# Digital Inclusive Financial Development and the Urban-Rural Income Gap

## -- Empirical Analysis based on 31 Provinces in China

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#### Abstract

A static panel model is constructed by selecting data from 31 Chinese provinces from 2011 to 2020 to analyze the impact of digital inclusive finance on the urban-rural income gap measured by the Thayer index. The results show that, in general, the impact of both the DIFI index and its three sub-dimensional indicators on the urban-rural income gap is not linear, showing a U-shaped effect of first narrowing and then widening the urban-rural gap. Further analysis of regional heterogeneity reveals that the eastern provinces show a more obvious U-shaped effect and have exceeded the inflection point of the influence curve, while the central and western provinces do not show an obvious non-linear effect. Accordingly, the digitalization of digital inclusive finance should be improved, the coverage and use of digital inclusive finance in the central and western regions should be enhanced, and the regulation should be strengthened to effectively promote the reduction of the income gap between urban and rural areas.

#### Keywords

Digital Inclusive Finance; Thiel Index; Urban-Rural Income Gap.

#### 1. Introduction

Due to China's dual economic structure of urban and rural areas, various resources tend to flow preferentially to faster developing and potential While many rural areas develop relatively slowly due to infrastructure, geographic environment, transportation, human capital and other reasons. Although China's urban-rural income gap is now showing a trend of continuous reduction, with the ratio of per capita disposable income between urban and rural populations in China decreasing from 2.75 to 2.37 between 2011 and 2020, the urban-rural income gap is still large. In addition In addition, due to the limitations of geographical environment, scarcity of talents and insufficient collateral, it is often difficult to get comprehensive financial services in remote rural areas, especially in the central and western rural areas, and the demand of rural residents for financing and financial management is difficult to be met.

In recent years In recent years, the policy means to promote rural revitalization and narrow the gap between urban and rural areas have been enriched and innovated, and the means in the financial field have also been upgraded, but traditional inclusive finance still requires the support of offline financial outlets and a certain number of financial practitioners, which makes it difficult to completely break the restrictions brought by geographical environment and regional human capital, and there are dead ends in the breadth of financial services. With the development and growth of China's Internet industry and mobile payment, digital inclusive financial services have come into being. With the help of mobile communication, the Internet and other technologies, digital inclusive finance can bring into play its characteristics of high accessibility, diverse products and sustainability, reduce the dependence of financial services.

This paper selects the panel data of 31 provinces, autonomous regions and municipalities directly under the central government from 2011 to 2020.

panel data of 31 provinces, autonomous regions and municipalities directly under the central government in China from 2011 to 2020. Based on the results of the empirical analysis, we propose constructive suggestions for reducing the imbalance between urban and rural development in China.

#### 2. Literature Review

This paper addresses The central question is how the development of digital inclusive finance has affected the urban-rural income gap. Currently, studies on digital inclusive finance cover the urban-rural gap, economic growth, employment, innovation capacity, import/export trade The research on digital inclusive finance covers urban-rural disparity, economic growth, employment, innovation capacity, import and export trade, etc. Scholars' research on urbanrural development imbalance mainly focuses on the urban-rural consumption gap and the urban-rural income gap. Using urbanization rate as a threshold regression variable and combining with financial exclusion theory, Zhang He et al. (2018) found that the convergence effect of digital inclusive finance on the urban-rural income gap was significant under the double threshold model and differed between the central and eastern regions. By constructing indicators and conducting an empirical study, Sun Jiguo et al. (2019) conclude that digital inclusive finance can contribute more significantly to the reduction of the urban-rural income gap compared with traditional inclusive finance, but the effects are exactly opposite at the regional levels of East, Central and West. Lv Yangin and other scholars (2019) found that digital inclusive finance significantly reduces the consumption gap between urban and rural residents in both dynamic panel and static panel models. Wang Yingzhi (2020) used prefecture-level cities in the Yangtze River Delta region as a research sample to measure the urban-rural income gap using the srama index and the Thayer index, respectively, and concluded that digital inclusive finance has a significant impact effect on narrowing the income gap in second- and third-tier cities with higher potential in the Yangtze River Delta region. Using an interprovincial panel model, Zhang Tongjin et al. (2021) found that digital inclusive finance can have a positive effect on the reduction of urban-rural consumption gap, and the effect is more obvious in the western region.

