Study on the impact of digital finance on consumption structure

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Abstract. Consumption level is the lasting driving force of economic growth. This paper combines China Digital financial Inclusion Index with relevant data in China Statistical Yearbook, establishes an empirical model, and studies the impact of digital financial inclusion on subsistence consumption, development consumption, enjoyment consumption and total consumption. The results show that: (1) the development of digital finance can promote the improvement of residents' consumption level, among which the promotion effect on developmental consumption is the most significant. This conclusion is still valid after considering the endogenous problem; (2) In terms of heterogeneity analysis, among the three sub-indexes of digital finance coverage, depth of use and degree of digitalization, the coverage of digital finance has the most obvious promoting effect on residents' consumption, while the development of depth of use and degree of digitalization has no significant impact on residents' consumption; (3) In terms of the mechanism of action, digital finance mainly promotes residents' consumption by narrowing the digital divide. Finally, this paper makes use of the research conclusions to put forward relevant policy suggestions on how to better use digital finance to promote consumption level and stimulate economic growth.

Key words: digital finance; residents' consumption; consumption structure.

1. Introduction

The Opinions on Further Releasing Consumption Potential and Promoting Sustainable Recovery of Consumption issued by The General Office of the State Council pointed out that consumption is the final demand and the key factor for the smooth circulation of the domestic cycle, and the improvement of consumption level is the lasting driving force for economic growth. In recent years, due to the impact of the epidemic, the recovery process of consumption is slow, leading to many small and medium-sized individuals, enterprises in the development of difficulties, in order to speed up the construction of a new development pattern, we need to continue to release the potential of consumption, and promote the sustainable recovery of consumption level. In December 2022, the Central Committee of the Communist Party of China and The State Council issued the Outline of the Strategic Plan for Expanding Domestic Demand (2022-2035), which also pointed out that expanding domestic demand is an inevitable choice to promote the formation of a new economic development situation dominated by domestic and international cycles and promoted by domestic and international cycles, and consumption plays an important role in this process. This shows the importance of promoting the improvement of consumption level in promoting domestic demand to build a new development pattern.

Combined with China's current national conditions, there are significant problems of unbalanced urban and rural development and unbalanced regional economy, the development of traditional finance is limited, and the low coverage of financial services cannot be solved, which makes it difficult for traditional finance to play a role in promoting consumption[1]. After years of efforts, China's inclusive finance has developed rapidly, made breakthroughs, and has been at the forefront of the world[2]. The emergence and development of digital finance has promoted the convenience of financial transactions, moved the threshold of financial services down, greatly reduced consumption costs, improved consumption experience, accelerated consumers' decision-making process, increased consumption payment frequency, created new consumer demand, fully released residents' consumption potential, and further promoted the improvement of consumption level[1]. Some studies have found that digital finance can alleviate liquidity constraints, effectively reduce the probability

of credit constraints, and provide payment convenience for residents to promote consumer consumption[3,4]. However, there are also studies showing that digital finance mainly promotes residents' consumption by improving the convenience of payment, that is, shortening residents' shopping time, while the relaxation of liquidity constraints is not the reason for digital finance to promote consumption[5]. Therefore, the question of how the development of digital finance can promote residents' consumption needs further research.

In the existing literature, most studies on the impact of digital inclusive finance on residents' consumption take total consumption as the research object, or distinguish between regions, human capital, household income and other differences to study the impact on residents' consumption level. For example, Yi Xingjian and Zhou Li (2018) showed through empirical research that the development of digital inclusive finance significantly promoted the total consumption of residents, and found in the heterogeneity analysis that the higher the education level of the household head, the more obvious the promotion effect of digital inclusive finance on residents' consumption[4]. Zhang Xun et al. (2020) found in their empirical study that the development of digital finance significantly improved the total consumption level of residents and promoted economic growth, and separately studied the impact on the total consumption of rural residents[5]. In the previous literature, few literatures considered the consumption structure, but this paper examined the consumption structure, divided the total consumption into subsistence consumption, enjoyment consumption and development consumption, studied the impact of digital finance on various consumption levels, and analyzed the mechanism.

Compared with the existing literature, the possible innovations of this paper and the marginal contributions of this paper are as follows: First, this paper classifies the total consumption, examines the consumption structure and deeply analyzes the impact of digital finance on various types of consumption of residents. Compared with previous studies on total consumption, this paper expands the existing literature; Second, this paper studies the transmission mechanism of digital finance to promote residents' consumption from different angles. Different from the analysis of transmission mechanism in most previous literatures, this paper analyzes the mechanism from three aspects: digital divide, information asymmetry, entrepreneurship, etc., and makes a reasonable explanation on how digital finance promotes various types of consumer consumption. Third, based on the existing literature, this paper analyzes the impact of the three sub-indexes of digital inclusive finance on various types of consumption, with a wide range of research and comprehensive content. At the same time, it makes the government formulate policies to promote consumption and stimulate domestic demand more targeted and the implementation of policies more effective.

The remaining contents of this paper are arranged as follows: the second part is mainly literature review. The third part considers the endogeneity by setting an empirical model between the development of digital inclusive finance and residents' consumption level, and introduces the definition and data of relevant variables. The fourth part empirically tests the impact of digital inclusive finance on various types of residents' consumption, introduces the endogeneity analysis of instrumental variables, and tests the robustness. The fifth part first uses the three sub-indexes of digital finance to conduct structural heterogeneity analysis, and then tests the mechanism of action. Finally, the sixth part puts forward the main conclusions and policy suggestions.

