

The Impact of Digital Financial Inclusion on Employment Quality

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Abstract: Achieving high-quality employment is essential to enhance of life quality, lead to growth of economy and achieve common prosperity. Meanwhile, keeping on developing financial inclusion continuously is essential to establish the well-off society in all aspects. Based on this, the paper conducts the research on 30 different China's provinces (excluding the Tibet Autonomous Region) and adopts the panel data, which is distributed between 2011 and 2022. This paper leverages the bivariate fixed-effect model and moderating effect model to examine the mechanism of digital financial inclusion on employment quality, and meanwhile researches the moderating effect of industrial structure upgrading and innovation ability in each area during the process of digital financial inclusion affecting employment quality. The findings suggest the promotional impact on employment quality has regional population heterogeneity and regional income heterogeneity. The promotion effect on employment quality is more pronounced in less populated regions, large population and high income. Also, the industrial structure enhancement and regional innovative ability conduct a positive moderating effect on the promotion effect, which implies that with a more advanced industrial structure or a stronger regional innovation ability, the promotion effect will be more obvious. Therefore, we should fully take advantage of digital financial inclusion in improving the job quality, keep improving the supporting mechanisms and enhancing the traditional financial institutions digitization, which can ultimately help to realize the high-quality employment.

Keywords: digital financial inclusion, employment quality, upgrading of the industrial structure, regional innovation ability.

1. Introduction

As the 20th National Congress of the Communist Party of China pointed out, employment issue is the most basic form of livelihood. Promoting high-quality employment for the people can enhance the happiness of the vast labor force, thereby increasing their enthusiasm for entrepreneurship and innovation. However, there are still issues in the employment field in China, such as low stability in employment, low share of labor remuneration in initial distribution, inadequate protection of labor rights, as well as the mismatch between labor supply and job demand in some regions, all of which indicate a low quality of employment[1].

To truly solve these employment issues and achieve high-quality employment, it's indispensable to guarantee the stable operation of small and medium-sized enterprises (SMEs). In China's existing

employment structure, SMEs provide abundant urban employment positions, and play an vital role in improving the rural employment structure and promoting non-agricultural employment as well. They are an essential force in expanding employment and promoting growth of economy[2]. For the purpose of fully leveraging the positive role of SMEs, which can enhance employment quality, efforts should be made to address their difficulties in financing and high financing costs. Recently, the central government has continuously increased policy support, with traditional financial institutions gradually undergoing digital transformation. By developing digital financial inclusion, it can mitigate the financing difficulties of SMEs[3]. In the digital economy era, digital financial inclusion is designed to deliver adequate financial services to all individuals and groups at reasonable costs. It seeks to achieve fairness in the use of financial resources by different market entities, address financing issues for businesses, and promote job quality improvement through the development of SMEs. On the other hand, by leveraging big data, it accurately matches the needs of various parts along the industrial chain, reduces asymmetric information and optimizes the allocation of financial resources, thereby driving industrial structural upgrades[4], and ultimately enhance the employment quality.

In conclusion, digital financial inclusion, which corresponds with the trend of digital development, serves as a vital driver in alleviating current operational pressures of SMEs, thereby expanding labor demand and promoting both the willingness and capacity for individual entrepreneurship and employment. Digital financial inclusion benefits both remote and developed regions, and is closely linked to the enhancement of regional employment quality. Therefore, the paper explores the mechanisms through which digital financial inclusion impacts employment quality, trying to inspire different regions in advancing the promotion of employment quality through digital financial inclusion. What this paper attempts to conduct theoretical and empirical analyses on is the theoretical and quantitative relations and meanwhile researches the mechanisms through which digital financial inclusion promotes the employment quality. Although there has been already a substantial amount of literature on digital financial inclusion, some of which also focus on its effects on employment quality. However, research on the moderating role played by industrial structure and innovation capacity is relatively scarce. This paper systematically analyzes this issue and enriches the analysis of the mechanisms between digital financial inclusion and employment quality. The potential contributions of this paper are listed below: 1) It constructs a new index system to evaluate employment quality and uses the entropy method to obtain employment quality ratings in different areas and compares the differences in employment quality, which enriches the existing researches on employment quality evaluation. 2) It innovatively uses regional industrial structure upgrading and innovation capacity as moderating variables to explain their moderating effects in the process through which digital financial inclusion impacts employment quality, outlining a new mechanism between digital financial inclusion and employment quality. 3) It conducts heterogeneity analysis from the perspectives of regional income and regional population size, comprehensively demonstrating that the promotional impact differentiates in different areas, which is conducive to tailored approaches and fully leveraging its inclusiveness.

