

# Study on the Impact of Digital Inclusive Financial Development on China's Consumption

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## Abstract

Resident consumption is an important driving force for China's economic growth, and boosting resident consumption is an important measure to promote high-quality economic development at this stage in China. This paper empirically examines the impact of digital inclusive finance on residents' consumption using panel data from 2011-2022 for 31 provincial-level administrative regions in China, and further analyzes the urban-rural and regional heterogeneity of this impact. The study finds that: the development of digital inclusive finance has a significant positive impact on residents' consumption; the results of the urban-rural heterogeneity test show that digital inclusive finance has a greater role in promoting the consumption of rural residents; the results of the regional heterogeneity test show that compared with the eastern region, the positive impact of digital inclusive finance on residents' consumption is greater in the central and western regions. Finally, based on the above conclusions, this paper puts forward policy recommendations such as strengthening the construction of digital inclusive financial infrastructure.

## Keywords

Digital Financial Inclusion; Resident Consumption; Heterogeneous Effect.

## 1. Introduction

For a long time, investment, export and consumption have been known as the “troika” that drives China's economic growth. Our country has one of the highest savings rates in the world, and “low consumption and high savings” is a significant feature of our economic development, so there is still much room for growth in China's consumption. In recent years, the trade sanctions imposed by countries led by the United States and the outbreak of the COVID-19 pandemic have had a serious negative impact on China's investment and exports. Therefore, China now urgently needs to take the expansion of domestic demand as a new landing point for pulling economic growth, promote the strategic transition from export-oriented to expanding domestic demand, further play the fundamental role of consumption in China's economic development, and fully release the consumption potential of residents. In recent years, the rapid development of digital finance, especially mobile payment, has largely changed the consumption concepts and consumption methods of China's residents. Compared with the traditional consumption methods of offline transactions and cash payments, digital finance is more convenient and fast, and thus has gained the favor of the majority of residents. As of December 2023, the number of mobile Internet users and the number of online payment users in China are as high as 1.091 billion and 954 million respectively, and Internet digital finance will inject new vitality into the high-quality development of China's economy.

Inclusive finance aims to serve financially excluded groups, with inclusiveness and sustainability as its basic characteristics, and is committed to alleviating the problem of

uncoordinated economic development. With the development of Internet technology, digital inclusive finance has emerged. With its advantages of high sharing, low cost and wide coverage, digital inclusive finance lowers the threshold of financial services and expands the scope of financial services, which can meet the financial needs of residents more quickly and conveniently, improve the availability of credit for residents who are financially excluded, and enable them to arrange their consumption activities in a planned manner, which will, to a certain extent, have a positive impact on the promotion of residents' consumption. Therefore, it is of great practical significance to study the relationship between the development of digital inclusive finance and residents' consumption in order to fully explore the potential of China's domestic demand, realize the domestic and international double cycle and promote the high-quality development of the economy. This paper studies the role of the development of digital inclusive finance on residents' consumption, reasonably analyzes the conclusions, and puts forward some targeted policy recommendations.

## 2. Literature Review

At present, the domestic and international literature on the study of the impact of the development of digital inclusive finance on residents' consumption can be divided into two main categories. One type of literature focuses on the study of the mechanism of its impact on residents' consumption, while the other focuses on the quantitative relationship between the two derived through empirical research.

### 2.1. Theoretical Studies of Digital Inclusive Finance on Resident Consumption

In recent years, scholars have explored the paths and mechanisms of digital inclusive finance's impact on residents' consumption from different perspectives, including the income effect, credit availability, and alleviation of liquidity constraints.

Xu Mingyan et al. (2019) argued that the average consumption propensity of residents depends largely on their income level. Compared with high-income people, low-income people have a higher average propensity to consume, and China has a large number of low-income groups, who often need lower-cost consumer financial services, and inclusive finance can precisely meet this demand. Therefore, digital inclusive finance mainly achieves the effect of promoting residents' consumption by increasing the consumption of low-income groups [1]. Xie Jiazhi and Wu Jingru (2020), on the other hand, focused on analyzing the micro-mechanisms of digital finance affecting residents' consumption from the perspective of credit, and they found that due to the characteristics of digital finance in terms of convenience, low-cost, and high availability, it can largely alleviate the problem of mismatch of the credit structure that exists in the traditional financial system, and thus promote residents' consumption [2]. Zhang Xun et al. (2020), on the other hand, illustrated the mechanism of digital inclusive finance's effect on residents' consumption from three perspectives: payment convenience, liquidity constraints and preventive savings. First, digital finance can provide a faster means of payment than cash transactions; second, the development of finance can alleviate liquidity constraints and help residents conveniently realize inter-temporal consumption smoothing, thus increasing residents' demand and boosting residents' consumption; lastly, digital inclusive finance can also affect consumption through the path of regulating residents' preventive savings [3].

### 2.2. Quantitative Studies of Digital Financial Inclusion on Resident Consumption

Scholars in the field of finance have done a lot of empirical research on the relationship between the development of digital inclusive finance and residents' consumption. Most of the scholars' studies show that the development of digital inclusive finance has a significant role in promoting residents' consumption, and its promotion role shows a certain degree of

heterogeneity depending on factors such as the level of residents' incomes and the different regions they live in.

