Digital Inclusive Finance and Income Growth of Urban and Rural Residents: Mechanism Test and Heterogeneity Analysis

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Abstract: This paper constructs provincial panel data based on the 2013-2020 Digital Inclusive Finance Index released by the Digital Finance Research Center of Peking University, and firstly verifies the direct impact of digital inclusive finance on the income of urban and rural residents in China, and then takes industrial structure upgrading and employment structure optimization as the mediator variables to explore the role mechanism of digital inclusive finance and the income of urban and rural residents. mechanism. The study draws the following conclusions: (1) the development of digital inclusive finance promotes the increase of per capita disposable income of urban and rural residents; (2) digital inclusive finance promotes the increase of per capita disposable income of urban residents by promoting the upgrading of industrial structure; (3) digital inclusive finance promotes the increase of per capita disposable income of rural residents by promoting the optimization of employment structure.

Keywords: digital inclusive finance; residents' income; industrial structure; employment structure

1. Introduction

Since the 1980s, China's economic development has made remarkable achievements, but the long-standing urban-rural dualistic structure has made the wealth gap between urban and rural areas widen, hindering the healthy development of the economy and society, and violating the essential requirements of common prosperity. The starting point of inclusive finance is to provide financial services for residents in economically relatively backward areas and disadvantaged groups such as small, medium and micro enterprises, and then to a certain extent to alleviate the mismatch of financial resources (Zhang and Naceur, 2019; Corrado, 2017)[1~2]. However, the traditional inclusive financial model is difficult to play a role in areas with relatively backward economic development due to the lack of coverage, information security hazards, and the serious phenomenon of "self-exclusion", and so on, and therefore the phenomenon of deviation between the reality and the expected results may occur in the process of the development of inclusive financial services, Xing Yan (2015)[3] research found that Financial institutions in the process of providing inclusive financial services have the phenomenon of "mission drift", i.e., they are unable to balance the inclusive nature and commercial nature. With the continuous penetration of scientific and technological innovation into various industries, it is a general trend to promote industrial development by science and technology and accelerate the digital transformation of the economy and society, and the combination of digital science and technology and financial inclusion will bring Internet finance in the form of informatization and mobility to the traditional financial inclusion model, injecting new vitality into the traditional financial inclusion.

At present, there are many difficulties in the employment of China's labor force, and the transformation of old and new kinetic energy and the acceleration of structural adjustment have made China's structural employment contradictions prominent. Digital inclusive finance has made it possible for the general public to enjoy high-quality financial products and services at the right price by boosting the construction of smart cities, driving precise poverty alleviation, and promoting the penetration of financial services into rural areas, thus providing a new solution to the problem of urban-rural income distribution. In addition, digital inclusive finance has also eased the financing difficulties of small and medium-sized enterprises and improved the allocation efficiency of industrial resources, thus exerting a far-reaching impact on the upgrading of the industrial structure, while at the same time bringing more high-quality jobs to promote the growth of urban and rural residents' disposable incomes, thus laying a

solid foundation for improving the pattern of urban and rural incomes, and promoting the renewal of the industrial structure and the rationalization of the employment structure.

2. Literature review

The relevant research results available at home and abroad are mainly focused on the following three aspects.

First, regarding the impact of digital inclusive finance on residents' income, the related literature mainly discusses the direct and indirect impacts. In terms of direct impact, Galak (2011)[4] argues that digital finance can rapidly expand the breadth of coverage of financial services and thus benefit more people. Zhu Yiming et al. (2017)[5] found that digital inclusive finance can significantly raise the income of rural residents after using county-level data empirically, and it is obvious in supporting innovation and entrepreneurship and realizing inclusive growth; Huang Qian et al. (2019)[6] found that poor groups are more likely to obtain the dividends of digital financial development than the affluent groups; and Chen Dan et al. (2019)[7] found that digital inclusive finance has a significant positive relationship with the rise of rural residents' income. positive relationship. In terms of indirect impact, Jack et al. (2013)[8] and Kapoor et al. (2014)[9] argue that digital inclusive finance can increase residents' income by alleviating financial exclusion and thus increase income, and the effect of income increase on low-income groups is more obvious. Zhang Bi-Qiong et al. (2021)[10] empirically examined the impact of digital inclusive finance on income distribution based on the perspective of urban-rural differences in China, and found that the income effect of digital inclusive finance on rural residents is greater than that of urban residents, and concluded that rural residents have gained more dividends through the development of digital inclusive finance.