2. Literature review

2.1 Development of digital finance and household consumption

With the continuous development of digital finance, its economic benefits have gradually emerged. Most scholars believe that the development of inclusive finance has a significant role in promoting economic growth[6], and in regions with low urbanization rate and high physical capital, the development of digital finance has a stronger positive role in promoting economic growth[7,8,9] and Zhang Xun et al. (2020) found in their empirical study that the development of digital inclusive finance promoted economic growth and had a significant impact on residents' consumption[5]. Sun

Yuhuan et al. (2021), based on the household survey data of a city from 2013 to 2018 and the China Digital inclusive Finance Index, combined with a variety of models, demonstrated empirical development[10]. With the continuous development of digital inclusive finance in China, there are differences in the impact on consumption in different provinces, promoting the consumption of residents in some urban areas while having no significant impact on the consumption of residents in others. Economic growth will also promote the improvement of residents' consumption level. Therefore, this paper puts forward hypothesis 1: The development of digital inclusive finance is conducive to the improvement of residents' consumption level.

2.2 The path of promoting consumption -- subsistence consumption, development consumption and enjoyment consumption

Residents' consumption includes subsistence consumption, development consumption and enjoyment consumption. According to the classification standards of the National Bureau of Statistics, residents' consumption can be divided into eight categories: food, clothing, housing, household equipment and supplies, medical care, transportation and communication, entertainment, education and services, and other goods and services. The eight categories of consumption are classified into subsistence consumption, development consumption and enjoyment consumption respectively, and different consumption subdivisions can reflect different ways to promote consumption. Yi Xingjian and Zhou Li (2018) discussed the theoretical model and set the econometric model, and found that the development of digital inclusive finance significantly promoted the consumption level of clothing, housing, daily necessities, transportation and communication as well as other goods and services in the eight categories[4]. Wang Xiaohua et al. (2022) used the data of China Household Finance Survey in 2019 to analyze the current situation of rural households using digital finance from three dimensions of digital payment, lending and financial management, and found through empirical research that the use of digital finance significantly promoted the improvement of rural households' consumption level and promoted the eight consumption items[1]. It has a significant promoting effect on subsistence consumption and development and enjoyment consumption, but the promoting effect of digital finance is different among the three categories of consumption. Based on the data of China Household Finance Survey (CHFS) from 2013 to 2019, Yin Zhichao and Guo Peiyao (2021) found that the government's poverty alleviation policy increased people's per capita consumption by 4.37%, in which subsistence consumption increased by 5.76% and developing-oriented consumption increased by 13.12%, which was significantly higher than subsistence consumption[11]. The development of digital inclusive finance plays a significant role in poverty reduction[12,13]. At the same time, the development of digital finance has significantly increased household income[14]. Similar to the government's poverty alleviation measures, the growth of household income is conducive to the improvement of residents' consumption level. Therefore, hypothesis 2 is proposed in this paper: The development of digital finance has a significant promotion effect on subsistence consumption, development consumption and enjoyment consumption, and the promotion effect on development consumption is the most significant.

2.3 The mechanism of action -- entrepreneurship, information asymmetry and digital divide

On the one hand, the development of digital finance enhances the availability of information, strengthens residents' sense of social trust, promotes residents' entrepreneurship and improves the level of entrepreneurship[8,15,16,17]. Xie Fuhui et al. (2018) built a model using the Peking University Digital Financial Inclusion Index and the registration information of new enterprises, and found that after considering various factors such as endogeneity, the development of the three major indexes of digital finance, namely the coverage breadth, depth of use of digital finance and the degree of digital support services, had a significant promoting effect on entrepreneurship[18]. The high-quality development of entrepreneurship is an important driving force for the high-quality development of China's economy[19]. Moreover, the development of digital finance can provide more employment opportunities by promoting entrepreneurship[20], thus improving residents'

income and consumption level. On the other hand, He Jing and Li Qinghai (2019) further study found that digital finance has no significant impact on agriculture-related entrepreneurship and development-oriented entrepreneurship, and the use of bank digital finance has no significant impact on rural households' entrepreneurship[15]. Through heterogeneity analysis, Yang Jia et al. (2022) found that when people's risk appetite is higher and the degree of distrust between people is increased, digital finance has a weak promotion effect on entrepreneurship. Moreover, the existence of "digital divide" makes the promotion effect on the entrepreneurship of individuals with low education level and old age even less significant[21]. As the phenomenon of "digital divide" is widespread in today's society, and people are becoming more cautious in their communication, this paper proposes hypothesis 3a: The development of digital finance may not promote household consumption through increasing entrepreneurship.

In recent years, the development of Internet infrastructure has expanded the coverage of the Internet and narrowed the access gap[21]. Cheng Mingwang and Zhang Jiaping (2019) found that accelerating the process of rural informatization and increasing the Internet penetration rate can improve the income level of rural and urban residents and effectively reduce the digital divide between urban and rural areas[22]. Zhao Yaxiong and Wang Xiuhua (2022) also discussed the urgency of bridging the multi-dimensional digital divide from the perspective of relative income and vulnerability[16]. However, the development of digital finance can increase the Internet penetration rate and further restrain the expansion of digital divide[23]. Using the data of China Household Tracking Survey (CFPS) for empirical analysis, Zhang Xun et al. (2021) found that the development of digital finance significantly increased residents' income and consumption level[23]. The income and consumption level of households with no access to the Internet are most significantly improved. Therefore, this paper puts forward hypothesis 3b: The development of digital finance can narrow the digital divide by increasing the Internet penetration rate, and then promote the improvement of residents' consumption level.