Many scholars have paid great attention to the role of digital inclusive finance on the consumption of residents in rural areas, some of which have been studied for rural samples, while others have studied urban-rural heterogeneity. Cui Haiyan (2017) found through empirical research that, as a whole, in rural areas, digital inclusive finance can increase residents' consumption, and consumption of consumer rural residents is very sensitive to changes in their incomes; in terms of regional heterogeneity, the impact of digital inclusive finance is more pronounced in the eastern rural areas<sup>[4]</sup>. Xiao Yuanfei and Zhang Keyang (2020) explored the role of digital inclusive finance mainly from the perspective of urban-rural heterogeneity, and they pointed out that although digital inclusive finance can promote the consumption upgrading of urban residents and rural residents, the role of residents' consumption in urban and rural areas is different. Digital inclusive finance can ease the liquidity constraints of rural residents, but it does not have such an effect on urban residents. In addition, digital inclusive finance does not stimulate consumption by reducing residents' precautionary savings<sup>[5]</sup>. Han, Gang and Zhao, Wei (2021) used panel data from 30 provinces and cities in China to conduct a dimensionality test and found that in digital financial inclusion mainly affects residents' consumption through the breadth of coverage and the degree of digitization; while the test of urban-rural heterogeneity shows that digital financial inclusion has a greater impact on rural residents' consumption<sup>[6]</sup>.

China is a vast country, due to the different levels of economic development, living habits, consumption concepts and other factors in different regions, making the role of digital financial inclusion may show different effects among regions. Zou Crescent and Wang Wang (2020) found that the development of digital inclusive finance can effectively stimulate residents' consumption through channels such as e-payment, insurance, and income, and that the role produces a greater effect on residents' consumption in the western part of the country than in other regions<sup>[7]</sup>. Wan Qingyun and Xiong Xiaolian (2021), however, came to the opposite conclusion, finding that digital financial inclusion only has a positive impact on the consumption of residents in the eastern and central regions, while it has a negative impact on the consumption of residents in the west<sup>[8]</sup>.

Some other scholars have studied whether digital financial inclusion has poverty reduction effects. Foreign scholars Mushtaq and Bruneau (2019), through empirical research, found that information technology accelerated economic growth, embodied a certain degree of poverty reduction effect, and alleviated inequality when it was used as a financial inclusion tool<sup>[9]</sup>. Domestic scholars have also done a lot of research on the poverty reduction effect of digital financial inclusion. Liang Shuanglu and Liu Peipei (2019) pointed out in their study that digital inclusive finance can reduce the gap between urban and rural areas in terms of residents' income through the threshold effect, the poverty reduction effect and the exclusion effect, thus driving residents' consumption<sup>[10]</sup>. Yao Fengge and Li Lijia (2020) further analyzed the poverty reduction effect in terms of transmission channels and regional heterogeneity, and they found that digital inclusive finance exhibits direct or indirect poverty reduction effects in China. Among them, the indirect effect is achieved by optimizing income distribution and promoting regional economic development; in addition, digital inclusive finance has a more obvious poverty reduction effect on the western region, which is less developed<sup>[11]</sup>.

In addition to studying urban-rural heterogeneity, regional heterogeneity and poverty reduction effects, some scholars have studied the heterogeneous effects of digital inclusive finance on promoting consumption at a more granular level. Jiang Hongli and Jiang Pengcheng (2020) constructed a dynamic panel model and found that digital inclusive finance can only increase the consumption of residents with an already high level of consumption, and the effect is more pronounced in urban areas. In addition, there are two transmission channels through

which digital inclusive finance affects consumption, one is to promote the optimization and upgrading of industrial structure, and the other is to reduce the income difference between residents in urban areas and rural areas [12]. Li et al. (2020), starting from the mechanism of action, analyzed and found that the effect of digital inclusive finance on the consumption of the residents is positive, and the effect on low-income families with less wealth, lack of financial knowledge, and in less developed cities is greater. In terms of the composition of consumption, digital inclusive finance mainly affects residents' current expenditures [13]. Sun Yuhuan et al. (2021) conducted an empirical test using a panel fixed-effects regression model and a mediation model, and found that digital financial inclusion has the effect of boosting consumption, but this effect is heterogeneous with the different conditions of the residents' living locations and incomes, etc. Specifically, digital financial inclusion has a greater impact on the urban center areas and other areas with a high degree of Internet penetration, and has no significant impact on the consumption of residents in the urban fringe areas and rural center areas. Rural center regions have no significant effect on residents' consumption. In addition, the lower the income and the higher the education level of the residents, the more digital financial inclusion benefits they enjoy [14].

A few scholars have also come to the opposite conclusion, finding that in some specific cases, the development of digital financial inclusion can inhibit residents' consumption. Yi Xingjian and Zhou Li (2018), on the other hand, focus on the micro perspective, pointing out that digital inclusive finance has a stimulating effect on consumption, and in addition, the effect is more obvious when the household income is lower or in the rural and central and western regions. However, this stimulus effect varies with the level of household indebtedness, and digital inclusive finance has a positive effect on household consumption only when the proportion of household indebtedness is low, while digital inclusive finance hinders the growth of household consumption when the proportion of household indebtedness is high. Therefore, while developing digital inclusive finance, it is also necessary to pay attention to the risks associated with a higher proportion of household indebtedness [15]. Lai et al. (2020), on the other hand, focusing on the perspective of income shocks, found that the development of digital inclusive finance reduces the ability of residents to cope with temporary income shocks, whereas the traditional financial sector is able to play a greater role in coping with temporary income shocks [16].

It can be seen that the effect of digital financial inclusion on consumption is very complex and has been studied from numerous perspectives. For urban-rural heterogeneity, most scholars agree that digital financial inclusion has a greater impact on rural residents' consumption. As for regional heterogeneity, scholars have different views. This paper studies the impact effect of digital inclusive finance from the perspectives of segmentation dimension, urban-rural heterogeneity and regional heterogeneity, and tries to put forward relevant suggestions by analyzing the reasons for the heterogeneity, so as to provide useful references for enhancing China's residents' consumption and promoting the high-quality development of China's economy.

