

Research on the Impact of Digital Financial Literacy on Consumption Inequality

-- An Empirical Analysis based on 2019 CHFS Data

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Abstract

Promoting consumption equity is an important component of enhancing people's well-being and promoting common prosperity. Digital financial literacy, as a key factor influencing individual consumption decisions and financial behavior, plays an important role in the formation and evolution of consumption inequality. Accordingly, this paper uses data from the 2019 China Household Finance Survey (CHFS) to explore the impact of individual digital financial literacy on consumption inequality. The results show that improving digital financial literacy can effectively alleviate consumption inequality, and this conclusion remains robust after a series of tests. Moreover, the alleviating effect of digital financial literacy on consumption inequality is more pronounced among the elderly, male, married, less-educated groups, and low-income households. At the regional level, digital financial literacy has a stronger alleviating effect on consumption inequality among households in rural areas and the central and western regions. Based on the findings, this paper argues that to further alleviate individual consumption inequality, great attention should be paid to improving individual digital financial literacy.

Keywords

Digital Financial Literacy; Consumption Inequality; Principal Component Analysis; Kakwani Index.

1. Introduction

It is an important problem facing the contemporary society to relieve the social consumption inequality. This is essential for improving social cohesion. Promoting the equity of consumption is an important component of improving people's well-being and achieving common prosperity. From the perspective of economic stability and sustainable development, to ease the consumption inequality can stimulate the consumer market vitality. It can widen the consumer market's horizon and stimulate economic growth [1]. At the same time, reducing consumption inequality can be a tool for breaking the intergenerational cycle of poverty. It encourages social mobility and therefore helps shared prosperity. Digital finance has also developed explosively in the present age of rapid digitalization. It has penetrated every detail of the socioeconomic system. First, digital finance breaks through the limitation of traditional finance. It can more accurately assess personal credit status through technologies such as big data and cloud computing. It means less reliance on collateral and makes start-up capital more readily available to entrepreneurs. Second, digital finance allows individuals to engage in different financial activities. In addition to traditional bank savings, they can also invest in stocks, funds and bonds through internet platforms to get property income. Third, the development of digital finance has driven the development of relevant industries such as financial technology. It has

created many jobs like “financial data analysis, blockchain development and intelligent investment advisory”.

Note that the development of digital finance has introduced new demands on individual financial literacy. While conventional financial literacy remains important, there is now more focus on digital skills of consumers. This underscores the need to focus on the digital financial literacy of residents. On November 27th, 2024, the People’s Bank of China and six other departments jointly released the Action Plan for Promoting High-Quality Development of Digital Finance. It stressed “organizing education and training on digital finance, improving consumer financial literacy and the ability to use digital financial products and risk prevention awareness”. There is no question that when considering the rapid development of digital finance, there are huge differences in opportunities and experiences among different consumers [2]. The main reason is the different level of digital financial literacy. Consumers with higher literacy are better at utilizing digital financial products. They can read complex financial information accurately, calculate yields and risks and understand loan terms. Low literacy people, in contrast, face cognitive and behavioral barriers. They don’t know safe mobile payment practices, can’t recognize the risk of high interest in online lending and may become trapped in debt. They also tend to avoid smart wealth management, leaving asset allocation opportunities on the table.

Digital financial literacy affects consumption inequality through wealth accumulation. This paper empirically analyzes this relationship using CHFS data. It contributes by examining individual-level effects and applying a heterogeneity framework. This helps to optimize and innovate products for the digital financial market [3].

2. Literature Review and Commentary

2.1. Concept and Effects of Digital Financial Literacy

2.1.1. Concept and Measurement of Digital Financial Literacy

The idea of digital financial literacy has become clearer gradually in recent years. It is considered to encompass various dimensions. They consist of digital financial knowledge, digital financial skills and risk awareness and prevention. Scholars have differences in objects, scope, methods and contents of measuring digital financial literacy. This is because of different research backgrounds and aims.

One sample selection was on objects and scope covering Asia, Africa and Latin America. It used a case-based method to evaluate the levels of digital financial literacy. It looked at how people in those areas are adapting to and perceiving digital finance. From the perspective of online literacy and financial literacy, another approach was developed. It came up with fifteen questions. These were “interest rates calculation” and “if one has a smartphone”. They were asked to answer. To collect the data. The data collected was analyzed by principal component analysis to extract the key information. Reliability of the indicators was tested using Cronbach’s alpha. The data was therefore of good quality. Then the weights standardization was performed by using standard score and min-max normalization methods. The digital financial literacy scores of the respondents were accurately obtained through these steps. This was an example of a scientific and operational measure [4].