2. Theoretical Mechanism and Research Hypothesis

The general enhancement of digital financial inclusion represents an optimization of the overall financial market environment. It can provide more differentiated financial services to SMEs, which are more easily constrained by financing. According to Xiang Xiuli et al., the biggest problem encountered in the development process of SMEs is financing constraints, which prevent enterprises from achieving optimal scale investment, thus reducing the labor demand. However, with the increasing volume and expanding coverage of inclusive microloans, digital financial inclusion can help SMEs break through financing barriers as well as provide more convenient financing channels,

thereby improving the accessibility of financing, boosting enterprise value growth, and ultimately enabling the absorption of more labor[5]. In promoting employment, SMEs are numerous and widely spread, which have the advantages of providing employment opportunities quickly and absorbing job seekers with rich levels. These enterprises offer a large number of positions and can continuously create new forms and patterns of employment during the process of digital transformation[6]. Therefore, utilizing the assistance from digital financial inclusion, SMEs can achieve scale growth and operational efficiency improvement, leading to more labor demand in society and optimization of the employment environment, which is manifested in the increase of wage rates and the reduction of working hours[7]. What's more, developing digital financial inclusion can also generate new job demand related to digital skills and promote new business startups. This not only creates new jobs but also drives employment through entrepreneurship[8].

In addition to promoting the overall increase of total employment and labor remuneration, digital financial inclusion also takes into account efficiency and fairness. Zhang Xun et al. proposed that beyond promoting the increase of labor remuneration, digital financial inclusion can develop online financial services, using big data to paint the overall picture of rural industries in accordance with local conditions, which can increase the non-farm employment in rural areas, improve entrepreneurial behavior, reduce the disparity between urban and rural incomes, and make high-quality financial services shared by all residents[9]. On the other hand, Guo et al. put forward that financial technology can decrease operating costs and capital constraints, thereby driving women's entrepreneurship and employment, increasing women's income, narrowing the gender wage gap, and offsetting negative impacts like the wage decreases due to childbirth and childcare, which eventually improves labor quality in terms of labor remuneration[10]. Furthermore, Li Lin et al. argued that digital financial inclusion can enhance regional education levels. By utilizing online education and skills training platforms, the constraints of time and space in education can be broken, while also increasing the accessibility of rural education loans. This can alleviate the limitations of insufficient funding and sources for rural education, promote educational equity[11], and enhance individuals' cultural literacy as well as employment capabilities. Based on the above analysis, this paper proposes research hypothesis 1:

H1: Digital financial inclusion can enhance the improvement of job quality.

Industrial structure upgrading involves the change of economic growth pattern. During the process of optimizing industrial structure, labor productivity is bound to change, driving the reconfiguration of resources, including the flow and reconfiguration of labor force[12]. Industrial structure upgrades, which is on the basis of the initial distribution, further provides a solid foundation for redistribution and tertiary distribution, extending the space for distribution. It injects new impetus into driving economic growth and narrowing income gaps, and is an important means to improve the employment quality[13]. Zhang Kai et al. proposed that during the industrial structure upgrades, labor generally tends to gradually shift from inefficient to efficient production sectors, leading to changes in the employment structure[14]. While the employment structure has been optimized, the level of labor income has been increasing, labor intensity has been relatively reduced[15], and labor compensation as well as labor protection have been further strengthened. In addition, Xiao Weize et al. proposed the upgrading of industrial structure implies an increase of capital and technology-intensive industries, which results in an increasing demand for high-skilled and highly educated personnel, prompting laborers to improve their own employability, which ultimately contributes to the employment quality enhancement[16]. On the basis of employment quality improvement, Zhang Fang et al. believed that after the upgrade of industrial structure, emerging industries characterized by high technological content and high value-added can fully leverage the impact of the technology diffusion as well as the industrial linkage, promote digital transformation and intelligent upgrading, and change their original cost and production functions[17]. Therefore, the level of industrial structure can positively moderate

the promoting effect on employment quality. Based on the above analysis, this paper proposes research hypothesis 2:

H2: Industrial structure plays a positive moderating role in the effect of digital financial inclusion on job quality, with a more sophisticated industrial structure leading to a stronger promotion of job quality by digital financial inclusion.