### 3. Theoretical Foundation

#### 3.1. Persistent Income Theory and Wealth Effects

The popularization and development of digital inclusive finance has greatly lowered the threshold of traditional financial investment, and the proliferation of innovative inclusive financial products has enabled individual investors with relatively small amounts of capital to obtain considerable rates of return. Moreover, the application of Internet technology in the financial sector has greatly improved the convenience of financial investment for residents, who can purchase various financial and investment products through online platforms without

leaving home, which not only meets the needs of residents to rationally allocate scattered idle funds, but also reduces the cost of financial institutions to open specialized outlets for the sale of financial and investment products. Therefore, the emergence of digital inclusive financial products will increase the wealth held by residents in the long run. According to the theory of persistent income, if people experience a persistent increase in their income, then they will increase their current consumption expenditure. From the perspective of the wealth effect, because inclusive financial products have lowered the investment threshold, some residents who do not have sufficient funds have also begun to enter the financial market, and when the market price of financial assets rises, the real wealth held by residents will also increase, thus prompting them to increase their current consumption.

### 3.2. Liquidity Constraint Theory

Liquidity constraint is one of the important reasons for limiting aggregate demand in an economy and refers to the phenomenon of insufficient aggregate demand by some people who have the desire to consume because of their lack of ability to do so and because of the difficulty in obtaining affordable credit from financial institutions, such as banks, which prevents them from consuming as much as they would like to. There are two main reasons for this phenomenon: first, people who lack consumption capacity, i.e., monetary funds, are often unable to provide effective and sufficient guarantees, which makes it difficult for banks and other financial institutions to obtain loans because of the increased risk of lending; second, China's financial market is not yet very developed, with insufficient effectiveness of the financial market and fewer financial products, and under the influence of adverse selection and moral hazards brought about by asymmetry of information, market interest rates will rise. Under the influence of adverse selection and moral hazard caused by information asymmetry, the market interest rate will rise, which will increase the cost of borrowing and reduce the availability of credit. Digital inclusive finance can help financially excluded groups obtain low-cost and convenient consumer credit, which is conducive to changing residents' conservative consumption attitudes and easing their liquidity constraints, thus playing an important role in promoting residents' consumption.

### 3.3. Psychological Account Effect

Psychological account effect refers to the fact that in real life, people often do not treat funds of different sources or uses equally, but will divide them into different subjective accounts. Even if the number of consumption is the same, it will bring different utility or sense of discrepancy to consumers because these funds belong to different psychological accounts. E-payment is an important way for digital financial inclusion to work, featuring low cost, electronization and convenience, which can be completed anytime and anywhere with just a smartphone. At present, e-payment has achieved a fairly high penetration rate in China, and has even replaced the traditional cash transaction mode. Under this effect, people tend to set up different mental accounts for cash payment and electronic payment. If paper money is the "symbol of value", then electronic money is the "symbol of the symbol of value", the loss of virtualized electronic money is lower than the sense of loss of cash payments, so people tend to have a higher propensity to spend on electronic money. Therefore, from the perspective of digitized payment, digital financial inclusion will also lead to an increase in consumption.

## 4. Study Design

### 4.1. Research Hypothesis

According to the persistent income theory, wealth effect, liquidity constraint theory and psychological account effect, digital inclusive finance can have a stimulating effect on residents'

consumption by affecting their long-term income, the amount of financial assets they hold, and credit availability. Therefore, this paper proposes the following research hypotheses:

H1: The development of digital inclusive finance can increase residents' consumption.

Because the economic level of rural areas is generally underdeveloped, the per capita income is low, and it is difficult for residents to provide effective and sufficient guarantees, so rural residents are difficult to obtain consumer credit, and have always been one of the targets of financial exclusion. One of the purposes of digital inclusive finance is to help these groups to obtain convenient and affordable credit, which to a certain extent alleviates the difficulties of rural residents who are unable to consume as they wish due to insufficient funds. Therefore for urban-rural heterogeneity, this paper proposes the hypothesis:

H2: Digital inclusive finance promotes rural residents' consumption more than urban.

China's east and west spans a large area, and the role of digital inclusive finance may also show a certain degree of heterogeneity due to the differences in geographic conditions, living habits, consumption attitudes and other factors between regions. In the economically underdeveloped central and western regions, it may be more difficult for residents to obtain credit at a reasonable cost, which may make digital inclusive finance more effective in alleviating financial exclusion. Based on this analysis, the following hypothesis is proposed:

H3: The role of digital inclusive finance in increasing residents' consumption is greater in the central and western regions.

## 4.2. Data Sources

The data about the Digital Inclusive Finance Index and its sub-dimensions in this paper are from the *Peking University Digital Inclusive Finance Index*, and the data about per capita consumption expenditure of residents and each control variable are from the National Bureau of Statistics and statistical yearbooks of each province.

## 4.3. Selection of Variables

### 4.3.1. Explained Variables

The explanatory variable of this paper is the per capita consumption expenditure (pcce) of each province and city from 2011 to 2022, which is introduced into the empirical model after taking the logarithm.

### 4.3.2. Explanatory Variables

This paper selects the Digital Financial Inclusion Index (DFII) as the core explanatory variable, which is released by the Digital Finance Research Center of Peking University, and consists of multiple dimensions such as breadth of coverage (DCB), depth of use (DUD), and degree of digitization (DDL), which measures the development of digital financial inclusion in China. In this paper, we will use the digital inclusive finance index and its three first-level dimensions (breadth of coverage, depth of use and degree of digitization) to conduct empirical tests.