2.1.2. Effects of Digital Financial Literacy

Digital financial literacy mainly affects residents’ income and consumption. It influences household savings and can reduce relative poverty. It also raises farmers’ disposable income and narrows the urban-rural income gap. Digital finance boosts urban and rural consumption, but its impact is stronger on urban households.

Financial literacy is closely linked to reason. Financial literacy has a great and positive impact on rural household behavior toward digital finance. Digital finance behavior mediates the relationship between financial literacy and consumption level and structure of rural households. Better financial literacy helps farmers understand and use digital finance services well. This enhances household consumption and optimizes the consumption structure. However, the low digital financial literacy of consumers generally results in insufficient financial knowledge. The lack of knowledge and skills leads to the psychological rejection of financial products and services. They deliberately avoid various financial resources. In China, these phenomena have become key factors limiting urban household consumption. They seriously hinder the release of consumption potential and the upgrading of consumption structure [5].

2.2. Measurement and Influencing Factors of Consumption Inequality

2.2.1. Measurement of Consumption Inequality

Consumption inequality measures the diversity of consumption capacity, structure and quality across groups. Measuring it is important to understand how economics and social welfare are distributed and to design accurate policies. Different perspectives bring about the measurement indicators at the macro level and micro level, but they do not conflict with each other. Taken together they paint a full picture of consumption inequality. At the macro level, the Theil index breaks down inequality in total consumption into components that are within and between groups. This allows us to look in detail at the sources of consumption inequality across groups. An adaptive non-parametric kernel density estimation method was used to map the distribution and evolution of urban household consumption. To measure inequality of consumption, Theil and Atkinson indices were built [6].

Beside that, Gini coefficient is one of the most popular indicators in measuring consumption inequality. At the micro level, the Kakwani index is built from the Lorenz curve. It has some unique advantages for measuring consumption inequality. The consumption inequality was quantitatively estimated and deeply discussed by means of the Kakwani index obtained from total household consumption expenditure based on relative deprivation theory. This contributed diverse perspectives and empirical data to the field. The Kakwani index was employed to measure consumption inequality based on the data of CHFS. Then, the effect of digital financial development on consumption inequality was analyzed.

2.2.2. Influencing Factors of Consumption Inequality

The macro level economic structure, as well as the micro level individual characteristics and household income, can influence consumption inequality. At the macro level, the industrial structure is changing from traditional agriculture to industry and services, and consumption inequality is changing dynamically. Industrial upgrading can effectively reduce the urban-rural consumption gap and alleviate consumption inequality. At the micro level, consumption inequality is usually attributed to income inequality. The gap in disposable income has caused the consumption inequality among China's urban residents to increase. Using micro-panel data from the CHFS, we found that subsistence and developmental or experiential consumption inequality were influenced by individual characteristics. They are different reasons.

Moreover, debt behavior might reduce inequality in consumption. Relative consumption deprivation is much lower among indebted households than among non-indebted households. This conclusion leads to a reconsideration of the role and potential effects of debt in consumption. It turns the normal view of debt on its head. Age differences are also evident in consumption inequality. It is usually more conspicuous in young than in old persons [7].

2.3. Related Analyses on the Impact of Digital Financial Literacy on Consumption Inequality

Some scholars have examined how digital financial literacy affects consumption inequality. Digital finance can reduce consumption inequality by easing credit constraints and improving access to information. The internet supports digital finance, enhances connectivity, and promotes resource use and information exchange. It also boosts rural consumption demand and narrows the urban-rural consumption gap. Digital payments encourage spending, digital credit smooths consumption, and digital insurance reduces precautionary savings. These effects ease financial constraints and narrow regional consumption inequality, especially between high-income and low-income groups. Digital inclusive finance also raises household income by lowering financial thresholds.

This increases the consumption capacity and gradually closes the consumption gap with high-income households. It also helps coordinate the consumption structure. Some scholars have argued that digital financial literacy has a negative effect on consumption inequality. Due to the uneven development of regional economy and technology in China, digital inclusive finance has regional differences. Such differences easily lead to digital divide and unbalanced allocation of financial resources. This benefits advantaged groups, but benefits disadvantaged groups relatively little. This worsens inequality of consumption even further [8].

2.4. Review of Prior Works

While this paper is driven by the existing literature, there are two gaps. First, consumption inequality is mainly measured at macro level, using regional or industry data. It shows aggregate trends rather than differences between households or individuals. It also does not capture heterogeneity across age, gender, occupation and income. Second, the availability and coverage of services in most of the analyzes are based on the digital inclusive finance index. But Digital Financial Literacy of an individual also includes tool use, knowledge of finance, and risk perception. These are more related to consumption decisions. This paper thus studies consumption inequality at the individual level. It examines the effect of digital financial literacy on consumption gaps and their heterogeneity. The goal is to push the frontier, inform decision-making, ensure equity in consumption, and improve well-being.

