variable represents the level of investment in science and technology research and development, innovation and application of a country or region. Spending on science and technology may promote technological innovation and industrial upgrading, and have an impact on the employment and income levels of urban and rural residents. Technological progress may change the structure of employment, affecting the employment opportunities and income levels of different groups of people.

Table 1: Statistical Table of Variables

| Variable Code | Variable Name | Calculation Method | Data Source |
|---|---|---|---|
| OPEN | Degree of Opening-up | Total Import and Export/GDP | Statistical Yearbook and Related Databases |
| LEV | Higher Education Level | Number of Students in General Institutions of Higher Learning/Total Population at the end of the year | Statistical Yearbook and Related Databases |
| SCI | Expenditure on Science and Technology Level | Expenditure on Science and Technology/General Expenditure of Government Finance | Statistical Yearbook and Related Databases |
| GOV | Local Fiscal Expenditure Level | Government Fiscal General Expenditure/Gross Regional Product | Statistical Yearbook and Related Databases |
| DIF | Digital Inclusive Financial Composite Index | Database Collection | Center for Financial Studies, Peking University |
| THEIL | Thayer Index | Database Collection + Calculation | Statistical Yearbook and Related Databases |

## 4. Results and Discussion

### 4.1 Preliminary Analysis of Samples

#### 4.1.1 Descriptive Analysis of Variables

Due to the large number of missing data of Qianxinan City and Qiandongnan City in Guizhou, the data of these two cities are not used in this paper. Finally, the number of samples used in this paper is 31 provinces and cities, and the results of descriptive statistical analysis of the data have been sorted out in the Table 2.

Table 2: Descriptive Statistics of Samples

| Variable Symbol | Variable Name | Sample Number | Mean Value | Maximum | Minimum | Variance | Ratio |
|---|---|---|---|---|---|---|---|
| THEIL | Theil Index | 372 | 0.06499 | 0.2017 | 0.0171 | 0.0015 | 11.79 |
| DIF | Digital Financial Inclusion Composite Index | 372 | 242.8758 | 460.69 | 16.22 | 11499.27 | 28.40 |
| LEV | Higher Education Level | 372 | 0.020648 | 0.0436 | 0.008 | 3.57E-05 | 5.45 |
| OPEN | Degree of 0pening-up | 372 | 0.265678 | 1.4638 | 0.0076 | 0.077715 | 192.6053 |
| GOV | Local Fiscal Expenditure Level | 372 | 0.29037 | 1.3538 | 0.105 | 0.042245 | 12.89333 |
| SCI | Expenditure on Science and Technology Level | 372 | 0.020497 | 0.0704 | 0.0001 | 0.000236 | 704 |

It can be seen from the chart that the maximum value of Theil index, which represents the income gap between urban and rural residents, is 0.2017, the minimum value is 0.0171, and the ratio is 11.79, indicating that there is still a certain gap. The maximum index of digital inclusive financial index is 460.69, and the minimum value is 16.22. The numerical difference is too large, and the variance also proves that the data is unstable, which may be caused by factors such as large time span and rapid development. The maximum and minimum values of coverage breadth, depth of use and digitalization degree well show the specific reasons for the large gap in the composite index, among which the large ratio of digitalization degree just shows the great development of science and technology in China from 2011 to 2022. The ratio of the maximum value of coverage breadth shows that the comprehensive coverage of information technology is very fast. The large numerical differences of other indicators may be due to the particularity of the country.

### 4.1.2 Correlation Analysis among Variables

(1) In order to verify whether there is autocorrelation among variables, correlation analysis is conducted, and the results are, as shown in the Table 3:

Table 3: Results of Autocorrelation Analysis

| | THEIL | Ln_DIF | OPEN | SCI | LEV | GOV |
|---|---|---|---|---|---|---|
| THEIL | 1 | | | | | |
| Ln_DIF | -0.4602 | 1 | | | | |
| OPEN | -0.6111 | 0.0664 | 1 | | | |
| SCI | -0.3077 | 0.1723 | 0.4794 | 1 | | |
| LEV | -0.6308 | 0.4139 | 0.2599 | 0.4734 | 1 | |
| GOV | 0.4854 | -0.1235 | -0.3169 | -0.3219 | -0.4356 | 1 |

(2) To verify the existence of multicollinearity among the variables, a multiple regression

analysis was conducted and the variance inflation factor (VIF) was calculated to evaluate the results, as shown in the Table 4.

Table 4: VIF Estimation Results

| Variable | VIF | 1/VIF |
|---|---|---|
| SCI | 1.57 | 0.586225 |
| OPEN | 1.35 | 0.739726 |
| GOV | 1.31 | 0.760809 |
| Ln_DIF | 1.21 | 0.823869 |
| LEV | 1.71 | 0.586225 |

From the results shown in the two charts, the correlation between variables is very small, and the maximum VIF value is only 1.71<5, indicating that there is no serious multicollinearity between variables, so the experiment can be continued.

## 4.2 Regression Analysis

### 4.2.1 Regression of Digital Inclusive Finance Composite Index

Preliminary regression analysis is conducted according to the model, and the results are shown in the Table 5:

Table 5: Regression Results of the Composite Index

| VARIABLES | THEIL |
|---|---|
| ln_DIF | -0.0158* |
| | (-9.17) |
| OPEN | -0.077* |
| | (-17.62) |
| LEV | -2.765* |
| | (-11.94) |
| GOV | 0.034* |
| | (5.74) |
| SCI | 0.665* |
| | 7.71 |
| Constant | 0.225* |
| Observations | 372 |
| R-squared | 0.7341 |
| F | 202.10 |

According to the results table, the variable coefficients and t-values are listed in their respective brackets, and the F-value is 202.10, indicating the overall significance of the model. In the results, the symbol '*' indicates that the variable is significant at the 5% level. R-squared is 0.7341, indicating that the model fits well. Among the explanatory variables, the coefficient of ln_DIF (DIF variable after natural logarithm transformation) is − 0.0158, which is significant at the level of 5%, indicating that ln_DIF has a significantly negative impact on Theil index. Moreover, when ln_DIF increases by one percentage point, THEIL index decreases by 0.0158%. In addition, the coefficients and p-values of control variables such as SCI, GOV, OPEN and LEV show that they have a significant impact on Theil index, and the first two have a positive correlation, and the last two have a negative correlation, which indicates that the education level and the degree of economic openness have a significant effect on the reduction of the income gap between urban and rural

residents.

## 5. Conclusions

Digital inclusive finance plays a positive role in reducing the income difference between urban and rural residents. The results of increasing digital support and government intervention reveal that it has a widening effect on the income gap between urban and rural residents. When other variables are controlled, the education level and economic openness are significant in reducing the income gap between urban and rural residents.

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