### 4.3.3. Control Variables

Regional GDP per capita (rgdp). GDP per capita directly responds to the economic strength of the region, and is one of the important factors affecting residents' income. From the income effect of demand, it can be seen that people's real income level has a significant positive relationship with consumption expenditure. Therefore, this paper selects the per capita GDP of each province as one of the control variables and takes its natural logarithm to introduce the empirical model.

The development level of industrial structure (inds). The optimization and upgrading of a region's industrial structure may have an impact on residents' consumption. According to Maslow's hierarchy of needs theory, when people's living conditions improve and the problem of food and clothing is no longer the main problem troubling people, more advanced needs will

arise, such as the demand for goods and services other than food. The optimization and upgrading of industrial structure is manifested in the transfer of the economic center of gravity from the primary industry to the secondary and tertiary industries, especially from resource-intensive industries to knowledge-intensive and technology-intensive industries. A reasonable industrial structure can provide consumer goods that match residents' needs, thus driving up the consumption level. Therefore, this paper introduces the development level of industrial structure into the empirical model. Referring to Yu Libin et al. (2017), the level of industrial structure development = (value added of the secondary industry in each province and city  $\times$  0.4 + value added of the tertiary industry in each province and city  $\times$  0.6)/regional GDP [17].

Relative size of fiscal expenditure (fsp). Local fiscal expenditures are often invested in public services, education, medical care, transportation and other undertakings, which can enhance the living standards of residents to a certain extent, thus promoting residents' consumption. This paper uses the ratio of local fiscal expenditure to regional GDP to measure the level of fiscal expenditure.

Total Dependency Ratio (tdr). The total dependency ratio is calculated as the number of non-working-age population/working-age population, which to a certain extent reflects the demographic composition of a region. The higher the total dependency ratio, the higher the burden in the economy. According to the life cycle hypothesis, people are not always confined to the present, but prefer to optimize their consumption allocation on the basis of their lifetime as a cycle, and people tend to save when they are working and increase their consumption when they are old and retired, which leads to the fact that the demographic structure will have a certain impact on the level of consumption. Therefore, this paper uses the total dependency ratio as a measure of population structure and introduces it into the empirical model [18].

Urbanization rate (urban\_rate):The urbanization rate can reflect the economic development level of the region, and different urbanization rates may also lead to different consumption behaviors of the residents, therefore, this paper uses the proportion of urban population to the total population to calculate the urbanization rate, and adds it to the empirical model.

#### 4.4. Model Setting

In this paper, panel data of 31 provincial-level administrative regions in China (except Hong Kong, Macao and Taiwan) from 2011 to 2022 are selected for empirical research using stata16.0. The basic model setting is as follows:

$$\ln\_pcce_{it} = \alpha_{it} + \beta_1 DFII_{it} + \gamma_k \sum_{k=1}^n Z_{it} + u_i + \varepsilon_{it} \quad (1)$$

where  $\ln\_pcce$  is the explanatory variable, which is the natural logarithm of the per capita consumption expenditure of residents in each provincial administrative region in China;  $DFII$  stands for the digital financial inclusion index of each province, which is the core explanatory variable;  $\alpha_{it}$  is the intercept term,  $Z$  is each control variable, which  $u_i$  indicates the fixed effect, and  $\varepsilon_{it}$  is the residual term,  $i$  is the 31 provincial administrative regions, and  $t$  is the year 2011-2022.

In order to explore the relationship between the three main dimensions of the digital financial inclusion index and residents' consumption, the following model is established.

$$\ln\_pcce_{it} = \alpha_{it} + \beta_2 DCB_{it} + \gamma_k \sum_{k=1}^n Z_{it} + u_i + \varepsilon_{it} \quad (2)$$

$$\ln\_pcce_{it} = \alpha_{it} + \beta_3 DUD_{it} + \gamma_k \sum_{k=1}^n Z_{it} + u_i + \varepsilon_{it} \quad (3)$$

$$\ln\_pcce_{it} = \alpha_{it} + \beta_4 DDL_{it} + \gamma_k \sum_{k=1}^n Z_{it} + u_i + \varepsilon_{it} \quad (4)$$

Where DCB represents the breadth of coverage, DUD represents the depth of use, and DDL represents the degree of digitization.

#### 4.5. Descriptive Statistics

In order to better observe the distributional characteristics of the variables, descriptive statistics were first performed on the variables and the following results were obtained.

**Table 1.** Descriptive statistics for each variable

| variables  | Variable meaning   | Obs | max     | mean   | min     | standard deviation |
|------------|--|-----|---------|--------|---------|--------------------|
| ln_pcce    | Natural logarithm of per capita consumption expenditure                    | 372 | 10.797  | 8.530  | 9.700   | 0.406              |
| ln_cpcce   | Natural logarithm of per capita consumption expenditure of urban residents | 372 | 10.845  | 9.342  | 9.982   | 0.307              |
| ln_rpcce   | Natural logarithm of per capita consumption expenditure of rural residents | 372 | 10.221  | 8.054  | 9.237   | 0.406              |
| DFII       | Digital Financial Inclusion Index  | 372 | 475.790 | 16.220 | 241.591 | 106.306            |
| DCB        | Breadth of Digital Financial Inclusion Coverage                            | 372 | 431.490 | 1.960  | 223.119 | 106.882            |
| DUD        | Depth of Use of Digital Financial Inclusion                                | 372 | 587.650 | 6.760  | 238.738 | 112.613            |
| DDL        | Degree of digital financial inclusion digitization                         | 372 | 462.230 | 7.580  | 307.792 | 114.376            |
| ln_rgdp    | Natural logarithm of regional GDP per capita                               | 372 | 12.155  | 9.682  | 10.856  | 0.462              |
| inds       | Development level of industrial structure                                  | 372 | 0.566   | 0.384  | 0.461   | 0.033              |
| fsp        | Relative size of fiscal expenditure  | 372 | 2.708   | 0.209  | 0.580   | 0.410              |
| tdr        | Total dependency ratio   | 372 | 0.578   | 0.193  | 0.388   | 0.074              |
| urban_rate | Urbanization rate  | 372 | 0.896   | 0.227  | 0.592   | 0.130              |

By analyzing the results of descriptive statistics, it can be found that the per capita consumption level is somewhat different between urban and rural areas, and the per capita consumption level in urban areas is higher than that in rural areas. The standard deviation of the digital financial inclusion index is large, indicating that the development level of digital financial inclusion in different provinces is relatively different, and the differences reflected in each sub-dimension are also relatively large. The per capita GDP, the level of industrial structure development, the relative scale of fiscal expenditure, the total dependency ratio and the urbanization rate all show some differences in different regions.