In addition, digital finance can also alleviate the traditional information asymmetry[24]. Wang Xiaohua et al. (2022) found through research that digital finance improves the information availability of rural residents through big data, ensures that rural residents can get accurate and transparent information to a certain extent, and enhances the consumer confidence of rural residents. And promote the improvement of consumption level[1]. However, the logical starting point of digital finance is Internet finance[24]. Xie Ping et al. (2015) showed that in Internet finance, big data can be widely used in various information processing, and the asymmetry of information has been significantly reduced[25]. Therefore, hypothesis 3c is proposed in this paper: Due to the significant reduction of information asymmetry, the development of digital finance may not improve residents' consumption level by reducing information asymmetry.

3. Empirical design

3.1 empirical model setting

On the basis of the above theoretical analysis, we further analyze the empirical relationship between the development of digital finance and residents' consumption level, and build an empirical model:

$$\mathrm{lncomsume}_{it}=\beta_0+\beta_1\mathrm{lnindex}_{it}+\beta_2\mathrm{controls}+\varphi_t+\vartheta_i+\mu_{1it} \quad (1)$$

Mechanism test model:

$$\mathrm{Intermediary}=\alpha_0+\alpha_1\mathrm{lnindex}_{it}+\alpha_2\mathrm{controls}+\varphi_t+\vartheta_i+\mu_{2it} \quad (2)$$

$$\mathrm{lncomsume}_{it}=\delta_0+\delta_1\mathrm{Intermediary}+\delta_2\mathrm{controls}+\varphi_t+\vartheta_i+\mu_{3it} \quad (3)$$

Among them, $\mathrm{lncomsume}_{it}$ on behalf of the consumption level of residents i in the t period, index_{it} on behalf of the digital inclusive financial development index of the province where the residents are located, controls represents the control variable, Intermediary represents the

intermediary variable, in this paper includes the Internet penetration rate, the total number of posts and telecommunications business /GDP, the total number of urban private and individual employees/employment, ϑ_i Indicates the individual fixed effect, φ_t indicates the year fixed effect, μ_{it} for the random disturbance item. The coefficient β_1 reflects the impact of the development of digital inclusive finance on residents' consumption level, and is also the core parameter concerned in this paper. If the coefficient β_1 is significantly positive, the theoretical analysis above can be verified, that is, the development of digital inclusive finance can improve residents' consumption level.

3.2 Endogenous considerations

There may be endogeneity problems and missing relevant variables in model (1). Residents' consumption level is affected by a variety of factors, which may not only have an impact on residents' consumption level, but also have a certain degree of impact on the development of digital inclusive finance. In order to solve the endogeneity problem of variables caused by other factors, this paper constructs a dual fixed-effect model to control the relevant missing variables, so as to make the estimation results more accurate.

The increase in household consumption may provide a good foundation for the development of digital inclusive finance, which means that there may be a problem of reverse causality in the model. Therefore, we introduce the spherical distance between Hangzhou and the region calculated based on geographic information system (GIS) as the instrumental variable, and adopt the estimation method of the instrumental variable to solve this problem. In terms of the correlation between instrumental variables and explanatory variables, the source of digital finance development in China is Hangzhou, which also plays a leading role in the development of digital inclusive finance in China. Therefore, it can be guessed that the closer the distance to Hangzhou, the better the development of digital finance, that is, the instrumental variable is correlated with the development of digital finance in this province. In terms of externality, there is no direct correlation between the distance between each region and Hangzhou and the consumption level of residents. Therefore, it will not directly affect the consumption level of residents, and the conditions of externality are also satisfied.

3.3 Definition and data of variables

Table 1. Descriptive statistics of variables

Variables	Samples	Mean	Standard deviation	Minimum	Maximum
Digital Financial Inclusion Index	186	254.349	55.696	143.910	410.281
Breadth of digital finance coverage	186	234.155	56.281	126.670	384.656
Digital finance use depth	186	239.504	72.555	107.290	439.912
Degree of digitalization of financial inclusion	186	348.017	54.328	230.710	462.228
Subsistence consumption	186	10570.780	4417.084	5415.432	28070.800
Developmental consumption	186	5845.643	2191.081	1260.333	14055.610
Enjoy consumption	186	1510.532	594.126	617.948	3539.172
Total Spent	186	17926.960	7051.956	7316.954	45605.140
GDP	186	2.653	2.143	0.092	10.767
Urbanization rate	186	0.594	0.123	0.262	0.893
Savings deposit	186	4.905	4.371	0.308	23.246
Loans	186	3.759	3.402	0.162	19.958
Per capita disposable income	186	2.509	1.082	1.073	6.944
Revenue from posts and telecommunications as a percentage of GDP	186	0.063	0.046	0.015	0.236
Share of urban private and self-employed workers in total employment	186	0.683	0.149	0.293	0.946
Internet penetration	186	55.255	10.800	34.100	81.500

Note: Data are from the provincial Statistical Yearbook in the China Statistical Yearbook.

Explained variable -- measure of residents' consumption level. According to the classification method of Engel's Law, generally, the consumption of food, clothing and housing is defined as subsistence consumption, the consumption of education, transportation and communication, and medical care is defined as development consumption, and the expenditure of entertainment and cultural services, household equipment and supplies, durable consumer goods and other goods and services is defined as enjoyment consumption. According to the classification standards of the National Bureau of Statistics, China's residents' consumption is divided into eight categories of food, tobacco and alcohol, clothing, housing, daily supplies and services, transportation and communications, education, culture and entertainment, medical care, other supplies and services, therefore, in these eight categories, food, tobacco and alcohol, clothing and housing are classified as subsistence consumption; Transportation and communication, education, culture and entertainment and medical care are classified as development-oriented consumption; Household goods and services and other goods and services are classified as enjoyment consumption. This article uses consumption data from provincial statistical yearbooks. According to the research needs, this paper matched various types of residents' consumption data, digital financial inclusion index and provincial macro data, and obtained a total of 186 observations. The description of the data is shown in Table 1.