Since the 18th Party Congress put forward the innovation-driven strategy, the main driving factors of China's economic development have gradually shifted from traditional labor and resource-driven to technology innovation-driven. In addition, the implementation of talent strategy has led to rapid development in various disciplines, promoting the transformation of innovative achievements within enterprises, which can significantly accelerate the development of digital economy technology, speed up technology spillovers, and bring about an overall increase in total factor productivity. However, scholars have different views about the effects of regional innovation capacity on employment quality. On the one hand, some scholars argue that the improvement of innovation capacity has a disruptive effect on employment. In terms of labor remuneration, Philippe A argues that innovative measures will cause inequality among the highest incomes[18]. Acemoglu D proposed that technological innovation and advancement will result in a reduction in the quantity of jobs and labor compensation in the area[19]. In terms of labor demand, Wang Jun et al. believed that the development of urban technological innovation effectively improves theories of enterprise management, enhances production efficiency, and leads to a decrease in labor demand[20]. On the other hand, some scholars argue that improving regional innovation capabilities can enhance the overall quality of employment. For example, Ding Lin et al. proposed that the advancement of information technology can increase the labor demand of all third industries and most second industries in China[21]. Aghion et al. also found through empirical research that industrial innovation in AI can remarkably enhance the total employment[22]. All in all, while the improvement of regional innovation capabilities somehow restrains the employment in the primary industry, it dramatically boosts the employment in the tertiary industry, giving rise to new models with better flexibility, creating a large number of new positions, and enriching the employment choices. Over a longer period, the enhancement of regional innovation capabilities can drive industrial digitization, accelerate the digital economy development, as well as the job creation effect outweighs the substitution effect of labor by technology[23,24]. Therefore, regional innovation capability can boost the employment quality in general. Besides, the integration of finance and digitalization can never be realized without the support of high-tech personnel, which requires a higher level of demand for high-tech[25], and it is necessary to build a self-reliant digital innovation system as a strategic support to strengthen key capabilities in the digital field, using advanced digital technologies to lay the ground for high-quality digital economy[26]. Based on the above analysis, this paper proposes research hypothesis 3:

H3: Regional innovation capability plays a positive moderating role in the effect of digital financial inclusion on job quality, with a stronger regional innovation capability leading to a stronger promotion of job quality by digital financial inclusion.

3. Data Sources and Model Setting

3.1. Data Sources

Based on the research objectives while considering the data availability, this paper takes the panel data of 30 China's provinces (except Tibet) from 2011 to 2022 as the sample, in which the core explanatory variable digital financial inclusion index comes from the Digital Finance Research Center of Peking University. The original data of the remaining variables comes from China statistical yearbook, provincial statistical yearbook, CSMAR database, etc. Besides, some data were manually calculated and sorted, and the missing ones were supplemented through linear interpolation method.

3.2. Variables Declaration

3.2.1.Explained Variable

This paper uses the employment quality as the explained variable. The quality of employment does not only refer to high work remuneration, but also to the comprehensive and organic coordination of work remuneration, working hours, employment satisfaction and social security under the premise of a free, fair and equal employment environment[27]. Currently, there is no uniform measurement of employment quality in domestic and foreign researches. Existing literatures mainly measure employment quality from the aspects of labor compensation, social security and job satisfaction. Therefore, referring to the research of Ding Shulei et al.[28], this paper establishes an employment quality index system from four dimensions, including employment environment, employment remuneration, employability and employment protection with the entropy method. In addition, in this empirical analysis, the research method of Liu Yaxin is used for reference[29], and the measured results of entropy method are multiplied by 100. The selection of specific indicators is presented in Table 1.

Table 1: Employment Quality Index

Level 1 dimension	Level 2 dimension	Indicators	Attribute
Employment environment	Economic development	Gross regional product per capita	+
	Number of job training institutions per capita	Number of private vocational training institutions/total resident population	+
	Proportion of tertiary industry employment	Employment in the tertiary sector/total employment	+
	Regional employment	Urban employment/(urban employment + urban unemployment)	+
	Regional unemployment	Urban registered unemployment rate	-
	Number of art performances	Direct data	+
Employment remuneration	Average wage of employees in urban entities	Direct data	+
	Average wages of manufacturing practitioners in urban units	Direct data	+
	Average wage of construction practitioner in urban units	Direct data	+
	Medical insurance scope	Number of labors with health insurance in urban areas/total resident population	+
	Endowment insurance scope	Number of labors' pension insurance participants in urban areas/total resident population	+
	Urban-rural income gap	Per capita urban family disposable income/Per capita rural family disposable income	-

Table 1: (continued).