## 5. Empirical Analysis

### 5.1. Correlation Tests

In order to avoid the possible interference of multicollinearity on the empirical results, this paper conducts correlation tests on the core explanatory variables and control variables, and the results are shown in the following table.

**Table 2.** correlation tests

| variables  | DFII      | ln_rgdg   | inds      | fsp       | tdr       | urban_rate |
|------------|-----------|-----------|-----------|-----------|-----------|------------|
| DFII       | 1         |           |           |           |           |            |
| ln_rgdg    | 0.737***  | 1         |           |           |           |            |
| inds       | 0.449***  | 0.758***  | 1         |           |           |            |
| fsp        | -0.146*** | -0.364*** | -0.0770   | 1         |           |            |
| tdr        | 0.401***  | -0.0620   | -0.200*** | 0.0570    | 1         |            |
| urban_rate | 0.500***  | 0.853***  | 0.700***  | -0.499*** | -0.359*** | 1          |

It can be seen from the data in the table that the correlation coefficient between urban\_rate and ln\_rgdg per capita exceeds 0.8, which may have multicollinearity. Therefore, in the following section, this paper respectively regression models with and without urbanization rate, and discusses this issue.

### 5.2. Baseline Regression

**Table 3.** Results of baseline regression and dimensional regression

|            | (1)                         | (2)                        | (3)                         | (4)                         | (5)                         |
|------------|-----------------------------|----------------------------|-----------------------------|-----------------------------|-----------------------------|
|            | Overall                     | Overall*                   | Coverage breadth            | Using depth                 | Digitization degree         |
| DFII       | 0.0008561***<br>(0.0001139) | 0.000717***<br>(0.0001292) |                             |                             |                             |
| DCB        |                             |                            | 0.0010333***<br>(0.0001337) |                             |                             |
| DUD        |                             |                            |                             | 0.0003177***<br>(0.0000878) |                             |
| DDL        |                             |                            |                             |                             | 0.0002112***<br>(0.0000422) |
| ln_rgdg    | 0.391***<br>(0.048)         | 0.661***<br>(0.045)        | 0.376***<br>(0.048)         | 0.562***<br>(0.044)         | 0.589***<br>(0.035)         |
| inds       | 1.871***<br>(0.386)         | 2.786***<br>(0.429)        | 1.976***<br>(0.377)         | 2.602***<br>(0.397)         | 2.655***<br>(0.375)         |
| fsp        | 0.096**<br>(0.046)          | 0.153***<br>(0.052)        | 0.114**<br>(0.044)          | 0.204***<br>(0.045)         | 0.141***<br>(0.047)         |
| tdr        | -0.342***<br>(0.087)        | -0.357***<br>(0.099)       | -0.400***<br>(0.088)        | -0.322***<br>(0.095)        | -0.149*<br>(0.090)          |
| urban_rate | 1.530***<br>(0.150)         |                            | 1.217***<br>(0.150)         | 1.585***<br>(0.166)         | 1.493***<br>(0.157)         |
| _cons      | 3.553***<br>(0.525)         | 1.115**<br>(0.534)         | 3.845***<br>(0.547)         | 1.397***<br>(0.454)         | 1.106***<br>(0.326)         |
| adj. R2    | 0.976                       | 0.968                      | 0.976                       | 0.973                       | 0.974                       |
| N          | 372                         | 372                        | 372                         | 372                         | 372                         |

Note: \*\*\*, \*\* and \* are significant at the significance level of 1%, 5% and 10%, respectively; Standard error in parentheses. Overall \* is the baseline regression result after excluding the urbanization rate.

In order to verify hypothesis H1 in this paper, regression is performed on models (1) - (4). The results of baseline regression and fractal dimension are shown in the following table.

#### Results of baseline regression and fractal regression

The regression results show that the goodness of fit of the model is high and the degree of fit is good, no matter the total regression or the fractal regression. The benchmark regression (Overall\*) results excluding the urbanization rate show that the core explanatory variables and control variables are still significant and the direction of influence does not change, indicating that the correlation between the urbanization rate and the natural logarithm of per capita GDP will not affect the research results of this paper. Therefore, the urbanization rate will be added to the model in subsequent studies.

In population regression, both the core explanatory variable and each control variable are significant at the 1% significance level. The influence coefficient of digital inclusive finance is 0.0008561, indicating that digital inclusive finance can promote residents' consumption, and every 1 unit increase of digital inclusive finance index will increase residents' per capita consumption by about 0.086%. Hypothesis H1 is verified. Every 1% increase in regional per capita GDP will lead to an increase of 0.391% in per capita consumption of residents, which is because regional per capita GDP reflects the regional economic situation. If the regional economic level is improved, it will have a positive promoting effect on consumption. Every 1% increase in the development level of regional industrial structure will increase the per capita consumption of residents by about 1.871%, because the optimization and upgrading of industrial structure will provide residents with more abundant and high-quality products and services, and promote residents to increase consumption. The relative scale of fiscal expenditure represents the government's behavior and plays a role in guiding residents' consumption. An increase of 1% will lead to an increase of about 0.096% in residents' per capita consumption. The urbanization rate affects the consumption behavior of residents. Every 1% increase in the urbanization rate will increase the per capita consumption of residents by about 1.530%. Among all the control variables, only the total dependency ratio has an inverse relationship with the change trend of residents' per capita consumption, and every 1% increase in the total dependency ratio will reduce residents' per capita consumption by about 0.342%. This may be because when the society is at a high dependency burden level, people will increase savings and reduce consumption out of caution for emergency needs.