Core explanatory variable---digital financial measurement. This paper selects the China Digital Financial Inclusion Development Index, which is jointly compiled by the Digital Finance Research Center of Peking University and Ant Financial Services Group, to describe the development of regional digital financial inclusion. The index makes use of the big data of the transaction accounts of Ant Financial, and has many good properties such as representativeness, inclusiveness and reliability[5]. It is also widely used to study the development of digital finance.

Selection and measurement of control variables. With reference to relevant research literature, important macro variables such as GDP, urbanization level, per capita disposable income of residents, loan scale and savings deposits are selected as control variables in this paper. Descriptive statistics of control variables are shown in Table 1. In addition, the data used in this paper also includes the spherical distance between the region and Hangzhou, which is the selected instrumental variable; Internet penetration rate, the proportion of post and telecommunications business income in GDP, and the proportion of urban private and self-employed employees in total employment are taken as mechanism variables; And the digital financial inclusion sub-index. Among them, the spherical distance from a region to Hangzhou was calculated through the geographic information system, and the data of Internet penetration rate, the proportion of post and telecommunications revenue in GDP, and the proportion of urban private and self-employed workers in total employment were calculated from the relevant data of provincial statistical almanac. Finally, the above data were combined and sorted by province and time to obtain the relevant data from 2014 to 2019.

4. Empirical test

4.1 The impact of digital financial inclusion on household consumption: baseline regression

In this paper, linear least squares (OLS) regression is carried out according to formula (1), and the dual fixed effect model of time and individual is adopted. The regression results are reported in Table 2.

In the results in columns (1), (3), (5) and (7) of Table 2, we respectively investigated the univariate relationship between the development of digital inclusive finance and subsistence consumption, developmental consumption, enjoyment consumption and total consumption. In columns (2), (4), (6) and (8), We control the characteristics of economic development such as GDP, urbanization rate, per capita disposable income, savings deposits, and loan amount. It can be found that for subsistence consumption, development consumption, enjoyment consumption and total consumption, the coefficients of the digital financial inclusion index are all positive, among which the coefficients of the digital financial inclusion index of subsistence consumption and total consumption are statistically significant at 1% confidence interval. The coefficients of the digital inclusive financial index of

development consumption and enjoyment consumption are statistically significant at the confidence intervals of 5% and 10% respectively. After specific analysis and adding the results of all control variables, the coefficients of digital finance are 0.469 and 0.829 respectively for subsistence consumption, development consumption, enjoyment consumption and total consumption. 0.514 and 0.516, indicating that for every 1 unit standard deviation increase of the digital inclusive finance index, the residents' subsistence consumption, development consumption and enjoyment consumption increase by about 5.10% (=0.469/9.20, where 9.20 is the sample mean), 9.62% (=0.829/8.61, 9.62) respectively, compared with the sample mean. Where 8.61 is the sample mean) and 7.08% (=0.514/7.26, where 7.26 is the sample mean) indicate that, on the whole, the development of digital inclusive finance is conducive to promoting various types of residents' consumption, among which, digital finance has the most significant promoting effect on developing-type consumption. Compared with the other two types of consumption and the total consumption, the promotion effect of digital finance on subsistence consumption is weaker. The reason for this result may be that the popularization and development of digital technology has facilitated people's lives, aroused people's demand for a comprehensive and healthy life, and greatly promoted the growth of developmental consumption such as resident education, transportation and communication, and medical care.

Table 2. Benchmark model

Dependent Variables	Survival consumption		Developmental consumption		Enjoyable consumption		Total consumption	
Independent variables	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Digital finance	0.602***	0.469***	0.894***	0.829**	0.586**	0.514*	0.639***	0.516***
	(0.000)	(0.005)	(0.007)	(0.040)	(0.033)	(0.079)	(0.000)	(0.005)
GDP		0.013		0.005		0.031		0.004
		(0.264)		(0.853)		(0.276)		(0.783)
Urbanization level		0.630		0.492		0.351		0.285
		(0.113)		(0.642)		(0.685)		(0.492)
Per capita disposable income		0.010		0.081		0.014		0.039
		(0.604)		(0.074)		(0.815)		(0.049)
Loans		0.000		0.012		0.022*		0.001
		(0.998)		(0.112)		(0.057)		(0.774)
Savings deposits		0.007		0.003		0.012		0.002
		(0.120)		(0.797)		(0.434)		(0.693)
Constant term	5.915***	6.217***	3.701**	4.530**	4.027***	4.283***	6.220***	6.764***
	(0.000)	(0.000)	(0.027)	(0.015)	(0.006)	(0.004)	(0.000)	(0.000)
Individual fixation effect	yes	yes	yes	yes	yes	yes	yes	yes
Time fixation effect	yes	yes	yes	yes	yes	yes	yes	yes
Sample size	186	186	186	186	186	186	186	186
adj. R^2	0.962	0.968	0.928	0.935	0.884	0.890	0.973	0.975

Note: In brackets are standard errors for Robust clustering (cluster), with ***, ** and * indicating significant at 1%, 5% and 10% levels, respectively. The same is true below.