Employability	The proportion of employees with college degree or above	(College employment + undergraduate employment + graduate and above employment)/total employment	+
	Educational expenditure	Education expenditure /GDP	+
	Number of higher education institutions	Direct data	+
Employment protection	Efficiency of union regulation	Successful mediated labor dispute cases by trade unions/Accepted labor dispute cases by trade unions	+
	Labor dispute settlement rate	Cases closed/cases accepted	+
	Ratio of labor demand to supply	Registered recruitment/registered job seekers	+

3.2.2. Core Explanatory Variable

Through literature review, it's found that there is currently no firm conclusion on how to evaluate the regional digital financial inclusion development. At present, the index compiled by the Digital Financial Research Center of Peking University and the World Bank financial inclusion evaluation index system are relatively commonly used. Since the former one has a more comprehensive dimension, and the use of Alipay and Yu'e Bao is closer to China's social situation, so the paper uses the digital financial inclusion index of Digital Finance Research Center of Peking University as the core explanatory variable, and constructs an index in terms of breadth, depth as well as the digitalization level to make comprehensive description of the digital financial inclusion development in each province. The details are as follows in Table 2.

Table 2: Digital Financial Inclusion Index

Level 1 dimension	Level 2 dimension	Indicators
Coverage Breadth	Account Coverage Rate	Number of Alipay accounts owned by per 10,000 people
		Proportion of Alipay users who have bank cards bound to their Alipay accounts
		Average number of bank cards bound to each Alipay account
Depth of Usage	Payment	Number of payments per capita
		Amount of payments per capita
		Proportion of number of high frequency active users (50 times or more each year) to number of users with frequency of once or more each year
	Money Funds	Number of Yu'e Bao purchases per capita
		Amount of Yu'e Bao purchases per capita
		Number of people who have purchased Yu'e Bao per 10,000 Alipay users

Table 2: (continued).

		Individual User	Number of users with an Internet loan for consumption per 10,000 adult Alipay users
			Number of loans per capita
			Total Amount of loan per capita
	Credit	Small & Micro Business	Number of users with an Internet loan for small & micro businesses per 10,000 adult Alipay users
			Number of loans per small & micro business
			Average amount of loan among small & micro businesses
	Insurance		Number of insured users per 10,000 Alipay users
			Number of insurance policies per capita
			Average insurance amount per capita
	Investment		Number of people engaged in Internet investment and money management Per 10,000 Alipay users
			Number of investments per capita
			Average investment amount per capita
	Credit Investigation		Number of credit investigations by natural persons per capita
			Number of users with access to credit-based livelihood (including finance, accommodation, mobility, social contact, etc.) per 10,000 Alipay users
Level of Digitalization	Mobility		Proportion of number of mobile payments
			Proportion of total amount of mobile payments
	Affordability		Average loan interest rate for small & micro businesses
			Average loan interest rate for individuals
	Credit		Proportion of number of Ant Check Later payments
			Proportion of total amount Ant Check Later payment
			Proportion of number of “Zhima Credit as deposit” cases (to number of full-deposit cases)
			Proportion of total amount of “Zhima Credit as deposit” (to amount of full-deposit)
	Convenience		Proportion of number of QR code payments by users
			Proportion of total amount of QR code payment by users

3.2.3. Moderating Variables

In order to examine the hypothesis 2 and hypothesis 3, the following moderating variables are used: 1) Industrial structure level (industry). According to the Liu Hui et al.'s research[30], it's defined by the industrial structure upgrades index, the specific formula of which is $\text{industry} = q_1 * 1 + q_2 * 2 + q_3 * 3$, where q_i is the rate of the regional added value of the industry i to the regional GDP of the same year. According to the formula, it can be concluded that the closer this index is to 3, the more

sophisticated the industrial structure is. 2) Regional innovation capability (avepatent), on the basis of practice of Yu Yongze et al.[31], this index is defined by the annual patent grants per capita. On the basis of the above, regulate1 and regulate2 are respectively the interaction terms between the level of industrial structure, regional innovation ability and the core explanatory variable. The specific formula is as below:regulate1 = difi * industry; regulate2 = difi * avepatent.

3.2.4. Control Variables

After examining relevant literature on the factors influencing the quality of employment, it is evident that regional employment quality is influenced by many other factors beyond the digital financial inclusion. For example, Zhang Mingdou et al. found through empirical research that new urbanization can actively promote the public service system and create employment through innovative reforms in the employment system[32]; Shi Enyi et al. proposed that an increase in the level of trade openness would lead to intensified market competition, resulting in an increased demand for high-skilled labor, thereby enhancing the level of human capital and subsequently improving the quality of employment[33].