3. Theoretical Basis and Mechanism Analysis

The rapid development of digital finance has a profound impact on the consumption pattern and financial behavior. In this context, digital financial literacy has deep implications for not only individual financial decisions but also consumption inequality. This paper draws on group effect theory, social comparison theory, ratchet effect theory and related conspicuous consumption psychology literature to explore the mechanism of digital financial literacy affecting consumption inequality. It is helpful to further understand the basic operation of the consumption market and explore the role of digital finance in consumption inequality. It gives a good theoretical basis for further analysis.

3.1. Theoretical Basis

3.1.1. Group Effect Theory

Theory of group effect is one of the important pillars of theory of social behavior. Its basic premise is that when people are in a group setting their behavior is strongly conditioned by group norms, values and behavior models. In the real context of development of digital finance, there are obvious differences in consumption and financial decisions among groups with different levels of digital financial literacy. The groups with higher digital financial literacy, supported by profound professional knowledge and rich practical experience, can accurately

identify the characteristics and possible risks of digital financial products. They can make reasonable use of various digital financial tools to achieve efficient allocation of financial resources. This supports the inter-temporal consumption optimization and balance. Conversely, groups with low digital financial literacy lack the knowledge and skills. They struggle to take full advantage of digital financial tools. They are more easily disturbed by the negative consumption behaviors within the group when planning consumption and making financial decisions. This leads to consumption problems and adds uncertainty and volatility to consumption [9].

3.1.2. Social Comparison Theory

The classic theoretical work is the source of the social comparison theory. It says people have an internal psychological tendency to judge their own social status and abilities by comparing themselves to others. This psychological mechanism has a deep impact on people's attitudes and behavior. With the rapid development of the digital economy today, the emergence of social media and e-commerce platforms has greatly expanded the breadth and depth of information dissemination. This makes it more convenient for consumers to know the consumption of others. Consequently, social comparison psychology is reinforced. Consumers with high digital financial literacy can use the knowledge they have learned to rationally judge the authenticity and applicability of information when faced with complex consumption information. They can then decide what is best for their own economic conditions and consumption needs. In contrast, consumers with low digital financial literacy are easily affected by blind comparison. They ignore their real economic strength and blindly pursue high consumption. In the end, this leads to an imbalance in the consumption structure and further exacerbates consumption inequality at the social level [10].

3.1.3. Ratchet Effect

According to the ratchet effect theory, consumer habits are difficult to reverse once they are formed. They have the characteristic of "easy to go up, hard to come down". High digital financial literacy consumers can enjoy the convenience and benefits brought by digital finance driven by digital finance. They can realize the optimization and upgrading of the consumption structure. Once this upgraded consumption pattern is created, it becomes difficult to reverse because of short-term economic fluctuations. In contrast, consumers with low digital financial literacy have no systematic ability of financial planning and effective risk management tools. Problems exist with flexible adaptation of consumption strategies and maintaining the initial consumption level in the face of economic shocks or falls in income. This further widens the gap in consumption between them and groups

3.1.4. Consumer Conspicuous Comparison Psychology

This is a common social psychology phenomenon of consumers - the psychology of conspicuous comparison. It is a psychological tendency of consumers to compete with others in consumption activities. This is driven by the desire to gain social recognition and improve one's social status. With the growth of digital finance, social network and e-commerce platform provide consumption display functions. These also further promote the spread of this psychology of comparison. A relatively high level of digital financial literacy among consumers allows them to fully use digital financial tools and scientifically formulate their consumption budget. They may at least partially meet their own comparison needs, while effectively avoiding excessive consumption. Low digital financial literacy consumers, by contrast, generally do not have a good sense of their own economic power. They borrow blindly and enjoy high consumption based on comparison psychology. Such irrational consumption behaviors not only increase the personal debt burden, but also aggravate the consumption inequality at the social level.

3.2. Mechanism Analysis

Digital financial literacy now shapes residents' consumption inequality through group effects, social comparison, the ratchet effect, and conspicuous consumption. Higher-literacy groups consume more rationally and optimize their consumption structure. Lower-literacy groups are more prone to irrational consumption due to limited knowledge and skills. Enhancing digital financial literacy can ease liquidity constraints, improve consumption decisions, and spread financial knowledge, helping consumers plan better and narrow consumption gaps.