4.2 Endogenetic analysis

The results of benchmark regression show that the development of digital inclusive finance can significantly promote various types of consumer consumption, but due to missing variables, mutual causality, measurement errors and other factors may cause endogeneity problems, this paper adopts

the method of instrumental variables to estimate the endogeneity problems. In order to satisfy the assumptions of correlation, exogeneity and no complete collinearity of the instrumental variables, the spherical distance between the residents' location and Hangzhou is selected as the instrumental variable. Considering that the digital financial index is a variable that changes with time, that is, the endogenous variable in the original model changes with time, but the spherical distance between the region where residents live and Hangzhou, that is, the instrumental variable, is a constant, directly using this instrumental variable to estimate will result in failure to perform the second-stage estimation. Therefore, in this paper, the spherical distance between the central city of the province where the residents live and Hangzhou is multiplied and interacted with the mean value of the digital financial index at the national level (except the province) as a new instrumental variable that is really used. The results of the estimation of instrumental variables are shown in Table 3. (1) is listed as the estimation result of the first stage of the instrumental variable. It can be seen from the table that the regression coefficient of the instrumental variable passes the significance test with the significance level of 1%, and the significance is negative, indicating that the instrumental variable has a significant negative correlation with the development of digital inclusive finance, that is, the farther away from the development center of digital finance, the smaller the digital inclusive finance index. The lower the degree of development of digital finance, this conclusion is consistent with the reality. In Table 3, paragraphs (2) to (4) are listed as the results of the second stage of instrumental variables. It can be seen that for subsistence consumption, development consumption, enjoyment consumption and total consumption, the coefficient direction of the digital finance index is consistent with the coefficient in the aforementioned benchmark regression. Among them, the digital financial coefficients of subsistence consumption, development consumption and total consumption all pass the significance test with a significance level of 1%, while the coefficient of enjoyment consumption passes the significance test with a significance level of 5%, indicating that the development of digital inclusive finance has significantly improved the consumption level of residents. Among all kinds of consumption, the promotion effect of development consumption is the most significant.

Table 3. Regression results of instrumental variables

Dependent Variable	Digital finance	Survival consumption	Developmental consumption	Enjoyable consumption	Total consumption
Independent variables	(1)	(2)	(3)	(4)	(5)
To Hangzhou spherical distance from the national (except the province) digital financial development average	31.054				
	(0.000)				
Digital finance		0.445***	0.770***	0.499**	0.485***
		(0.000)	(0.001)	(0.029)	(0.000)
controls	yes	yes	yes	yes	yes
Individual fixation effect	yes	yes	yes	yes	yes
Time fixation effect	yes	yes	yes	yes	yes
Sample size	180	180	180	180	180

4.3 Robustness test

In order to further test the robustness of the benchmark regression results, this paper conducts corresponding tests. Due to the prominent economic development advantages and regional advantages of the four municipalities directly under the central government of Beijing, Tianjin, Shanghai and Chongqing, the improvement of per capita consumption level is more advantageous. In order to avoid causality and significant errors caused by special data, the results are more robust. On the original basis, the data of the four municipalities were excluded from the regression again, and the results in Table 4 were obtained. It can be pointed out that the positive and negative regression

coefficients of digital finance are consistent with the benchmark regression, and both have passed the significance test, which proves the robustness of the benchmark regression.

Table 4. Robustness test: The regression results of four municipalities' data are excluded

Dependent Variable	Subsistence consumption		Developmental consumption		Enjoyable consumption		Total consumption	
Independent variables	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Digital finance	0.604***	0.485***	0.989***	0.926*	0.576*	0.625**	0.648***	0.539**
	(0.001)	(0.010)	(0.009)	(0.079)	(0.068)	(0.050)	(0.000)	(0.012)
controls		yes		yes		yes		yes
Individual fixation effect	yes	yes	yes	yes	yes	yes	yes	yes
Time fixation effect	yes	yes	yes	yes	yes	yes	yes	yes
Sample size	162	162	162	162	162	162	162	162
adj. R^2	0.963	0.966	0.926	0.933	0.885	0.887	0.973	0.973

5. Further analysis

5.1 Heterogeneity analysis(Structural heterogeneity analysis)

In the previous benchmark regression, the impact of the total index of digital inclusive finance on various types of consumption is studied, and the digital inclusive finance index has three sub-indexes: coverage breadth of digital finance, depth of use of digital finance and digitization degree of inclusive finance. This paper will further analyze the impact of the three sub-indexes on various types of consumption. Table 5 (2) (4) (6) (8) shows the regression results after adding control variables. The results show that for survival consumption, development consumption, enjoyment consumption and total consumption, the regression coefficients of digital financial coverage breadth sub-index are all positive, which are 0.408, 1.225, 0.929 and 0.611, respectively. Moreover, they all passed the significance test with a significance level of 1%, indicating that the development of digital financial coverage breadth, that is, the provision of adequate financial services, has a significant promoting effect on subsistence consumption, developmental consumption, enjoyment consumption and total consumption, among which the promotion effect on developmental consumption is the most significant.

The data in column (2) (4) (6) (8) of Table 6 show the regression results of the influence of the depth of use of digital finance on various types of consumption after the addition of control variables. It can be found that the sub-index of the depth of use of digital finance has no significant promoting or inhibiting effect on subsistence consumption, development consumption, enjoyment consumption and total consumption. The reason is that with the general development of digital finance, people have the opportunity to enjoy financial services, but they do not have a deep understanding of how to make full use of digital finance, and many people do not fully enjoy the dividends brought by digital finance. In addition, the coverage of digital finance plays a role in promoting residents' consumption, while the development of the depth of use does not. It also shows that the development of sub-indexes such as insurance, monetary funds and credit services, which are subordinate to the depth of use index, has limited promoting effect on residents' consumption.