Therefore, to minimize errors resulting from other possible factors, this paper systematically reviews relevant studies by scholars[34,35], and selects 6 control variables: Urbanization rate (urban), measured by the ratio of urban population to total permanent population in the region; Extent of opening up to foreign trade (trade), measured by total import and export trade as a proportion of regional GDP; Level of social security (security), measured by the ratio of social security expenditure to regional GDP; Regional financial development (development), measured by the share of domestic and foreign currency loans and deposits to regional GDP; FDI Amount (invest), measured by the ratio of foreign direct investment to regional GDP; Degree of population aging (old), measured by the share of population aged 65 and above to regional population at year-end.

3.2.5. Descriptive Statistics

Table 3 lists the descriptive statistics of the baseline regression variables as follows.

Table 3: Descriptive Statistics

Variables	(1) N	(2) mean	(3) sd	(4) min	(5) max
quality	360	22.737	8.272	9.515	58.297
difi	360	243.928	107.640	18.330	460.691
urban	360	0.601	0.121	0.350	0.896
trade	360	0.272	0.281	0.008	1.464
development	360	3.432	1.085	1.688	7.605
invest	360	0.020	0.019	0.000	0.121
old	360	0.112	0.029	0.055	0.200
security	360	0.259	0.112	0.105	0.758

3.3. Model Construction

3.3.1. Baseline Regression Model

To test the effect of digital financial inclusion on the employment quality, the paper constructs the econometric model as follows:

$$\text{Quality}_{i,t} = \alpha_0 + \alpha_1 \text{Difi}_{i,t} + \alpha_2 X_{i,t} + \mu_i + \eta_t + \varepsilon_{i,t} \quad (1)$$

In which $Quality_{i,t}$ represents the employment quality of province i in year t , $Difi_{i,t}$ represents the digital financial inclusion index of province i in year t , $X_{i,t}$ represents the control variables, $\mu_i, \eta_t, \varepsilon_{i,t}$ respectively represent individual fixed effects, year fixed effects, and random disturbance term.

3.3.2. Analysis Model of Moderating Effects

So as to further examine whether the industrial structure and regional innovation capacity play a moderating role in the impact of digital financial inclusion on the employment quality, the paper introduces interaction terms between industrial structure, regional innovation capacity and the explanatory variable into model (1), and construct the following moderation effect models (2) and (3) as follows.

$$Quality_{i,t} = \alpha_0 + \alpha_1 Difi_{i,t} + \alpha_2 regulate1 + \alpha_3 industry_{i,t} + \alpha_4 X_{i,t} + \mu_i + \eta_t + \varepsilon_{i,t} \quad (2)$$

$$Quality_{i,t} = \alpha_0 + \alpha_1 Difi_{i,t} + \alpha_2 regulate2 + \alpha_3 avepatent_{i,t} + \alpha_4 X_{i,t} + \mu_i + \eta_t + \varepsilon_{i,t} \quad (3)$$

4. Empirical result

4.1. Multicollinearity Analysis

The multicollinearity test findings in Table 4 imply that the VIF values of each independent variable are all less than 10. So it implies no significant multicollinearity issue, indicating the selection of independent variables in the sample is relatively appropriate.

Table 4: Multi-Collinearity Analysis

Variables	urban	trade	development	security	difi	old	invest	Mean VIF
VIF	5.99	5.45	3.73	3.03	2.79	2.26	1.48	3.53

4.2. Baseline Regression

The baseline regression outcomes are presented in Table 5, where columns (1) and (3) do not control for individual fixed effects and year fixed effects, while columns (2) and (4) simultaneously control for both of them. In addition, columns (3) and (4) present the regression results after adding all control variables. According to columns (2) and (4), it shows that whether there are control variables or not, the regression coefficient of the digital financial inclusion index is positive and significant at the 1% level, indicating that the digital financial inclusion development can significantly improve the quality of employment. Furthermore, the control variables such as trade openness, foreign direct investment, and population aging is also significant at the 1% level, showing a certain correlation between these control variables and the quality of employment, which helps to enhance the explanatory power and accuracy of the model. These results confirm research hypothesis H1.