Second, regarding the impact of digital inclusive finance on industrial structure upgrading, Yang Hong et al. (2021)[11] found that digital inclusive finance and its three sub-dimensions promote industrial structure upgrading, but the effect is more obvious for regions with relatively developed economic level. Du Jinmin et al. (2020)[12] found that digital inclusive finance promotes the rationalization, advancement and internal evolution of industrial structure through capital accumulation, consumer demand expansion and technological innovation.

Third, on the impact of digital inclusive finance on the optimization of employment structure. The current research mainly focuses on the impact of digital inclusive finance on the level of employment, and there are relatively few studies on the impact on the optimization of employment structure. Ma Guowang et al. (2021)[13] found that the development of digital inclusive finance has a positive impact on employment, and the employment-promoting effect is more significant in less economically developed regions. Yin Zhichao et al. (2021)[14] found that digital inclusive finance can significantly increase the employment rate of the household sector through the development of entrepreneurial self-employment employment activities.

3. Analysis of the mechanisms of digital inclusive finance on income growth for urban and rural residents

3.1. Impact of digital inclusive finance on rural and urban incomes

The impact of digital inclusive finance on the income of urban and rural residents is analyzed in the following three dimensions.

In terms of breadth of coverage, digital inclusive finance has made it possible for urban and rural residents, especially rural residents in less developed areas, to enjoy fast and convenient financial services because of its great breadth of coverage. In terms of depth of use, digital inclusive finance includes a wide range of financial products and services, such as money funds, credit and insurance, and can provide more targeted financial services to different demanders through its advantages in data acquisition, processing and analysis. In terms of the degree of digitization, with the construction of new infrastructure for the digital economy such as 5G, big data, artificial intelligence, the Internet and the improvement of the financial service system, the financial reform will be further increased, and the level of digitization of financial services in the region will be gradually increased.

Hypothesis 1: The development of digital inclusive finance has contributed to the increase in the income of urban and rural residents.

3.2. Digital Inclusive Finance Promotes Income Growth for Urban and Rural Residents by Driving Industrial Structure Upgrade

Digital inclusive finance can enhance the income of urban and rural residents by driving the upgrading of industrial structure. The integration of traditional finance with big data and the Internet has greatly alleviated the problems of financial barriers and financing constraints, while the deepening of financial services contributes to the effective allocation of social resources and the upgrading of industrial structure. Through its accessibility and acceptability, digital inclusive finance makes the threshold and cost of financial services continuously reduced, thus efficiently connecting the supply side and demand side of funds to meet the financing needs of industrial development, and further promoting economic growth and industrial structure upgrading.

Hypothesis 2: Digital inclusive finance drives up the income of urban and rural residents by leading to the upgrading of industrial structure.

3.3. Digital inclusive finance contributes to income growth for urban and rural residents by optimizing the employment structure

The large-scale application of new Internet financial services brought about by the development of digital inclusive finance can, to a large extent, provide urban and rural residents with more high-quality jobs and employment opportunities, and then promote the optimization of the employment structure to promote the growth of urban and rural residents' income. Based on China's development situation, due to the lack of traditional financial resources and the difficulty of obtaining information and other constraints, the relatively backward areas of economic development and small, medium and micro enterprises are often neglected by the financial system, the development of digital inclusive finance can improve the relatively backward areas and small, medium and micro enterprises financing constraints, and enhance their financing ability, and thus improve the level of residents' individual employment and private sector employment. The development of digital inclusive finance can further strengthen the "blood-forming" function of the residents by improving the problem of limited financing in relatively backward areas and small and medium-sized enterprises, thus increasing the level of individual employment and private enterprise employment.

Hypothesis 3: Digital inclusive finance promotes income growth for urban and rural residents by promoting the optimization of the employment structure.

4. Mechanism testing and heterogeneity analysis

4.1. Variable selection and data sources

4.1.1. Explained variables

This paper expresses residents' income by taking the logarithm of the per capita disposable income of residents in all provinces of China from 2013 to 2020, which consists of three parts: per capita disposable income of residents, per capita disposable income of urban residents and per capita disposable income of rural residents.

4.1.2. Explanatory variables

In this paper, the provincial data of Peking University's Digital inclusive finance Index from 2013 to 2020 were selected and logarithmized.