Similarly, the data in column (2), (4), (6) and (8) of Table 7 show the regression results of the influence of the digitization degree of inclusive finance on various types of consumption after the addition of control variables. It can be found that the digitization degree sub-index has no significant promoting or inhibiting effect on subsistence consumption, development consumption, enjoyment consumption and total consumption. Most residents do not make use of digital finance, and those who

can make use of digital finance may not make good use of it, which directly results in that the dividends brought by digital finance cannot be fully enjoyed by people.

Table 5. covers breadth heterogeneity

Dependent Variables	Subsistence consumption		Developmental consumption		Enjoyable consumption		Total consumption	
Independent variables	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Coverage breadth	0.323***	0.408***	0.967***	1.225***	0.714***	0.929***	0.524***	0.611***
	(0.002)	(0.001)	(0.000)	(0.003)	(0.001)	(0.000)	(0.000)	(0.000)
controls		yes		yes		yes		yes
Individual fixation effect	yes	yes	yes	yes	yes	yes	yes	yes
Time fixation effect	yes	yes	yes	yes	yes	yes	yes	yes
Sample size	186	186	186	186	186	186	186	186
adj. R^2	0.958	0.967	0.942	0.945	0.898	0.901	0.977	0.978

Table 6. Uses deep heterogeneity

Dependent Variables	Subsistence consumption		Developmental consumption		Enjoyable consumption		Total consumption	
Independent variables	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Use depth	0.123	0.095	0.306**	0.143	0.016	0.164	0.161**	0.076
	(0.114)	(0.200)	(0.024)	(0.271)	(0.877)	(0.128)	(0.033)	(0.290)
controls		yes		yes		yes		yes
Individual fixation effect	yes	yes	yes	yes	yes	yes	yes	yes
Time fixation effect	yes	yes	yes	yes	yes	yes	yes	yes
Sample size	186	186	186	186	186	186	186	186
adj. R^2	0.953	0.963	0.923	0.929	0.876	0.888	0.967	0.971

Table 7. Degree of digitization heterogeneity

Dependent Variable	Subsistence consumption		Developmental consumption		Enjoyable consumption		Total consumption	
Independent variables	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Degree of digitization	0.082	0.088	0.245	0.014	0.075	0.157	0.042	0.062
	(0.279)	(0.251)	(0.136)	(0.926)	(0.656)	(0.355)	(0.671)	(0.521)
controls		yes		yes		yes		yes
Individual fixation effect	yes	yes	yes	yes	yes	yes	yes	yes
Time fixation effect	yes	yes	yes	yes	yes	yes	yes	yes
Sample size	186	186	186	186	186	186	186	186
adj. R^2	0.952	0.963	0.922	0.928	0.877	0.887	0.964	0.970

5.2 Mechanism of action test

In this paper, digital divide, information asymmetry and entrepreneurship are introduced as mechanism variables. First, digital financial index is used to regression mechanism variables, and then mechanism variables are used to regression various types of residents' consumption to build mechanism test models. Among them, digital divide is measured by Internet penetration rate,

information asymmetry is measured by the proportion of postal and telecommunications business income in GDP, and entrepreneurship is measured by the proportion of urban private and self-employed employees in total employment. See descriptive statistics in Table 1 for details. Table 8 shows the regression results. In terms of the digital divide, the data in column (5) (6) of Table 8 show that the regression coefficient of the digital finance index is positive and passes the significance test of 1% significance level, indicating that the development of digital inclusive finance has a significant promoting effect on the Internet penetration rate. Meanwhile, the report in Table 9 shows that, The regression coefficients of Internet penetration for subsistence consumption, development consumption, enjoyment consumption and total consumption are all positive. After adding a series of control variables, the coefficients of Internet penetration for development consumption and total consumption pass the significance test at the significance level of 1%, while the coefficient of Internet penetration for enjoyment consumption passes the significance test at the significance level of 5%. The coefficient of subsistence consumption does not pass the significance test, indicating that Internet penetration has a significant promoting effect on development consumption, enjoyment consumption and total consumption. Table 8 and Table 9 jointly illustrate that the development of digital inclusive finance can promote the growth of consumption by increasing the Internet penetration rate and reducing the digital divide, in which the promotion of developmental consumption and enjoyment consumption plays a leading role. The reasons are as follows: with the development of digital finance, residents' ability to apply various digital technologies such as Internet and electronic payment has been continuously enhanced, the Internet penetration rate has been significantly increased, and the digital divide has been narrowed, making mobile payment, live delivery and online shopping more common, and residents' consumption more convenient, thus significantly improving the consumption level of residents.

In terms of information asymmetry, combined with Table 8 and Table 10, it can be seen that the proportion of post and telecommunications revenue in GDP has no significant impact on residents' consumption and fails to pass the mechanism test. Combined with the above review, the possible reason for this research result is the rapid development of network information technology, the emergence and full development of various forms such as live streaming and online shopping, and the rapid information transmission, which greatly reduces the phenomenon of information asymmetry in the society. Therefore, the action mechanism of the development of digital finance to promote consumer consumption by solving the phenomenon of information asymmetry is not significant.

In terms of entrepreneurship, combined with the data in Table 8 and Table 11, it is found that the development of digital inclusive payment has no significant impact on the proportion of urban private and self-employed employees in the total number of employment, and the proportion of urban private and self-employed employees in the total number of employment has no significant impact on residential consumption, so it does not pass the mechanism test. The possible reason is that digital finance provides consumer loans, dispersing the funds that may be used for starting a business and reducing the capital for starting a business, so the role of promoting entrepreneurship is not obvious.