The results of fractal regression show that the coverage breadth, use depth and digitization degree of digital inclusive finance are all positively correlated with the per capita consumption of residents, and all are significant at the significance level of 1%. However, compared with the coverage breadth, the regression coefficients of the depth of use and the degree of digitization are smaller, indicating that digital financial inclusion mainly plays a role through the coverage breadth dimension. This is because the coverage is reflected in the coverage of digital inclusive financial infrastructure, which directly determines whether residents can obtain effective digital inclusive financial services. The more sufficient the supply of digital inclusive financial infrastructure, the more it can promote residents' consumption. The reasons for the low impact of digital inclusive finance on residents' consumption are as follows: On the one hand, the basic services of digital inclusive finance can already meet the needs of most residents, and excessive use of digital inclusive finance cannot effectively promote residents' consumption; On the other hand, because the development of digital inclusive finance in China is not very perfect, and financial and digital technology are still in running-in, digital inclusive financial services can not fully play the advantages of digital technology, resulting in a small role of digital degree in promoting residents' consumption.

### 5.3. Urban-rural Heterogeneity Analysis

The long-term urban-rural dual structure in China will reduce the efficiency of market resource allocation and make the flow of resources between urban and rural areas have obstacles. As the overall economic level of rural areas is lower than that of urban areas, the per capita disposable income in rural areas is relatively low, and the ability to resist risks is also weak. Therefore, financial institutions are more inclined to invest funds in urban areas with higher returns and less risks, rather than lend funds to rural residents, making rural residents a group excluded by the traditional financial system. In addition, due to the differences in consumption concepts, rural residents tend to have a strong sense of savings, and the savings of rural residents have become the main source of deposit for some financial institutions. However, after absorbing the savings of rural residents, these financial institutions did not apply them to the construction of rural areas, but chose to invest in urban areas, resulting in further widening the economic gap between urban and rural areas. The original intention of developing digital financial inclusion is to help the financially excluded groups and alleviate their difficulties in accessing financial products and services at an acceptable cost. In order to study the heterogeneity of the development of digital financial inclusion on urban and rural residents, this paper replaces the explanatory variables with the natural logarithm of rural per capita consumption ( $\ln\_rpcce$ ) and the natural logarithm of urban per capita consumption ( $\ln\_cpcce$ ), and uses seemingly uncorrelated regression (SUR) for testing. The results are shown in the following table.

**Table 4.** Regression results of urban-rural heterogeneity

|             | (1)          | (2)          |
|-------------|--------------|--------------|
|             | Urban        | Rural        |
| DFII        | 0.0013058*** | 0.0019894*** |
|             | (0.0000785)  | (0.000105)   |
| $\ln\_rgdp$ | 0.271***     | 0.314***     |
|             | (0.025)      | (0.034)      |
| inds        | 1.324***     | -0.661**     |
|             | (0.212)      | (0.283)      |
| fsp         | 0.056***     | -0.054***    |
|             | (0.013)      | (0.018)      |
| tdr         | -0.276***    | 0.108        |
|             | (0.088)      | (0.117)      |
| urban_rate  | 0.276***     | 0.676***     |
|             | (0.084)      | (0.112)      |
| _cons       | 6.020***     | 5.246***     |
|             | (0.212)      | (0.284)      |
| R2          | 0.940        | 0.938        |
| N           | 372          | 372          |

Note: \*\*\*, \*\* and \* are significant at the significance level of 1%, 5% and 10%, respectively; Standard error in parentheses.

It can be seen from the regression results that the digital financial inclusion index has a positive impact on the per capita consumption of both rural residents and urban residents, and has passed the significance test at the significance level of 1%. By comparing the regression coefficient, it can be found that digital inclusive finance has a greater impact on residents' consumption in rural areas, but a smaller effect on urban areas, indicating that digital inclusive finance has the effect of reducing the gap between urban and rural consumption when the

current urban consumption level in our country is generally higher than that in rural areas, and H2 is confirmed. This is because digital inclusive finance, which is developed based on Internet technology, has the natural advantage of playing a role across the differences in geographical environment and economic development level, which makes digital inclusive finance play a greater role in rural areas where financial infrastructure is relatively weak than in urban areas.

#### 5.4. Regional Heterogeneity Analysis

Due to China's large land area, different regions have different economic development status, financial infrastructure and other aspects, so the development of digital inclusive finance may have different impacts on residents' consumption in different regions. Therefore, this paper refers to the division method proposed by Li Jianjun et al. (2020), and divides 31 provincial administrative regions into eastern and central and western regions for regression respectively. The eastern region includes 11 provinces and cities, including Beijing, Fujian, Guangdong, Hainan, Hebei, Jiangsu, Liaoning, Shandong, Shanghai, Tianjin and Zhejiang, while the rest are the central and western regions<sup>[19]</sup>. The regression results are shown in the following table.