In addition, many scholars scholars have found in their studies that the existence of digital divide makes the digital economy and digital inclusive finance have a non-linear impact on the urban-rural income gap. Tan Yanzhi et al. (2017) explored the impact of informatization on income from both individual and urban-rural perspectives, and the results after excluding individual heterogeneity showed that the diffusion of informatization and Internet technology could bring 14% income return to individuals, but this return varied significantly between urban and rural areas, and the impact on rural residents was not significant. Zhao Ruijuan et al. (2020) studied the prefecture-level cities in the Pearl River - Xijiang Economic Belt and found that the impact of digital inclusive finance on the urban-rural income gap showed a U-shaped relationship within the sample area. Chen and other scholars (2021) constructed digital economy development indicators and analyzed inter-provincial panel data in China, and found that the digital economy can effectively reduce the urban-rural income gap at the early stage of development, but with the development of the digital economy, it will show a U-shaped effect effect and widen the urban-rural income gap. Hu Zhenhua et al. (2021) used inter-provincial panel data from 2011 to 2018 but came to the opposite conclusion that the effect relationship between the development of digital inclusive finance and the urban-rural income gap is an inverted U-shaped relationship that increases and then decreases. Changbing Zhang et al. (2021) studied the role effect and found that digital inclusive finance has a significant convergence

effect on the urban-rural income gap, but the digital divide inhibits this convergence effect, and the impact of digital inclusive finance has a double threshold effect.

Scholars' research has provided a wealth of references and lessons learned. In general, in terms of urban-rural scholars usually choose the ratio of rural per capita disposable income to urban per capita disposable income, the Gini coefficient, the Thaver index or reconstruct the index system to analyze the income gap; and they usually adopt the digital inclusive finance index released by Peking University to measure the development of digital inclusive finance in different regions. In terms of research methods, scholars have adopted panel regression, systematic GMM estimation, threshold model, TOPSIS comprehensive evaluation method, and spatial Durbin model. However, in previous studies, the conclusions regarding the effect of digital inclusive finance on the urban-rural income gap are not the same. In this paper, we will refer to the previous research results and use the Thayer index of urban-rural income to select the statistics of 31 Chinese provinces, autonomous regions and municipalities directly under the central government for panel regression. Considering that the effect of digital inclusive finance on urban-rural income gap found in previous research results may show a U-shaped or inverted U-shaped effect, this paper introduces a quadratic term of the digital inclusive finance index to examine whether there is a nonlinear effect.

#### 3. The Current Situation of Digital Inclusive Finance Development and its Impact on Urban and Rural Analysis of the Impact Mechanism of Income

#### 3.1. The Current State of Development of Digital Inclusive Finance

Digital Inclusive Finance Finance has emerged in China It has not been long since its emergence in China, but the speed of its development has been very impressive. According to a report by the Digital Finance Center of Peking University, the digital inclusive finance index of each province grew particularly fast from 2011 to 2012, and although the growth rate has slowed down in recent years, it still manages to maintain a relatively stable year-on-year growth trend. At the same time, China's digital inclusive finance has the problem of uneven development between regions. Taking the latest data in 2020 as an example, the digital inclusive finance index of Shanghai has reached 431.93, the highest in China, but the digital inclusive finance index of Qinghai Province is only 298.23, and the popularity and application of digital inclusive finance in the eastern region is better than that in the central and western regions. In addition, the development of digital inclusive finance is usually better in regions with a higher degree of urbanization.