According to Maslow's hierarchy of needs, lower needs are met before higher ones emerge. Subsistence consumption satisfies basic needs, is highly inelastic, and depends on income and living costs. Development-enjoyment consumption meets higher needs. Digital financial literacy helps consumers use financial tools, manage wealth, plan consumption, allocate capital, diversify income, and thus more strongly promotes development-enjoyment consumption.

Based on the above analysis, this paper proposes the following hypotheses:

Hypothesis 1: Improving digital financial literacy can alleviate consumption inequality.

Hypothesis 2: Compared with subsistence consumption, improving digital financial literacy is more helpful in alleviating developmental and enjoyment-oriented consumption inequality.

4. Model Construction and Indicator Selection

4.1. Data Sources and Screening Description

This paper uses the CHFS database. This database was formed by a large-scale national sampling survey. The survey was conducted by the Survey and Research Center for China Household Finance at Southwestern University of Finance and Economics. The database is comprehensive, covering household assets and liabilities, income and expenditure, insurance and protection, financial knowledge and behavior, and demographic characteristics. The basic requirements for the data in this paper are as follows. (1) The head of household is aged between 18 and 75. (2) Household information is complete. (3) Participation in the digital financial literacy survey is required. The 2019 CHFS data meets these requirements. Therefore, this paper mainly uses the 2019 CHFS public data to conduct the corresponding research. After excluding missing values and outliers in variables such as income and liabilities, 12,216 valid samples are obtained.

4.2. Model Construction and Indicator Selection

This paper explores the effect and mechanism of digital financial literacy on consumption inequality. The impact is mainly studied in terms of direction and magnitude by means of a linear regression model. Robustness tests were carried out by substituting or deleting important variables, using random sampling, and changing the estimation models. Endogeneity is addressed using the instrumental variable method. Individual, household, migration and regional characteristics heterogeneity is analyzed.

To empirically test the impact of digital financial literacy on consumption inequality, this paper constructs the following basic regression model:

$$rdkak = \alpha_0 + \alpha_1 sy_t + \alpha_2 person + \alpha_3 family + \delta + \varepsilon \quad (1)$$

rdkak is the individual consumption inequality degree in this model. *sy_t* is the individual digital financial literacy level. *person* is a series of separate control variables, including age, gender, marital status, health, and education. *family* is a group of household control variables, such as household registration, income, net assets and region. δ are province fixed effects, ε is the random error term.

For the dependent variable, consumption inequality *rdkak*, the Kakwani index is used for measurement. Specifically, other individuals in the same district or county are selected as the comparison benchmark. The surveyed household is compared with households having higher consumption expenditure in the same district or county. Taking the district or county as the basic statistical unit, the total sample size is set as n . The mean consumption is μ_x , and the consumption vector of the n samples is $x_1, x_2, \dots, x_n$. These are assumed to be arranged in ascending order, that is, $x_1 \leq x_2 \leq \dots \leq x_n$. The mean consumption of those exceeding the k -th sample is defined as μ_{xk} . The proportion of households exceeding the k -th sample is denoted as y_{xk} . Based on these definitions, the corresponding calculation formula is as follows:

$$kakwani = \frac{1}{n \mu_x} \sum_{i=k+1}^n (x_i - x_k) = \gamma_{xk} [\mu_{xk} - x_k] / \mu_x \quad (2)$$

The core explanatory variable of this paper is digital financial literacy. The variable is constructed with reference to the relevant questions in the 2019 CHFS database. It comprises different aspects such as digital payments, digital wealth management, digital lending, risk identification etc. Table 2 shows specific questions. The questions include awareness of internet finance products, mobile payment and wealth management behavior, and the frequency of online credit usage. The questions are submitted to a principal component analysis to reduce their dimensionality. The core information is extracted and weighted into a comprehensive index of the main components.

Table 1. Variable Definitions

Variable Type	Variable Name	Variable Label	Variable Description
Dependent variable	Consumption inequality	<i>rdkak</i>	Kakwani index
Independent variable	Digital financial literacy	<i>sy_t</i>	Composite score calculated by principal component analysis (PCA)
Individual characteristics	Age	age	Age of household head
	Age squared/1000	age2	Squared age of household head divided by 1000
	Gender	gender	Male =1; female =0
	Marital status	mari	Married/cohabiting =1; other =0
	Physical health	phys	Very poor =1; poor =2; fair =3; good =4; very good =5
	Education	educ	No schooling =1; primary school =2; junior high =3; senior high =4; secondary vocational =5; junior college =6; bachelor's =7; master's =8; doctoral =9
	Employment status	job	Employed =1; unemployed =0
Household characteristics	Household registration type	hukou	Agricultural hukou =1; non-agricultural hukou =0
	Household size	renkou	Total household population
	Household income	income	Total household income
	Net assets	asset1	Total assets minus liabilities
	Urban-rural area	rural	Rural =1; urban =0