Table 5: Baseline Regression

Variables	(1) y	(2) y	(3) y	(4) y
difi	0.044*** (0.001)	0.044*** (0.001)	0.025*** (0.004)	0.032*** (0.004)
urban			17.713*** (6.583)	4.843 (7.857)

Table 5: (continued).

trade			-3.119*	-6.304***
			(1.892)	(1.943)
security			-16.797***	-8.791*
			(4.482)	(5.303)
development			0.926**	-1.398**
			(0.469)	(0.548)
invest			25.787***	28.313***
			(9.789)	(9.366)
old			51.281***	73.647***
			(11.134)	(11.168)
Constant	11.942***	12.030***	1.730	11.994***
	(0.729)	(0.293)	(3.273)	(4.049)
Observations	360	360	360	360
R-squared		0.827		0.858
Individual Fixed	NO	YES	NO	YES
Year Fixed	NO	YES	NO	YES

Notes: ***, **, * represent significance at the 1%, 5%, 10% levels respectively. The same below.

4.3. Robustness Test

For the purpose of enhancing the robustness of the baseline regression, this paper performed the tests in following ways: 1) Replacing explanatory variables. Based on the method of He Di et al.[36], the paper constructed a digital economy index in terms of digital infrastructure development, digital industry progress as well as the digital economy environment by utilizing the entropy method. The digital economy index was then used to replace the core explanatory variable. 2) Sample reduction. To ensure that the empirical conclusions are not influenced by specific regions, as Beijing, Shanghai, and Guangdong have relatively developed economies and are equipped with high-quality financial services, these three provinces were excluded from the new regression analysis. 3) Addition of control variables. The ratio of total regional fiscal outlays to local GDP was used to measure the level of fiscal expenditure (expense), which was included as a new control variable. 4) Trimming. To prevent the impact of some extreme values, the sample data was trimmed by 1% before conducting the regression analysis again. As presented in columns (1) to (4) of Table 6, the coefficient of digital financial inclusion index remains significant and positive at the 1% level, meanwhile the coefficients of control variables show no significant differences and most of them are still significant at the 1% level. This indicates that digital financial inclusion can promote the regional employment quality dramatically, and its promoting effect still exists. Therefore, the results of the study are generally reliable.

Table 6: Robustness Test

Variables	(1) Replacement of explanatory variables	(2) Sample Reduction	(3) Addition of Control Variables	(4) 1% Trimming
difi		0.023*** (0.005)	0.032*** (0.004)	0.030*** (0.004)
digital	19.017***			

Table 6: (continued).

	(4.928)			
expense			-154.912***	
			(50.922)	
urban	42.150***	28.592***	3.011	7.485
	(5.374)	(9.738)	(7.782)	(7.522)
trade	-10.862***	-2.069	-5.650***	-6.913***
	(1.959)	(3.060)	(1.930)	(1.971)
security	-9.527*	-1.346	299.947***	-9.511*
	(5.606)	(5.697)	(101.622)	(5.283)
development	-1.069*	-1.807***	-1.126**	-1.329**
	(0.577)	(0.595)	(0.548)	(0.530)
invest	9.924	3.888	28.009***	28.993***
	(10.030)	(12.535)	(9.249)	(9.211)
old	101.667***	68.261***	71.998***	78.176***
	(10.852)	(11.518)	(11.041)	(10.925)
Constant	-8.824***	-1.805	12.422***	10.507***
	(2.588)	(4.818)	(4.001)	(3.886)
Observations	360	324	360	360
R-squared	0.842	0.857	0.862	0.865
Individual Fixed	YES	YES	YES	YES
Year Fixed	YES	YES	YES	YES

4.4. Endogeneity Test

To reduce endogeneity issues caused by factors such as omitted variables, the paper draws on the relevant literature[37,38], and uses the total telecommunications service volume (IV1) and internet penetration rate (IV2) as instrumental variables for the digital financial inclusion index, with the two-stage least squares estimation method employed for correction. For one thing, according to columns (1) and (3) of Table 7, total telecommunication services volume and Internet penetration rate are highly related to the core explanatory variable, with coefficients significant at the 1% level, meeting the demand of strong correlation for effective instrumental variables. For another, the total telecommunications service volume and internet penetration rate are not directly related to the regional quality of employment, satisfying the exogeneity condition for instrumental variables. According to the findings of instrumental variable estimation shown in Table 7, the positive impact of digital financial inclusion on employment quality remains significant after addressing the endogeneity issues, proving the robustness of the baseline regression.