Improving financial The ability to reach financial services. Internet digital technology will greatly improve the breadth of financial inclusion coverage, whereby residents in remote areas or disadvantaged residents can also enjoy new types of financial services such as deposits, loans, consumption, investment and insurance, thus facilitating the circulation of social capital and other factors. Residents in rural areas with poor credit environment often suffer from greater financial exclusion due to high credit risk and lack of gualified collateral, and this financial exclusion can cause the problem of excessive income disparity between urban and rural areas. Digital inclusive finance can bring some of the slightly riskier but slightly less profitable small, medium and micro enterprises or individual operators in rural areas into the scope of providing credit and other financial services, and rural residents can also conduct transactions through mobile payment and e-commerce logistics. In addition, the increased revenue of rural enterprises can also provide more local employment opportunities, thus creating conditions for rural residents to increase their income.

# **3.2.** The Mechanism of the Role of Digital Inclusive Finance in Narrowing the Urban-Rural Income Gap

Reduce the cost of receiving financial The cost of receiving financial services. The implementation of digital financial inclusion can reduce the labor cost, time cost and capital cost of various institutions, enterprises and residents in making payments and handling financial services. Users no longer need to go to financial institutions for access and credit, and the fees for financial services are greatly reduced and the speed of business processing is rapidly increased. At the same time, financial institutions can also gradually reduce their manual involvement and use big data information platforms to provide efficient services to customers.

### 4. Empirical Results and Analysis

#### 4.1. Data Source

In this paper The data mainly comes from the China Digital Inclusive Finance Index compiled by the Digital Finance Research Center of Peking University and Ant Financial Services Group, as well as provincial data from the China Statistical Yearbook in previous years. The Digital Inclusive Finance Index consists of three dimensions: breadth of coverage, depth of use and digitalization index, as well as indices for payments, insurance, money funds, credit services, investment, credit and other categories. The index was first released in 2011, and for the sake of data availability and comparability, the provincial panel data of 31 provinces, autonomous regions and municipalities directly under the Central Government of China from 2011 to 2020 were selected for analysis and examination.For the sake of data availability and comparability, the provincial panel data of 31 provinces, autonomous regions and municipalities directly under the central government from 2011 to 2020 were selected for analysis and testing.

#### 4.2. Variable Selection and Handling

The core explanatory variable of this paper is the Digital Inclusive Finance Index (DIFI) of each province, autonomous region and municipality directly under the central government, and the data are taken from the Digital Inclusive Finance Index (2011-2020) of Peking University. the larger the value of the DIFI index, the higher the degree of development of digital inclusive finance. the DIFI index can also be divided into three indicators: breadth of coverage, depth of use and degree of digitization.

In order to thoroughly study the impact of digital inclusive finance on the urban-rural income gap and ensure the scientific accuracy of the study, this paper selects the level of economic development, industrial structure, urbanization, education level, science and technology development, foreign openness, and social security expenditure as control variables. In this paper, the level of economic development, industrial structure, urbanization, education level, science and technology development, foreign openness, and social security expenditure are selected as control variables. The per capita GDP of each province, autonomous region, and municipality directly under the central government is used to measure the level of economic development (RGDP), and the income of residents usually increases accordingly when the economy develops well. The ratio of tertiary industry to secondary industry value added is used to measure the degree of industrial structure advanced (IS), and the upgrading of industrial structure can provide an important driving force for regional economic development and increase of residents' income. Using the proportion of urban population to total population to measure the level of urbanization (UR), the process of urbanization will accelerate the flow of labor between urban and rural areas, release surplus rural labor and raise the income level of rural residents. The average number of students in higher education per 100,000 population is used to measure the education level of a region (EDU). Measure the level of regional science and technology development (TEC) by the number of domestic patent applications granted. The level of foreign trade (TRA) is measured by the ratio of total local imports and exports to GDP. It should be noted in particular that in the statistical yearbook, the unit of total exports is thousands of US dollars, and this value is converted to RMB using the annual average exchange rate of US dollars to RMB in the year in which it is located; the larger the value, the more developed the export trade is. The proportion of social security and employment expenditures to local fiscal expenditures is used to measure the social security of the region (GOV). Social security expenditures can, to a certain extent, improve the welfare level of rural residents and narrow the urban-rural gap, but if social security expenditures are too biased and tilted too much toward urban areas, it will increase the urban-rural income gap. Using the ratio of the number of Internet broadband access households to the total population to measure Internet penetration (INT), the increase in Internet penetration can help rural residents enjoy online payments, Internet finance and other services, as well as increase income through e-commerce, etc. However, the increase in Internet penetration may also increase the digital divide between urban and rural areas, thus further worsening the urban-rural gap problem.