4.1.3. Mediating variables

Referring to the research of Ma Zhili et al. (2008)[15], this paper uses the proportion of secondary industry and tertiary industry in GDP, that is, the proportion of non-agricultural output, to indicate the upgrading of industrial structure, and a larger proportion of this ratio indicates a more advanced industrial structure. Referring to the study of Qi Yudong et al. (2020)[16], this paper adopts the proportion of employment in the tertiary industry to indicate the optimization of the employment structure, and the larger the proportion of employment in the tertiary industry is, the more reasonable the employment structure becomes.

4.1.4. Control variables

By synthesizing the choices of control variables of residents' disposable income made by various

scholars in China, this paper selects five indicators as control variables: per capita gross regional product, fiscal expenditure, education level, urbanization rate and degree of opening to the outside world. Among them, the number of students enrolled in general higher education institutions (10,000) is used to indicate the education level, the proportion of fiscal expenditure to GDP of each province is used to indicate the level of fiscal expenditure, the proportion of total import and export to GDP of each province is used to indicate the degree of opening up to the outside world, and the GDP per capita and the level of education are logarithmized.

In this paper, provincial panel data from 2013-2020 are selected, and the digital inclusive finance index is from the website of the Digital Finance Research Center of Peking University. Data on disposable income of residents, per capita GDP, financial expenditure, education level, urbanization rate and degree of openness to the outside world are from the website of the National Bureau of Statistics. Descriptive statistics for the variables are shown in Table 1.

Table 1: Descriptive statistics

Variable	Mean	Std. Dev.	Min	Max	Obs
Population's income	10.053	0.379	9.184	11.188	248
Income of urban residents	10.389	0.275	9.897	11.244	248
Income of rural inhabitants	9.456	0.354	8.629	10.461	248
Digital Inclusive Finance	5.493	0.288	4.746	6.068	248
Breadth of coverage	5.408	0.467	4.305	10.317	248
Depth of use	5.453	0.322	4.726	6.192	248
Degree of digitization	5.811	0.198	5.384	6.136	248
Upgrading of industrial structure	0.904	0.052	0.749	0.997	248
Optimization of the employment structure	0.425	0.107	0.225	0.831	248
GDP per capita	10.826	0.419	10.036	12.011	248
Share of fiscal expenditure	0.300	0.212	0.120	1.354	248
Educational level	4.172	0.944	1.209	5.447	248
Urbanization rate	0.578	0.129	0.233	0.942	248
Degree of openness to the outside world	0.040	0.042	0.002	0.203	248

4.2. Model setup

This paper refers to the method of Wen Zhonglin et al. (2004)[17] to take industrial structure upgrading and employment structure optimization as the mediating effect between digital inclusive finance and residents' income. The test steps of the mediation effect are firstly the regression of the explanatory variables on the explanatory variables, then the regression of the mediating variables on the explanatory variables, and finally the regression of the explanatory variables, the explanatory variables and the mediating variables together into the model, and the specific model is as follows:

Model 1: $PCDI_{it} = \alpha_1 + \alpha_2 Index_{i(t-1)} + \alpha_3 Control_{i(t-1)} + \varepsilon_{it}$

Model 2: $Mediator_{it} = \alpha_1 + \alpha_2 Index_{i(t-1)} + \alpha_3 Control_{i(t-1)} + \varepsilon_{it}$

Model 3: $PCDI_{it} = \beta_1 + \beta_2 Mediator_{it} + \beta_3 Index_{i(t-1)} + \beta_4 Control_{i(t-1)} + \varepsilon_{it}$

Where. i denotes provinces, municipalities and autonomous regions, and t denotes the year. $PCDI_{it}$ denotes disposable income per capita, urban disposable income per capita and rural disposable income per capita. $Index_{i(t-1)}$ denotes the total digital inclusive finance index lagged one period. $Mediator_{it}$ denotes the mediating variables, i.e. industrial structure upgrading and employment structure optimization. $Control_{i(t-1)}$ denotes the control variables in the lagged period, including GDP per capita, the proportion of fiscal expenditure, the education level, the urbanization rate and the degree of openness to the outside world. ε_{it} denotes the random disturbance term.

Model 1 is used to test hypothesis 1, that is, the development of digital inclusive finance promotes

the increase of urban and rural residents' income, and model 2 and model 3 are used to test hypothesis 2 and hypothesis 3, that is, the role mechanism test of the impact of digital inclusive finance on urban and rural residents' income.