Table 7: Endogeneity Test

Variables	(1) difi	(2) y	(3) difi	(4) y
IV1	70.089*** (5.803)			
IV2			-851.269*** (24.767)	

Table 7: (continued).

difi		0.040*** (0.007)		0.026*** (0.004)
Controls	YES	YES	YES	YES
Constant	-215.282*** (38.323)	3.390 (2.144)	717.588*** (14.040)	0.450 (1.878)
Observations	360	360	360	360
R-squared	0.307	0.805	0.782	0.802
Individual Fixed	YES	YES	YES	YES
Year Fixed	YES	YES	YES	YES

5. Further analysis

5.1. Moderating Effects

The moderating effect test results are as follows in Table 8. According to column (1) and column (2), the coefficients of the interaction terms regulate1, regulate2 between the industrial structure, regional innovation capability and the explanatory variable, are significant at the 1% level with positive values, proving that industrial structure upgrading and innovation capability have a significant positive moderating effect. In other words, with a more advanced industrial structure or a stronger innovation capability, the promoting effect of digital financial inclusion on improving job quality is also more significant.

Table 8: Moderating Effects of industrial structure upgrading and regional innovation ability

Variables	(1) y	(2) y
difi	-0.158*** (0.027)	0.025*** (0.005)
regulate1	0.077*** (0.011)	
industry	-15.820*** (5.467)	
regulate2		0.024*** (0.006)
avepatent		-6.666*** (2.028)
Controls	YES	YES
Constant	32.650*** (11.169)	12.339*** (4.010)
Observations	360	360
R-squared	0.878	0.864
Individual Fixed	YES	YES
Year Fixed	YES	YES

5.2. Heterogeneity Analysis

Due to differences in economic development levels, digitalization of financial services and other factors in different regions, the paper conducts two sets of heterogeneity analyses to further examine if the promotion effect varies across regions: 1) Regional Population Heterogeneity. The overall sample was divided into small population regions, medium population regions and large population regions based on total permanent population; 2) Regional Income Heterogeneity. The overall sample is categorized into low, medium, and high-income areas by the regional GDP. Table 9 presents the regression outcomes.

From columns (1) and (3) of Table 9, the coefficient of the core explanatory variable is significant and positive at the 1% level, implying that in small and large population regions, the development of digital financial inclusion can significantly improve the employment quality. The possible reason for this result is that in smaller population regions, the total demand for financial services is relatively low, so digital financial inclusion can offer better targeted financial services, increasing support depth and intensity at the same affordable cost, which consequently enables businesses to operate more smoothly and thus creates more labor demand; In large population regions, where traditional financial institutions are more prevalent, the competition between institutions is relatively stronger. So as the digital financial inclusion develops, financial institutions keep trying to better meet the financial service needs of all parties, fully leveraging the inclusiveness of digital financial inclusion, which can gradually optimize the employment structure and improve employment quality. While from column (2), the result shows that in medium population regions, the regression coefficient of the explanatory variable is not significant, which suggests that a less obvious connection in these regions.

Additionally, from columns (4) and (5), it can be concluded that in low-income and medium-income regions, the core explanatory variable has a not significant but still positive coefficient, showing that the promotion effect on employment quality is limited, possibly due to the dominance of traditional employment, low levels of digital integration, and relatively weak digital technology utilization capabilities, which is called the "digital divide". From column (6), it can be seen that in high-income regions, the promoting effect on improving employment quality is more pronounced, possibly because the economy in high-income regions is relatively developed, so the supply side can provide higher quality financial services, which can be fully utilized by the business, leading to a relatively more significant promotion effect.

Table 9: Heterogeneity Analysis

Variables	(1) Small Population	(2) Medium Population	(3) Large Population	(4) Low Income	(5) Medium Income	(6) High Income
difi	0.034*** (0.006)	-0.002 (0.007)	0.045*** (0.010)	0.006 (0.005)	0.004 (0.007)	0.071*** (0.012)
urban	6.320 (10.207)	64.549*** (15.197)	-4.137 (23.607)	56.575*** (9.442)	58.286*** (15.382)	-39.949* (23.214)
trade	-8.540*** (2.567)	10.049** (3.927)	0.202 (4.293)	- (3.637)	-10.407*** (2.782)	10.152** (4.828)
security	-2.641 (6.654)	-3.462 (9.314)	14.810 (19.679)	2.173 (4.649)	-25.627** (11.563)	27.413 (21.456)
development	-1.961*** (0.680)	-1.195 (0.871)	-2.331 (1.567)	-2.004*** (0.530)	-0.169 (1.008)	-1.289 (1.439)
invest	8.622	0.063	44.444* (1.567)	-16.812	36.495** (1.008)	31.313

Table 9: (continued).