#### 4.3. Model Setting

Based on the available Based on the available data, the following panel model is constructed to study the impact of digital inclusive finance on the income gap between urban and rural residents.

$$GAP_{it} = \beta_0 + \beta_1 DIFI_{it} + \propto X_{it} + \mu_i + \nu_{it}$$
<sup>(1)</sup>

Introducing The quadratic term of the DIFI index can be introduced to explore whether the impact curve of the DIFI index on the Thiel index, and explore whether the current development of digital inclusive finance in China has reached the inflection point of the U-shaped or inverted U-shaped curve, which is conducive to judging the specific impact of digital inclusive finance on the urban-rural gap according to its development in each region.

#### 5. Empirical Results and Analysis

#### 5.1. Descriptive Statistical Tests

The main variables The descriptive statistics of the index, in which, in order to prevent the difference in magnitude To prevent the regression results from being affected by too large a range, the digital financial inclusion index refers to Song's practice of using the index as a percentage value of 100 as the raw data.

#### 5.2. Overall Regression Analysis

First, this paper regresses the model without introducing the quadratic term of DIFI index, and the results are shown in Table 3. result (1) is the regression result of mixed least squares regression, result (2) is the regression result of random effects, and result (3) is the regression result of fixed effects. The Hausman test was performed and yielded a P-value of 0.3989, so the original hypothesis could not be rejected. It can be seen that, at the 1% significance level, the results of fixed and random effects The regression coefficients of digital inclusive finance are both negative and have a negative effect on the Thayer index, indicating that the development of digital inclusive finance can promote the reduction of urban-rural income gap. In the regression results of the random effects, for every 1 unit increase in the digital inclusive finance index, the Thiel index decreases by 0.0102 units, all other things being equal; in the regression results of the fixed effects, for every 1 unit increase in the digital inclusive finance index, the Thiel index decreases by 0.0084 units, all other things being equal.

Next, the quadratic term of digital financial inclusion is introduced in the model for regression. The Hausman test yields a P-value of 0.0593, so the regression results of fixed effects are chosen. According to the regression results, at the 1% significance level, DIFI has a negative effect on the Thayer Index, which reduces the urban-rural income gap, while the quadratic term of DIFI has a positive effect on the Thayer Index, which widens the urban-rural income gap. Therefore, we can conclude that the impact of digital inclusive finance on the urban-rural income gap is non-linear, showing a U-shaped effect. The inflection point at which the DIFI index turns from negative to positive is 2.0263, and comparing the available data, we find that the DIFI index of most provinces in China has already exceeded the inflection point. The DIFI has already exceeded the inflection point in most of the provinces in China, and we should be alert to the possible negative impact of DIFI while developing digital inclusive finance.

In addition, the economic The improvement of economic development level, advanced industrial structure, urbanization In addition, the improvement of economic development, advanced industrial structure, urbanization, education, technological progress, and openness to the outside world all have negative effects on the Thayer index, which can contribute to the reduction of the urban-rural income gap to a certain extent. Social security and Internet penetration also have positive effects on the Thiel index, but the results are not significant, indicating that the effects of social security and Internet penetration on the urban-rural income gap are not significant.