Table 8. Test of intermediary effect

Dependent Variable	Total postal and telecommunications business /GDP		Urban private and self-employed persons/Total employment		Internet penetration	
Independent variables	(1)	(2)	(1)	(2)	(1)	(2)
Digital finance	0.008	0.116	0.342	0.276	40.221***	25.950***
	(0.887)	(0.099)	(0.116)	(0.181)	(0.001)	(0.006)
controls		yes		yes		yes
Individual fixation effect	yes	yes	yes	yes	yes	yes
Time fixation effect	yes	yes	yes	yes	yes	yes
Sample size	186	186	186	186	186	186
adj. R^2	0.867	0.911	0.023	0.016	0.802	0.836

Table 9. Digital Divide mechanism

Dependent Variable	Subsistence consumption		Developmental consumption		Enjoyable consumption		Total consumption	
Independent variables	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Internet	0.003**	0.002	0.010***	0.009***	0.006**	0.006**	0.005***	0.004***
	(0.025)	(0.121)	(0.000)	(0.000)	(0.014)	(0.030)	(0.000)	(0.001)
controls		yes		yes		yes		yes
Individual fixation effect	yes	yes	yes	yes	yes	yes	yes	yes
Time fixation effect	yes	yes	yes	yes	yes	yes	yes	yes
Sample size	186	186	186	186	186	186	186	186
adj. R^2	0.954	0.964	0.937	0.940	0.889	0.893	0.974	0.975

Table 10. Information asymmetry mechanism

Dependent Variables	Subsistence consumption		Developmental consumption		Enjoyable consumption		Total consumption	
Independent variables	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Posts and telecommunications /GDP	0.025	0.095	0.396	0.344	0.447	0.035	0.175	0.146
	(0.906)	(0.736)	(0.319)	(0.374)	(0.314)	(0.938)	(0.432)	(0.509)
controls		yes		yes		yes		yes
Individual fixation effect	yes	yes	yes	yes	yes	yes	yes	yes
Time fixation effect	yes	yes	yes	yes	yes	yes	yes	yes
Sample size	186	186	186	186	186	186	186	186
adj. R^2	0.951	0.962	0.918	0.928	0.879	0.886	0.964	0.970

Table 11. Entrepreneurial mechanism

Dependent Variables	Subsistence consumption		Developmental consumption		Enjoyable consumption		Total consumption	
Independent variables	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Employment rate	0.000	0.023	0.055	0.051	0.008	0.001	0.015	0.027
	(0.998)	(0.548)	(0.501)	(0.519)	(0.932)	(0.994)	(0.764)	(0.510)
controls		yes		yes		yes		yes
Individual fixation effect	yes	yes	yes	yes	yes	yes	yes	yes
Time fixation effect	yes	yes	yes	yes	yes	yes	yes	yes
Sample size	186	186	186	186	186	186	186	186
adj. R^2	0.951	0.962	0.918	0.928	0.876	0.886	0.964	0.970

6. Main conclusions and policy recommendations

In recent years, with the rapid development of science and technology in the world and the continuous reform and innovation of Internet technology, China's digital finance has also been developed rapidly. Financial services are widely provided in a wide range, which greatly enrichis and facilitates the life of residents. Based on the relevant data of China's Digital inclusive Finance Development Index and provincial statistical yearbooks, this paper mainly analyzes how the development of digital finance has an impact on residents' consumption level through empirical research, and further studies the mechanism and path of the impact.

Based on the empirical analysis, the following findings are made in this paper. First, the development of digital inclusive finance is conducive to improving the total consumption level of residents and promoting all kinds of consumption, among which the promotion effect on

development-oriented consumption is the most significant. This conclusion is still valid after introducing instrumental variables and removing some special values or testing. Second, compared with the depth of use of digital finance and the degree of digitalization of inclusive finance, the development of the coverage of digital finance has a more significant effect on the promotion of various types of consumer consumption. Third, in terms of the mechanism of promotion, digital finance mainly promotes various types of consumption by increasing the Internet penetration rate, that is, reducing the digital divide, while it has no significant impact on various types of consumption by reducing information asymmetry and promoting entrepreneurship.

On the basis of the above research, this paper draws the following policy implications. First, targeted development of digital financial inclusion. In regions where financial resources are relatively scarce and development is relatively backward, it is necessary to provide policy and institutional guarantees for the sound development of digital finance in the region, promote the construction of financial infrastructure, and provide conditions for the full play of digital financial inclusion's role in promoting residents' consumption level. For the developed regions with good economic development, superior geographical conditions and good financial foundation, more attention should be paid to the development of digital inclusive finance, promote the progress of financial technology, and further play the role of digital financial development in promoting residents' consumption and accelerating the domestic economic process. Secondly, to promote the development of digital inclusive finance, it is necessary to focus on how to narrow the digital divide and other issues, so as to better play the role of the development of digital inclusive finance in promoting residents' consumption, and then promote the rapid development of China's economy. The government should increase the construction of relevant infrastructure, promote the comprehensive development of the Internet, and meet the basic needs of residents to narrow the digital divide; Relevant preferential policies should be introduced to help narrow the digital divide; We will strengthen training in digital skills so that more people can have access to digital information technology, and create more possibilities for digital finance to boost consumption and drive economic development. Finally, in the process of promoting the development of digital finance and raising the level of consumption, we should focus on the role of the coverage of digital finance. Provide more extensive digital financial services, promote the universality of residents to enjoy financial services, improve the coverage of digital finance, further meet the consumer needs of residents, and realize the further development of science, technology and economy in China.