Table 2. Questions and Scoring for Measuring Digital Financial Literacy

Dimension	Question Type	Specific Question	Scoring
Digital literacy	Digital payment	Which type of mobile phone do you currently use?	A phone enabling online shopping and social networking =1; other phones or no phone =0.
	Digital wealth management	Has your household opened third-party payment accounts?	Third-party accounts such as Alipay, WeChat Pay, JD Finance, or Baidu Wallet =1; not opened =0.
	Digital lending	Did your household borrow money online to purchase this house?	Online borrowing =1; no online borrowing =0.
Financial literacy	Interest calculation	If you borrow 10,000 yuan at 10% annual compound interest, what is the total repayment after 2 years?	Correct answer =1; incorrect answer =0.
	Inflation	If the bank rate is 5% and inflation is 8%, what can 100 yuan buy after one year?	
	Risk identification	Generally, which has greater risk: main board stocks or ChiNext stocks?	

Table 3. Principal Component Extraction and Variance Contribution

Principal Component	Eigenvalue	Variance Contribution Rate	Cumulative Variance Contribution Rate
Comp1	2.19163	0.3653	0.3653
Comp2	1.03581	0.1726	0.5379
Comp3	0.984082	0.1640	0.7019
Comp4	0.786786	0.1311	0.8331
Comp5	0.554528	0.0924	0.9255
Comp6	0.447166	0.0745	1.0000

Note. Comp1-Comp6 denote the first through sixth principal components.

According to Table 3, based on the Kaiser criterion (eigenvalue >1), two principal components are extracted. Their eigenvalues are 2.18025 and 1.03088, with a cumulative variance contribution of 64.22%. This effectively retains the core information of the original indicators. This threshold ensures that the extracted components account for the majority of the variance. In terms of loading coefficients, digital payment and digital wealth management load highly on the first principal component. Their loadings are 0.6850 and 0.7258, respectively, corresponding to “digital literacy”. Risk identification loads highly on the second principal component at 0.5046, corresponding to “financial literacy”.

Finally, using the variance contribution as weights, the standardized indicators are substituted into the principal component score formula. A comprehensive index of digital financial literacy is calculated to quantify household digital financial literacy. A larger index value indicates a higher level of household digital financial literacy [11].

The definitions and descriptions of all variables in model (1) are detailed in Table 1.

4.3. Descriptive Statistics of Variables

Table 4 shows the descriptive statistics of the variables used in the empirical analysis. Average consumption inequality among participants is 0.41, with moderate variation across the sample (Table 4).

The average digital financial literacy (DFL) score is 1.017 but the variation across individuals is large. The mean age is 52.347 years, almost 80% are male and approximately 90% are married. The health status is still moderate and the level of education is moderate to low.

Urban household registration is about 73% and employed persons is about 76%. The average household has 3.262 people. But household income and net assets vary greatly, with clear wealth gaps. These patterns suggest that demographic and socioeconomic factors may jointly shape consumption inequality. Some 36% of the samples are urban samples, while the rest are rural samples.

Table 4. Descriptive Statistics

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
<i>rdkak</i>	12216	0.41	0.237	0	0.969
<i>sy_t</i>	12216	1.017	0.865	0.082	4.371
<i>age</i>	12216	52.347	12.354	18	75
<i>age2</i>	12216	2.893	1.266	0.324	5.625
<i>gender</i>	12216	0.792	0.406	0	1
<i>mari</i>	12216	0.884	0.32	0	1
<i>phys</i>	12216	3.295	0.998	1	5
<i>educ</i>	12216	3.445	1.629	1	9
<i>job</i>	12216	0.757	0.429	0	1
<i>hukou</i>	12216	0.731	0.443	0	1
<i>renkou</i>	12216	3.262	1.544	1	15
<i>income</i>	12216	84637.24	109000	770	800000
<i>asset1</i>	12216	483000	382000	800000	1000000
<i>rural</i>	12216	0.356	0.479	0	1

5. Empirical Results and Analysis of Digital Financial Literacy on Consumption Inequality

5.1. Baseline Regression Results

In this paper, a linear regression model is employed to analyze the impact of digital financial literacy on consumption inequality. Model (1) does not have any control variables. Models (2) and (3) include individual and household control variables, respectively. Model (4) includes all controls. All regressions include province fixed effects and robust standard errors. Table 5 reports the regression results. Digital financial literacy has a negative coefficient, with or without controls, significant at 1%. This suggests it effectively reduces individual consumption inequality. Higher literacy improves access to financial services, optimizes household asset allocation, and narrows consumption inequality. R^2 rises as controls are added, showing individual and household variables matter.