#### 5.3. **Sub-dimensional Regression Analysis**

The above empirical findings show that the development of the digital economy significantly increases the innovation output of regional enterprises, as manifested by the increasing number of patent applications and patents granted. Further, this part attempts to analyze in depth the impact of digital economy development on enterprise innovation activities from multiple perspectives, including the R&D end of enterprise innovation activities, innovation structure, innovation quality and cooperative innovation behavior, in order to enrich the community's understanding of the relationship between digital economy and enterprise innovation activities.

The DIFI index can be divided into Breadth of coverage, depth of use and digitalization. The breadth of coverage measures the degree of account coverage of digital financial inclusion in geographical areas and places where residents gather; the depth of use measures the use of digital financial services such as payment, insurance, money fund, investment and credit by residents in practice; the degree of digitalization refers to the use of information technology and digital technology in financial services. The regressions are conducted separately using the three dimensions as the core explanatory variables to analyze the effect of each dimension on the urban-rural income gap. Again, the percentage value of each dimension to 100 is used as the raw data. The results of the panel regression are shown in Table 5. All three indicators, breadth of coverage, depth of use, and digitalization, have significant effects on the Thiel index, and all show U-shaped effects. The inflection point of negative to positive effect of breadth of digital financial inclusion on Thiel index is 2.5161, and the values of all provinces in China have exceeded the inflection point, so the increase of breadth of DIFI coverage may have a suppressive effect on the reduction of urban-rural income gap; the inflection point of negative to positive effect of depth of DIFI usage on Thiel index is 1.6364, and the values of all provinces in China have exceeded the inflection point. The inflection point of negative to positive effect of DIFI digitization on the Thiel index is 4.1364, and at present, all provinces except Beijing, Shanghai, Jiangsu and Zhejiang have not exceeded the inflection point, that is, the increase of DIFI digitization can still promote the reduction of urban-rural income gap in most provinces.

#### 5.4. Regression Analysis by Region

Since China occupies Since China occupies a large area and the economic development rate and the degree of informatization vary among regions, this paper refers to the classification of the National Bureau of Statistics and divides the 31 Chinese provinces into three subsamples: eastern region (Beijing, Tianjin, Hebei, Liaoning, Shanghai, Suzhou, Zhejiang, Min, Lu, Guangdong, and Qiong), central region (Jin, Ji, Heilong, Anhui, Gan, Henan, E, and Xiang), and western region (Inner Mongolia, Gui, Chongqing, Sichuan, Gui, Yun, Shaanxi, Gan, Tibet, Qing, Ning, and Xin)., and Xin), a panel regression is conducted by region to examine the impact of digital inclusive finance development on the urban-rural income gap by region. In the sample period, only in the eastern region, the DIFI index has a U-shaped effect on the Thayer index. The quadratic term of the DIFI index is not significant in the panel regressions for both central and western regions, probably because the inflection point has not yet been reached in the sample period and the linear function fits better. In the eastern region, the inflection point at which the effect of DIFI on the Thayer index changes from negative to positive is 1.6346. Before the inflection point, an increase in the DIFI index promotes the reduction of the urban-rural income gap, and beyond the inflection point, an increase in the DIFI index inhibits the reduction of the urban-rural income gap. At present, the DIFI indexes of all provinces in the eastern region have exceeded this inflection point value. In the central region, each unit increase in the DIFI index is associated with a 0.0196 unit decrease in the Thiel index. In the western region, the DIFI index decreases by 0.0177 units for each unit increase in the DIFI index, suggesting that digital financial inclusion contributes slightly more to the reduction of the urban-rural income gap in the central region than in the western region.