**Table 5.** Regional heterogeneity regression results

|            | (1)         | (2)                         |
|------------|-------------|-----------------------------|
|            | Eastern     | Central and western regions |
| DFII       | 0.000775*** | 0.0008299***                |
|            | (0.0001702) | (0.0001717)                 |
| ln_rgd     | 0.332***    | 0.439***                    |
|            | (0.070)     | (0.064)                     |
| inds       | 5.021***    | 1.278***                    |
|            | (0.806)     | (0.447)                     |
| fsp        | 0.160*      | 0.116**                     |
|            | (0.095)     | (0.054)                     |
| tdr        | -0.320**    | -0.323***                   |
|            | (0.130)     | (0.123)                     |
| urban_rate | 1.227***    | 1.391***                    |
|            | (0.216)     | (0.312)                     |
| _cons      | 2.844***    | 3.400***                    |
|            | (0.826)     | (0.672)                     |
| adj. R2    | 0.978       | 0.976                       |
| N          | 132         | 240                         |

Note: \*\*\*, \*\* and \* are significant at the significance level of 1%, 5% and 10%, respectively; Standard error in parentheses.

It can be seen that the development of digital inclusive finance has a positive impact on residents' consumption in the eastern, central and western regions, all of which are significant under the significance level of 1%. By observing the impact coefficients of the eastern and central regions, it can be seen that the impact of digital inclusive finance on residents' consumption in the western region is greater than that in the eastern region, indicating that hypothesis H3 is correct.

The consumption of residents in the central and western regions is greatly affected by digital inclusive finance. On the one hand, the digital inclusive finance based on information technology has the characteristics of lower cost and more convenient, breaking the restriction of geographical conditions, so the residents in the central and western regions can obtain more financial services. On the other hand, compared with the eastern region, the financial

infrastructure in the central and western regions is weaker and the financial market is less mature, so residents in the central and western regions are more likely to be excluded from the traditional financial system, so in the central and western regions, digital financial inclusion can better play its role in alleviating financial exclusion.

The consumption of residents in the eastern region is less affected by digital inclusive finance, which is because the eastern region is a relatively developed region in China with the most complete financial infrastructure and the most sound financial market. Therefore, residents in the eastern region are more likely to obtain affordable credit through traditional financial channels, resulting in limited development space for digital inclusive finance in the eastern region. Therefore, the marginal benefit of digital inclusive finance to promote the consumption of residents in the eastern region is small.

### 5.5. Robustness Test

In order to ensure that the conclusions obtained in this paper are robust, the method of replacing the explained variables is used to test again. `consump_rate` is the ratio of per capita consumption expenditure and per capita GDP in a region, which can measure the consumption level of residents to a certain extent. Therefore, this paper changes the explained variable to the resident consumption rate for regression, and the robustness test results are as follows.

**Table 6.** Overall and dimensional robustness tests

|            | (1)                        | (3)                       | (4)                        | (5)                         |
|------------|----------------------------|---------------------------|----------------------------|-----------------------------|
|            | Overall                    | Coverage breadth          | Using depth                | Digitization degree         |
| DFII       | 0.000281***<br>(0.0000363) |                           |                            |                             |
| DCB        |                            | 0003436***<br>(0.0000424) |                            |                             |
| DUD        |                            |                           | 0.0001132***<br>(0.000028) |                             |
| DDL        |                            |                           |                            | 0.0000642***<br>(0.0000136) |
| ln_rgdp    | -0.190***<br>(0.015)       | -0.196***<br>(0.015)      | -0.137***<br>(0.014)       | -0.123***<br>(0.011)        |
| inds       | 0.564***<br>(0.123)        | 0.594***<br>(0.120)       | 0.789***<br>(0.126)        | 0.833***<br>(0.120)         |
| fsp        | 0.042***<br>(0.015)        | 0.047***<br>(0.014)       | 0.076***<br>(0.014)        | 0.059***<br>(0.015)         |
| tdr        | -0.099***<br>(0.028)       | -0.119***<br>(0.028)      | -0.095***<br>(0.030)       | -0.037<br>(0.029)           |
| urban_rate | 0.458***<br>(0.048)        | 0.355***<br>(0.048)       | 0.481***<br>(0.053)        | 0.443***<br>(0.050)         |
| _cons      | 1.792***<br>(0.167)        | 1.904***<br>(0.174)       | 1.123***<br>(0.145)        | 0.963***<br>(0.105)         |
| adj. R2    | 0.548                      | 0.554                     | 0.492                      | 0.500                       |
| N          | 372                        | 372                       | 372                        | 372                         |

Note: \*\*\*, \*\* and \* are significant at the significance level of 1%, 5% and 10%, respectively; Standard error in parentheses.

The regression results after replacing the explained variables show that the impact of the digital financial inclusion index on the resident consumption rate is still significant at the significance level of 1%, and there is a positive relationship between the two, which is consistent with the previous results, and the results of the fractal dimension test are also consistent with the previous results, indicating that the previous regression results are robust.

In the previous paper, seemingly uncorrelated regression (SUR) was used to test urban-rural heterogeneity. In this paper, the robustness of the results of urban-rural heterogeneity was tested by replacing the seemingly uncorrelated regression with a fixed effect model. The test results are shown in the following table.

**Table 7.** Regression results of urban-rural heterogeneity

|            | (1)          | (2)          |
|------------|--------------|--------------|
|            | Urban        | Rural        |
| DFII       | 0.0009899*** | 0.0012604*** |
|            | (0.000115)   | (0.0001474)  |
| ln_rgdg    | 0.312***     | 0.466***     |
|            | (0.048)      | (0.062)      |
| inds       | 1.960***     | 1.451***     |
|            | (0.390)      | (0.500)      |
| fsp        | 0.116**      | 0.085        |
|            | (0.046)      | (0.059)      |
| tdr        | -0.390***    | 0.085        |
|            | (0.088)      | (0.113)      |
| urban_rate | 0.726***     | 1.066***     |
|            | (0.151)      | (0.194)      |
| _cons      | 5.105***     | 2.493***     |
|            | (0.530)      | (0.679)      |
| R2         | 0.965        | 0.972        |
| N          | 372          | 372          |

Note: \*\*\*, \*\* and \* are significant at the significance level of 1%, 5% and 10%, respectively; Standard error in parentheses.