Table 5. Baseline Regression Table

/	Dependent variable: <i>rdkak</i>			
/	(1)	(2)	(3)	(4)
<i>sy_t</i>	-0.0807***	-0.0403***	-0.0427***	-0.0247***
/	(0.0025)	(0.0027)	(0.0024)	(0.0026)
<i>age</i>	/	-0.0059***	/	-0.0011
/	/	(0.0012)	/	(0.0012)
<i>age2</i>	/	0.0973***	/	0.0351***
/	/	(0.0121)	/	(0.0113)
<i>gender</i>	/	-0.0029	/	0.0018
/	/	(0.0051)	/	(0.0047)
<i>mari</i>	/	-0.1160***	/	-0.0402***
/	/	(0.0068)	/	(0.0062)
<i>phys</i>	/	-0.0062***	/	0.0009
/	/	(0.0022)	/	(0.0020)
<i>educ</i>	/	-0.0191***	/	-0.0146***
/	/	(0.0015)	/	(0.0015)
<i>job</i>	/	0.0415***	/	0.0286***
/	/	(0.0053)	/	(0.0049)
<i>hukou</i>	/	/	0.0296***	0.0192***
/	/	/	(0.0047)	(0.0048)
<i>renkou</i>	/	/	-0.0479***	-0.0444***
/	/	/	(0.0013)	(0.0014)
<i>income</i>	/	/	-0.0484***	-0.0414***
/	/	/	(0.0019)	(0.0020)
<i>asset1</i>	/	/	-0.0002	-0.0001
/	/	/	(0.0005)	(0.0005)
<i>rural</i>	/	/	0.0195***	0.0029
/	/	/	(0.0045)	(0.0046)
<i>_cons</i>	0.5103***	0.6469***	1.1277***	1.0429***
/	(0.0156)	(0.0360)	(0.0260)	(0.0386)
<i>N</i>	12216	12216	12216	12216
<i>R</i> ²	0.0971	0.1828	0.2862	0.3086

Note. Standard errors in parentheses * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

5.2. Robustness Tests

This paper tests the current evaluation method and indicator system with stable, consistent and reliable explanations for the empirical results through robustness tests. The tests are for dependent variable exchange and random sampling.

5.2.1. Replacement of the Dependent Variable

The Kakwani index was used as the main measure of consumption inequality in the core analysis. The relationship between digital financial literacy and consumption inequality was studied. However, to ensure reliability and robustness it is necessary to reproduce the main empirical analysis with alternative measures of consumption inequality. For robustness testing we choose the Yitzhaki and the Podder indices.

Regression results are shown in Table 6. After replacing the dependent variable, the coefficient of digital financial literacy remains consistent with the original model. Magnitude, sign, and significance all agree. All three are significant at the 5% level.

The consistency across alternative measures gives confidence in the findings. It implies that the observed relationship is not dominated by a single indicator. Therefore, the results provide strong evidence that the estimated effect is robust. The results above provide initial evidence for the robustness of the effect of digital financial literacy on consumption inequality. It does not depend on the choice of the dependent variable.

Table 6. Replacement of the Dependent Variable

/	Yitzhaki Index	Podder Index
	(1)	(2)
<i>sy_t</i>	-0.0847**	-0.0482***
(0.0411)	(0.0048)	
Control variables	Yes	Yes
Province fixed effects	Yes	Yes
<i>N</i>	12216	12216
<i>R</i> ²	0.2325	0.3075

Note. Standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

5.2.2. Random Sampling

To further verify the robustness of the empirical results, this paper performs random sampling of the sample at three different proportions (40%, 50% and 60%). Then, the results of sampling are further tested. The results of the regression are shown in Table 7. It can be observed that the consumption inequality among different sampling groups is significantly negatively affected by digital financial literacy (consistent with the baseline regression results). Its estimated coefficient lies between -0.02 and -0.03. This indicates a rise in digital financial literacy that will go a long way to ease consumption inequality by 2%-3%. From the significance point of view all the three sampling groups are significant at 1% statistical level. It implies that the results of the model estimation have a good robustness.