In this paper, the explanatory variable digital inclusive finance and all control variables are lagged to the first order, and the endogeneity problem caused by reverse causality is eliminated by studying the impact of digital inclusive finance and other control variables in the previous year on the per capita disposable income of residents in that year. For the problem of omitted variables in the model, this paper selects the Internet penetration rate of each province as an instrumental variable, because the Internet is an important carrier for accessing digital inclusive finance, so the Internet penetration rate is closely related to the level of digital inclusive finance, and there is no significant relationship between the Internet penetration rate and per capita disposable income of the residents on the basis of certain control variables, so the selection of the Internet penetration rate as an instrumental variable is valid.

4.3. Analysis of benchmark regression results

In this paper, provincial panel data from 2013 to 2020 are selected and regression tests are carried out using the individual fixed-effects model, and Table 2 represents the regression results of Model 1. From the regression results, each parameter is significantly positive before adding control variables, which indicates that digital inclusive finance enhances residents' income, urban residents' income and rural residents' income. After adding the control variables, the degree of impact of digital inclusive finance on the income of urban and rural residents decreases, but it is still very significant, and it is found that the effect of digital inclusive finance on the income of urban residents is more effective than that of rural residents by observing Columns (4) and (6), which may be due to the fact that due to the income level, geographic location, educational resources, etc., it is easier for urban residents to utilize their own capital to access financial services, while rural residents may be not be able to reach the corresponding threshold, so digital inclusive finance has a more obvious effect on urban residents' income enhancement.

Table 2: Benchmark regression of the impact of digital inclusive finance on residents' income

Explanatory variable	Population's income		Income of urban residents		Income of rural inhabitants	
	(1)	(2)	(3)	(4)	(5)	(6)
Digital Inclusive Finance	0.640***	0.295***	0.576***	0.306***	0.653***	0.300***
	(0.011)	(0.027)	(0.012)	(0.022)	(0.011)	(0.042)
GDP per capita		0.427***		0.359***		0.469***
		(0.046)		(0.039)		(0.051)
Share of fiscal expenditure		0.114		0.049		0.119
		(0.099)		(0.093)		(0.121)
Educational level		-0.084*		-0.147***		-0.037
		(0.042)		(0.033)		(0.070)
Urbanization rate		0.956***		0.718***		0.686**
		(0.181)		(0.187)		(0.298)
Degree of openness to the outside world		-0.930***		-1.175***		-0.795***
		(0.212)		(0.236)		(0.257)
Intercept term	6.612***	3.666***	7.290***	5.107***	5.944***	2.545***
	(0.062)	(0.328)	(0.064)	(0.288)	(0.059)	(0.422)
N	217	217	217	217	217	217
R^2	0.537	0.838	0.648	0.653	0.573	0.838

Note: *, ** and *** represent significant at the 10%, 5% and 1% levels, respectively, with robust standard errors in parentheses.

4.4. Robustness check

In order to ensure the robustness of the above results, this paper adopts the instrumental variable method for testing. On the basis of model 1, a two-stage least squares regression is conducted by adding the provincial Internet penetration rate as an instrumental variable for digital inclusive finance, in which the provincial Internet penetration rate is derived from the provincial statistical yearbooks. The test

results are shown in Table 3. Column (8) indicates that the effect of digital inclusive finance on residents' income is still significantly positive after adding instrumental variables, indicating that the effect of digital inclusive finance on enhancing residents' income is robust. Columns (9) and (10) show that the effect of digital inclusive finance on per capita disposable income of urban residents is still significantly larger than that of rural residents. In order to prevent multicollinearity, this study subjected the results of the benchmark regression to the Variance Inflation Factor (VIF) test, which resulted in a VIF mean value of 4.19, thus preventing the problem of serious multicollinearity.

Table 3: Results of regression with introduction of instrumental variables

Explanatory variable	Digital Inclusive Finance	Population's income	Income of urban residents	Income of rural inhabitants
	(7)	(8)	(9)	(10)
Internet penetration	1.473***			
	(0.151)			
Digital Inclusive Finance		0.377***	0.355***	0.209***
		(0.052)	(0.055)	(0.078)
Control variable	Yes	Yes	Yes	Yes
Constant	0.117	3.378***	4.430***	2.240***
	(0.443)	(0.231)	(0.243)	(0.372)
N	217	217	217	217