References

[1] Wang Xiaohua, Ma Xiaoke, He Qian. Has the use of digital Finance Promoted the Full Release of Rural consumption?. China Rural Economy. 2022. No. 11, p. 21-39.

[2] Li Yanlong, Shen Yan. Digital Financial Inclusion and Regional economic Imbalance. Economics Quarterly. Vol. 22 (2022) No. 5, p. 1805-1828.

[3] Brito,D.L. and Hartley, P.R. Consumer Rationality and Credit Cards. Journal of Political Economy. Vol.103(2), p. 400-433.

[4] Yi Xingjian, Zhou Li. Whether the development of digital inclusive finance significantly affects household consumption —— Micro evidence from Chinese households. Finance Research. 2018. No. 11, p. 47-67.

[5] Zhang Xun, Yang Tong, Wang Chen, et al. The development of Digital finance and Household consumption Growth: Theory and Practice in China. Management World. Vol. 36(2020) No. 11, p. 48-63.

[6] Kodan A.S., Chhikara K.S. A Theoretical and Quantitative Analysis of Financial Inclusion and Economic Growth. Management and Labour Studies. 38(1-2), p. 103-133.

[7] Li Tao, Xu Xiang, Sun Shuo. Inclusive Finance and Economic Growth. Financial Research. 2016. No. 4, p. 1-16.

[8] Qian Haizhang, Tao Yunqing, Cao Songwei, et al. Theory and Demonstration of China's Digital Finance Development and economic Growth. Journal of Quantitative and Technical Economics. Vol. 37 (2020) No. 6, p. 26-46.

[9] Hu Debao, Zhai Chenzhe, Zhao Sibo. Does digital finance promote household consumption upgrading? An analysis based on data from the China family panel studies. Economic Modelling. 125.

[10] Sun Yuhuan, Zhang Tingyu, Wang Xuene, et al. The current situation, Problems and Prospects of the development of Digital Inclusive Finance in China. Journal of Quantitative and Technical Economics. Vol. 38(2021) No. 2, p. 43-59.

[11] Yin Zhichao, Guo Peiyao. Assessing the Effect of Targeted poverty alleviation policies —— An Empirical Study from the perspective of Household Consumption. Management World. Vol. 37(2021) No. 4, p. 64-83.

[12] Wang Y. Empirical Research of Poverty Alleviation Effects of Digital Inclusive Finance from the Perspective of Internet-Based on 2011-2015 Provincial Panel Data. DEStech Transactions on Economics, Business and Management.

[13] Mushtaq R., Bruneau C. Microfinance, Financial Inclusion and ICT: Implications for Poverty and Inequality. Technology in society. 59, p. 101-154.

[14] Zhang Xun, Wan Guanghua, Zhang Jiajia, et al. Digital Economy, Inclusive Finance and Inclusive Growth. Economic Research. Vol. 54(2019) No. 8, p. 71-86.

[15] He Jing, Li Qinghai. Use of digital finance and farmers' of farmers. Chinese Rural Economy. 2019. No. 1, p. 112-126.

[16] Zhao Yaxiong, Wang Xiuhua. Digital Finance, Household Relative Income and Vulnerability —— A Discussion on the impact of the Multi-dimensional 'Divide'. Finance Research. 2022. No. 10, p. 77-97.

[17] Beck T., Pamuk H., Ramrattan R., et al. Payment Instruments,Finance and Development. Journal of Development Economics. 133 p. 162-186.

[18] Xie Huali, Shen Yan, Zhang Haoxing, et al. Can digital Finance Promote entrepreneurship? ——Evidence from China. Economics (Quarterly Journal). Vol. 17(2018) No. 4, p. 1557-1580.

[19] Tian Ge, Huang Hai, Zhang Xun. Digital Finance and high-quality development of entrepreneurship: Evidence from China. Finance Research. 2023. No. 3, p. 74-92.

[20] Chen Gang. How Finance Promotes Entrepreneurship: Scale Expansion or Diversity of Subjects. Research in Financial Economics. Vol. 30 (2015) No. 5, p. 29-42.

[21] Yang Jia, Lu Yao, Li Jizhen, et al. The impact of Inclusive Finance on Entrepreneurship in the Digital Age: Evidence from a Microsurvey of Chinese Households. Journal of Management Science. Vol. 25(2022) No. 11, p. 43-68.

[22] Qiu Zeqi, Zhang Shuqin, Liu Shding, et al. From Digital Divide to Dividend Difference —— The Perspective of Internet Capital. Chinese Social Sciences. 2016. No. 10, p. 93-115+203-204.

[23] Cheng Mingwang, Zhang Jiaping. Internet popularization and income gap between urban and rural areas: theory and demonstration. China Rural Economy. 2019. No. 2, p. 19-41.

[24] Zhang Xun, Wan Guanghua, Wu Haitao. Narrowing the Digital Divide: The Development of Digital Finance with Chinese Characteristics. Social Sciences in China. Vol. 2021. No. 8, p. 35-51+204-205.

[25] Wang Zuogong, Li Huiyang, Sun Lulu. The Development and governance of Digital Finance: From Information Asymmetry to Data Asymmetry. Financial Theory and Practice. 2019. No. 12, p. 25-30.

[26] Xie Ping, Zou Chuanwei, Liu Haier. The Basic Theory of Internet Finance. Financial Research. 2015. No. 8, p. 1-12.