Table 7. Random Sampling

/	Dependent variable: <i>rdkak</i>		
	40% Sample	50% Sample	60% Sample
/	(1)	(2)	(3)
<i>sy_t</i>	-0.0262***	-0.0247***	-0.0212***
	(0.0042)	(0.0037)	(0.0034)
Control variables	Yes	Yes	Yes
Province fixed effects	Yes	Yes	Yes
<i>N</i>	4886	6108	7330
<i>R</i> ²	0.2960	0.3147	0.3016

Note. Standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

5.3. Endogeneity Treatment

Endogeneity biases estimates of how digital financial literacy affects consumption inequality. In high-inequality regions, residents learn digital finance to gain resources, creating reverse causality. Risk attitude, income stability, and social security also influence both literacy and consumption, causing omitted-variable bias. To address this, the district average digital financial literacy is used as an instrumental variable. It is shaped by regional financial education and digital infrastructure, and is exogenous to individual consumption inequality. Good local knowledge diffusion also helps individuals improve literacy through social interaction, satisfying the relevance condition.

Two-stage least squares (2SLS) is used for estimation. Table 8 reports the instrumental variable results. The first-stage F-value is 139.89, well above the weak-instrument threshold of 10, so the instrument passes the test. The district average digital financial literacy positively affects digital financial literacy, consistent with theory. The second stage shows that higher digital financial literacy significantly reduces consumption inequality ($\beta=0.035$, $p<0.01$), confirming robustness.

Table 8. Instrumental Variable Method

/	First stage	Second stage
	Digital financial literacy	Consumption inequality
sy_t	/	-0.035***
/	/	(0.0006)
District average digital financial literacy	0.4840***	/
/	(0.0259)	/
First-stage F value	139.89	/
Control variables	Yes	Yes
Province fixed effects	Yes	Yes
N	12216	12216
R^2	0.3877	0.0714

Note. Standard errors in parentheses. * $p<0.1$, ** $p<0.05$, *** $p<0.01$.

5.4. Heterogeneity Analysis

5.4.1. Heterogeneity in Individual Characteristics

Individual characteristics shape consumption behavior and inequality. Age and gender are key factors, with differing effects. Exploring their heterogeneity helps understand consumption and guide targeted policies. The sample is split into three age groups: under 35, 30-60, and over 60, based on differences in consumption concepts and digital financial access. Gender grouping reflects social role divisions, as men and women differ in consumption and economic participation. Regression results for these groups are shown in Table 9.

Table 9. Heterogeneity Analysis by Age and Gender

/	Dependent variable: $rdkak$				
	Grouped by age			Grouped by gender	
	(1)	(2)	(3)	(4)	(5)
	Under 35	30-60	Over 60	Male	Female
sy_t	-0.0062	-0.0279***	-0.0355***	-0.0267***	-0.0186***
/	(0.0062)	(0.0033)	(0.0056)	(0.0030)	(0.0051)
Control variables	Yes	Yes	Yes	Yes	Yes
Province fixed effects	Yes	Yes	Yes	Yes	Yes
N	1366	7186	3664	9680	2536
R^2	0.2019	0.2381	0.3392	0.3030	0.3472

Note. Standard errors in parentheses. * $p<0.1$, ** $p<0.05$, *** $p<0.01$.

Columns (1)-(3) of Table 9 show the effect of digital financial literacy on consumption inequality by age group. The effect is declining for those under 35, but it does not pass the significance test. The alleviating effect is strongest for those over 60, exceeding the 30-60 group. Different generations integrate digital finance differently. Those under 35 grew up digital, so literacy gaps are small and effects limited. The 30-60 group increasingly relies on digital tools,

so literacy gaps start to matter. The over-60 group had later contact, so low literacy restricts access to digital services and deepens consumption inequality.

Columns (4) and (5) of Table 9 show that the coefficients of digital financial literacy are significant for consumption inequality for both males and females. Males have larger absolute value of the coefficient. This demonstrates that the effect of digital financial literacy in reducing consumption inequality is stronger for males. One possible reason is that males have higher engagement in financial markets. Better digital financial literacy offers them more advantages in investment and wealth management. They can better optimize consumption decisions and reduce consumption inequality. Women are relatively more conservative in their financial decisions. For females, the improvement in digital financial literacy has a weaker effect on consumption inequality.

Individual characteristics strongly shape consumption behavior and inequality. Marital status and education are controllable self-selection factors, reflecting life stage and knowledge while influencing consumption decisions and economic participation. They also affect how individuals use digital financial services. The sample is therefore divided into married and unmarried groups by marital status, and into low, middle, and high education groups. This grouping examines how digital financial literacy affects consumption inequality across different marital and educational backgrounds, revealing deeper determinants of consumption inequality.