4.5. Mediation effect test

4.5.1. Mechanisms for upgrading the industrial structure tested

In order to test hypothesis 2, i.e., digital inclusive finance promotes the rise of urban and rural residents' income by driving industrial structure upgrading, this paper obtains the results after empirical testing as shown in Table 4, column (11) is the regression result based on model 2, and column (12) and column (13) are the regression results based on model 3. From column (11), it can be seen that the effect of digital inclusive finance on industrial structure upgrading is significantly positive, indicating that digital inclusive finance can promote industrial structure upgrading. As can be seen from column (12), when model 1 adds the intermediary variable of industrial structure upgrading, the coefficient of the impact of digital inclusive finance and industrial structure upgrading on urban residents' income is still significantly positive, and the coefficient of the impact of digital inclusive finance has been reduced, which indicates that industrial structure upgrading has an intermediary effect between digital inclusive finance and urban residents' income. From the perspective of rural residents' income, after adding the intermediary variable, it is found that the coefficient of influence of industrial structure upgrading on rural residents' income is not significant, which indicates that digital inclusive finance does not drive the growth of rural residents' income by driving industrial structure upgrading, and there may be other influence mechanisms, so this paper will next optimize the employment structure as an intermediary variable to carry out the mechanism test.

Table 4: Industry upgrading structure level mechanism test

Explanatory variable	Upgrading of industrial structure	Income of urban residents	Income of rural inhabitants
	(11)	(12)	(13)
Digital Inclusive Finance	0.028***	0.304***	0.290***
	(0.008)	(0.018)	(0.035)
Upgrading of industrial structure		0.516**	-0.323
		(0.203)	(0.294)
Control variable	Yes	Yes	Yes
Constant	0.823***	4.491***	2.632***
	(0.090)	(0.366)	(0.444)
N	217	217	217
R²	0.3288	0.8676	0.8824

4.5.2. Testing of mechanisms for optimizing the employment structure

In order to test hypothesis 3, that is, digital inclusive finance promotes the income growth of urban and rural residents by promoting the optimization of employment structure, this paper replaces the mediator variable with the optimization of employment structure, and the regression results are shown in Table 5, with Column (14) being the regression results based on Model 2, and Column (15) and Column (16) being the regression results based on Model 3. As can be seen from column (14), the coefficient of the impact of digital inclusive finance on the optimization of employment structure is significantly positive, indicating that digital inclusive finance can promote the optimization of employment structure. Immediately after exploring whether the mechanism of employment structure optimization differs between urban and rural residents, it can be seen from Column (15) that after adding employment structure optimization as a mediating variable, the impact effect of employment structure optimization on urban residents' income is not significant, and the probable reason for this is that at this stage, China's urban residents' employment structure is already at a more reasonable level, and therefore the contribution of employment structure optimization to the income of urban residents is relatively small. From column (16), after adding the mediator variable, both digital inclusive finance and employment structure optimization can significantly promote the rise of rural residents' income, and the impact coefficient of digital inclusive finance becomes smaller, which indicates that digital inclusive finance can promote the growth of rural residents' income by promoting the optimization of employment structure.

Table 5: Test of the mechanism of optimization of the employment structure

Explanatory variable	Optimization of the employment structure	Income of urban residents	Income of rural inhabitants
	(14)	(15)	(16)
Digital Inclusive Finance	0.039**	0.307***	0.296***
	(0.018)	(0.022)	(0.035)
Optimization of the employment structure		0.046	0.166**
		(0.063)	(0.067)
Control variable	Yes	Yes	Yes
Constant	-0.761***	5.189***	2.719***
	(0.165)	(0.268)	(0.471)
N	214	214	214
R^2	0.8038	0.6409	0.8797

5. Conclusions

First, the development of digital inclusive finance promotes the increase of per capita disposable income of residents, per capita disposable income of urban residents and per capita disposable income of rural residents, and the marginal effect of digital inclusive finance on the per capita disposable income of urban residents is larger than that of rural residents. After introducing the Internet penetration rate as an instrumental variable for two-stage least squares regression and replacing the core explanatory variables, the robustness test results obtained again prove the reliability of the conclusion.

Second, the results of the sub-dimensional regression show that the three sub-dimensions of breadth of coverage, depth of use and degree of digitization can all significantly increase the per capita disposable income of urban and rural residents. In addition, unlike the other two dimensions, depth of use has a greater effect on rural per capita disposable income than that of urban residents.

Third, after introducing industrial structure upgrading and employment structure optimization as mediating variables, the regression results show that there is a difference in the mechanism of the impact of digital inclusive finance on the income of urban residents and rural residents, i.e., digital inclusive finance promotes the growth of urban residents' income by promoting industrial structure upgrading, and digital inclusive finance promotes the growth of rural residents' income by promoting the optimization of employment structure.

Acknowledgements

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