#### 5.5. Regression Analysis by Region

To further confirm the reliability of the results, the robustness of the model will be tested by replacing the variables in this paper. The explanatory variable is replaced by the ratio of urban per capita income to rural per capita income (DGAP) from the Thayer index, and the more the ratio deviates from 1, the larger the urban-rural income gap is. The results of the static panel regression of the replaced model are shown in Table 7. In general, both the primary and secondary terms of the DIFI index have significant effects on the ratio of urban-rural income gap per capita (DGAP) at the 1% significance level, and the effect of the DIFI index on the ratio of urban-rural income still has a U-shaped effect, and the inflection point value is 2.4295, which is not much different from the regression results when the variables are not replaced. It indicates that the conclusion of the effect of digital inclusive finance on the income gap between urban and rural residents in the previous paper is robust and credible. By region, the effect of DIFI index on the ratio of urban and rural residents' per capita income in the eastern region shows a U-shape; in the central and western regions, the regression results of the quadratic term of DIFI index are insignificant and the one-time regression coefficients are all negative, indicating that digital inclusive finance can promote the reduction of the urban-rural income gap in the central and western regions. It proves that the conclusions drawn from the regression analysis above are plausible.

#### 6. Key Research Findings and Policy Implications

Only by raising the income level of residents and narrowing the gap between urban and rural areas can we achieve high-quality economic development. Only by raising people's income level and narrowing the gap between urban and rural areas can we achieve high-quality economic development. With the wide application and popularity of digital information technology, digital inclusive finance plays a great role in promoting the narrowing of the urban-rural gap. By selecting the statistical data of 31 provinces, autonomous regions and municipalities directly under the central government in China from 2011 to 2020, a static panel model is used to

analyze the effect of digital inclusive finance development on the urban-rural income gap. The results show that, firstly, the relationship between the DIFI index and the Thiel index reflecting the urban-rural income gap is not purely linear, but shows a U-shaped impact effect in general during the sample period. In the early stage of development, digital inclusive finance can promote the reduction of urban-rural income gap, but as the development progresses, the accompanying digital divide may increase the urban-rural income gap. However, as the development progresses, the accompanying digital divide may increase the urban-rural income gap. Second, the three sub-dimensions of the DIFI index, i.e., breadth of coverage, depth of use and digitalization, do not have a linear effect on the urban-rural income gap, but they all show a U-shaped effect of first narrowing and then widening. Therefore, promoting the digitalization of digital inclusive finance can still have a positive impact on the reduction of urban-rural income gap. Again, in terms of regional differences, digital inclusion has a positive impact on the income gap between urban and rural areas. However, this non-linear effect is not significant in the central and western regions, and the development of digital inclusive finance can promote the reduction of the urban-rural income gap in the central and western regions. In addition, the level of economic development, industrial structure, urbanization, education level, technology level and openness to the outside world also have important effects on the urbanrural income gap. In order to narrow the urban-rural income gap and promote social equity, the following recommendations are made based on the findings of the above study: First, promote the development of digital and information-based industries and increase the digitalization of digital inclusive finance. The government should actively promote the development of digitization-related industries and give corresponding subsidies to enterprises, so as to form a virtuous system of promoting digitization first, providing technical guarantee for digital inclusive finance, and then enabling digital inclusive finance to promote enterprises and residents to improve their income, and then narrowing the urban-rural income gap. Then, digital inclusive finance can promote enterprises and residents to improve their income, and then narrow the income gap between urban and rural areas. Second, to balance the development of digital inclusive finance in each region. In the central and western regions of China, especially in the rural areas of the central and western regions, we should increase the popularization of digital network technology, improve the use of digital inclusive finance and mobile networks in rural areas through public welfare training and rural publicity, and enhance the reach of financial services. The company will increase the reach of financial services through public welfare training and rural publicity. Additional financial service institutions should be established to optimize the structure of financial service processes and reduce financial exclusion, so that residents in less developed areas and rural areas can enjoy financial services more conveniently. Third, improve the regulation of digital inclusive finance and promote its standardized development. Financial institutions should take measures and set standards to improve the degree of regulation of digital inclusive finance in the areas of credit, investment, insurance and payment, so that residents can safely enjoy digital inclusive financial services. Regulators should improve the supervision of services related to digital inclusive finance, protect consumer rights and interests, and raise awareness of risk monitoring and risk prevention.

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