	(14.169)	(16.126)	(23.398)	(13.417)	(15.166)	(22.512)
old	72.298***	86.589***	55.437	81.954***	62.402***	3.727
	(16.783)	(13.643)	(34.388)	(12.413)	(17.732)	(39.907)
Constant	16.905***	-23.901***	11.972	-	-12.683	27.070**
	(6.067)	(7.785)	(10.183)	14.047***	(7.957)	(12.114)
Observations	120	120	120	120	120	120
R-squared	0.904	0.902	0.836	0.917	0.813	0.785
Individual	YES	YES	YES	YES	YES	YES
Fixed	YES	YES	YES	YES	YES	YES
Year Fixed	YES	YES	YES	YES	YES	YES

6. Conclusion

Based on data from 30 China's provinces from 2011 to 2022, this paper examines the impact of digital financial inclusion on regional employment quality utilizing a bivariate fixed-effects model. It further explores the moderating influence of industrial structure upgrades as well as the regional innovation capacity on the promotion effect. The study results suggest that: 1) Digital financial inclusion can significantly enhance regional employment quality, and this conclusion remains robust after taking account for the endogeneity problem. 2) The industrial structure upgrades conduct a remarkable positive moderating effect on the impact of digital financial inclusion on employment quality. The more developed the industrial structure is, the more pronounced the promotional effect will be. 3) Regional innovation capability conducts a pronounced positive moderating effect on the promotion effect, which means that the enhancement of regional innovation capacity will positively moderate the promotional effect on employment quality. 4) The subsample heterogeneity analysis indicates that the promotion on employment quality differs from demographic heterogeneity and income heterogeneity in different regions. In terms of regional demographic heterogeneity, the positive impact is more significant in regions with small or large populations than in regions with medium populations; while in terms of regional income, the promotional impact is more remarkable in high-income areas than in areas with relatively low or medium income.

Based on the above findings, this paper puts forward the following policy recommendations: 1) Give full play to the positive impact of digital financial inclusion on the quality of employment, and further improve its supporting mechanisms. Also, continuously focus on the further digital transformation and reduce the financial services cost, make basic financial services more inclusive and widespread, improve the accessibility of financing for SMEs, and thus enhance the scale of enterprises and the rate of return, which will not only lead to an increase in the demand for labor and improve the employment environment, but also allow more people to share digital inclusive financial products, and ultimately achieve high-quality employment. 2) Industrial structure optimization has a positive effect on improving the quality of employment quality has a positive impact. Currently, China's industrial structure is shifting from relying on the growth of the first factor input to relying on technology, data and other new factors to boost the total factor productivity. Therefore, investment in digital economy infrastructure should be increased and leverage the digital economy to help with realizing the transformation of existing industries and promote integration with digitization, which will help realize efficient allocation of enterprise resources and cost reduction. By helping enterprises run smoothly, it can provide a high-quality and stable external employment environment for laborers.

3) Focus on the positive moderating effect of regional innovation capacity, continue to implement the innovation-driven development strategy and invest in science and technology innovation. Meanwhile, by playing the guiding role of fiscal expenditure and making science and technology innovation a key area of fiscal expenditure, it can help to lay a solid material foundation for independent innovation. In addition, adhere to the strategy of reinvigorating China through human resource development, that is, increase investment in human capital, focus on the cultivation of high-skilled talents, and promote the digitization of educational infrastructure. With a more developed digital technology, it can gradually remove the space-time limitations of education, enhance the availability of high-quality educational resources, and focus on cultivating high-skilled talents in underdeveloped and weak regions, thus narrowing the differences between individuals, industries, and regions. In this way, workers in different regions and fields will have higher employability and realize the improvement of employment quality. 4) Pay attention to regional differences in the impact of digital financial inclusion on employment quality. On the one hand, less developed regions should further lower the threshold and offer more accessible financial services, thus expanding the extensiveness of the digital financial inclusion. Meanwhile, less developed regions should also improve the digital skills and financial literacy of their residents through training and other means, thereby narrowing the "digital divide" and tapping into the potential of residents. On the other hand, for more financially developed regions, efforts should be made to continuously improve financial service quality, enrich digital financial products and reduce financial transaction costs, thus leveraging the digital financial inclusion to improve employment quality and eventually to benefit all regions as a major source of vitality for high-quality employment.

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