The test results of the fixed effect model show that the digital inclusive financial index has a significant impact on the consumption of both urban and rural residents, and the sign of the influence coefficient is positive, and the effect is greater in rural areas than in urban areas, which is consistent with the test results above, indicating that the test results of urban and rural heterogeneity are robust.

The test results of regional robustness show that the promotion effect of digital inclusive finance on residents' consumption is significant in both eastern and central and western regions, and the influence coefficients are positive. Moreover, the promotion effect of digital inclusive finance on residents' consumption is greater in central and western regions than in eastern regions, which is consistent with the previous results, indicating that the test result of regional heterogeneity is robust.

**Table 8.** Robustness test of urban-rural heterogeneity

|            | (1)          | (2)                         |
|------------|--------------|-----------------------------|
|            | Eastern      | Central and western regions |
| DFII       | 0.0002413*** | 0.0002832***                |
|            | (0.0000511)  | (0.0000559)                 |
| ln_rgdg    | -0.202***    | -0.179***                   |
|            | (0.021)      | (0.021)                     |
| inds       | 1.626***     | 0.344**                     |
|            | (0.242)      | (0.146)                     |
| fsp        | 0.035        | 0.051***                    |
|            | (0.029)      | (0.018)                     |
| tdr        | -0.108***    | -0.088**                    |
|            | (0.039)      | (0.040)                     |
| urban_rate | 0.363***     | 0.424***                    |
|            | (0.065)      | (0.102)                     |
| _cons      | 1.488***     | 1.793***                    |
|            | (0.248)      | (0.219)                     |
| adj. R2    | 0.691        | 0.502                       |
| N          | 132          | 240                         |

Note: \*\*\*, \*\* and \* are significant at the significance level of 1%, 5% and 10%, respectively; Standard error in parentheses.

## 6. Conclusion and Policy Recommendations

Using the panel data of 31 provincial administrative regions in China from 2011 to 2022, this paper empirically tested the impact of digital inclusive finance on residents' consumption from the aspects of overall and sub-dimensional effects, urban and rural heterogeneity and regional heterogeneity, and drew the following conclusions: (1) The development of digital inclusive finance has a significant promoting effect on the per capita consumption of Chinese residents. Among the three main dimensions of digital financial inclusion, coverage has the greatest impact on household consumption. (2) From the perspective of urban and rural heterogeneity, the development of digital inclusive finance has a significant positive impact on the consumption of both urban and rural residents, but the impact on the consumption of rural residents is greater, which indicates that digital inclusive finance has contributed to narrowing the economic gap between urban and rural areas and is conducive to promoting common prosperity. (3) From the perspective of regional heterogeneity, although the development of digital inclusive finance has a significant promoting effect on the per capita consumption of residents in the eastern and central and western regions, the impact is greater in the central and western regions than in the eastern regions.

Based on the above conclusions, this paper puts forward the following policy recommendations: First, improve digital financial inclusion infrastructure and expand the coverage of digital financial inclusion. Digital inclusive finance is the product of the combination of inclusive finance and Internet technology. Good Internet infrastructure is the key to the vigorous development of digital inclusive finance. However, in some backward regions and remote rural areas in western China, the penetration rate of the network is still low, which may hinder the role of digital inclusive finance in promoting consumption. Therefore, we should accelerate the construction of Internet infrastructure projects in remote and backward areas, improve communication and network facilities, improve the coverage of the Internet, thereby improving

the coverage of digital inclusive finance, and smooth the transmission channels of digital inclusive finance to stimulate consumption.

Second, encourage financial institutions to innovate digital inclusive financial products. At present, the diversity of digital inclusive financial products in China is still lacking, with fewer product types, a high degree of homogeneity, and a lack of targeted services. The demand side of digital inclusive finance often needs a small amount of funds, a short term and frequent demand, but at present, some digital inclusive financial products still have problems of large quotas and high interest rates, which reduces the availability of credit on the demand side and makes the supply of digital inclusive financial products not match the demand. Therefore, financial institutions providing digital inclusive financial products and services should take full account of the actual needs of residents, vigorously promote the innovation of digital inclusive financial products, make full use of Internet technology to locate the real needs of residents, launch more easy-to-access, affordable and personalized digital inclusive financial products, so that residents can truly enjoy the benefits of digital inclusive financial services. Thus to promote the consumption of residents, to support the economic development of our country.

Third, strengthen the publicity of digital financial inclusion. One of the advantages of digital financial inclusion is that it can use the Internet platform to provide financial services to the financially excluded residents across the geographical constraints, but some residents in the more remote western and rural areas still maintain too conservative consumption concepts. Due to the lack of relevant knowledge, these residents often think that digital inclusive finance is no different from traditional financial products with large quota and high interest rate, leading to their low acceptance of digital inclusive finance, which will hinder the role of digital inclusive finance to a certain extent. Therefore, it is necessary to strengthen the publicity of digital financial inclusion in backward areas, encourage the government and financial institutions to carry out "financial literacy" for local residents, popularize relevant knowledge through radio, television, newspapers, magazines and other media, and improve people's recognition of digital financial inclusion. In addition, professional teams should also be organized to popularize basic Internet operations in backward areas to avoid the situation that residents cannot enjoy digital inclusive financial services because they do not know how to use smartphones.

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