This lays a theoretical foundation for subsequent formulation of economic policies and optimization of the consumption market. The analysis below will consider the grouped data concerning marriage and education.

Table 10. Heterogeneity Analysis by Marital Status and Education

/	Dependent variable: <i>rdkak</i>				
	Grouped by marital status		Grouped by education level		
	(1) Married	(2) Unmarried	(3) Low education	(4) Middle education	(5) High education
<i>sy_t</i>	-0.0254***	-0.0203***	-0.0502***	-0.0214***	0.0026
/	(0.0027)	(0.0075)	(0.0042)	(0.0042)	(0.0049)
Control variables	Yes	Yes	Yes	Yes	Yes
Province fixed effects	Yes	Yes	Yes	Yes	Yes
<i>N</i>	10803	1413	7956	3268	992
<i>R</i> ²	0.2804	0.3699	0.3011	0.2335	0.2795

Note. Standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 10, columns (1) and (2) show that digital financial literacy has a negative coefficient on consumption inequality for married and unmarried groups, respectively. Both pass the significance test at 1% level. However, the magnitude of the coefficient for the married group is significantly larger than that for the unmarried group. It implies that the alleviating effect of improved digital financial literacy on consumption inequality is more significant for married groups. This difference can be explained by the patterns of household financial decision-making and the size of capital. Married households tend to plan finances and make consumption decisions jointly. Better digital financial literacy helps couples better manage household assets and consumption planning. It reduces differences in consumption due to lack of financial knowledge. Consequently, it exerts a more profound inhibitory impact on consumption inequality. Single people have more independent consumption decisions based on their own needs. They have only a very small capital. The effects of digital financial tools on their

consumption are constrained both in scope and depth. Thus, they are less influenced by digital financial literacy.

Table 10, columns (3)-(5) reveal significant heterogeneity in the effects of digital financial literacy on consumption inequality across different education groups. The low-education group is most affected and passes the 1% significance test. Next is the group of middle education. The group of high education is the least affected and does not pass the significance test. Here are some possible reasons: The low-education group is lacking in financial knowledge reserves and digital financial tool skills. They may struggle to understand financial markets. Facing complex digital products, they are prone to information asymmetry and poor decisions. Improving digital financial literacy helps them use financial tools, improving consumption and reducing inequality. The middle-education group already has some financial knowledge and familiarity with digital tools. Better literacy further improves their consumption and wealth management, but with smaller marginal benefits. The high-education group has abundant financial knowledge and strong learning ability. They are already experienced in using different digital financial tools in everyday life. There are small differences in digital financial literacy within this group. Thus, the effect on consumption inequality is not large.

5.4.2. Heterogeneity in Household Characteristics

Characteristics like income level can cause a significant difference in the effect of DFL on consumption inequality. Therefore, it is valuable to explore the mechanism that DFL affects consumption inequality from the perspective of household heterogeneity in detail. This is helpful to reveal the deep logic of consumption stratification in digital economy. It also offers a theoretical basis for targeted financial inclusion policies. Annual household income is an important indicator of economic strength and resource endowment of households. It determines the ability to consume and the access to financial resources. It may also moderate the pathway through which DFL affects consumption behavior.

Descriptive statistics of the variables reveal that there are large differences in the household income of the subjects. The sample is therefore classified into low-, middle- and high-income groups based on the annual household income in this study. This enables better analyze of the relationship between DFL and consumption inequality at different income levels.

Table 11. Heterogeneity Analysis Based on Household Income Level

/	Dependent variable: <i>rdkak</i>		
	Low-income	Middle-income	High-income
/	(1)	(2)	(3)
<i>sy_t</i>	-0.0416***	-0.0151***	-0.0044
/	(0.0040)	(0.0043)	(0.0056)
Control variables	Yes	Yes	Yes
Province fixed effects	Yes	Yes	Yes
<i>N</i>	8326	2846	1044
<i>R</i> ²	0.2592	0.1484	0.1153

Note. Standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

As shown in Table 11, the regression coefficients of digital financial literacy on consumption inequality of low- and middle-income households are significantly negative at the 1% level. The effect of alleviation is greater for the low-income households. The coefficient for high income households is insignificant. Much of this difference is a reflection of the economic characteristics and financial demand structure of each income group. Low-income households are often more financially constrained. Low-income households have little disposable income

after basic expenses. Digital financial literacy helps them access digital tools, cut time and transaction costs, and use microcredit for unexpected needs. This prevents missed consumption due to fund shortages, reducing consumption inequality. It also compensates for their lack of traditional financial knowledge and pathways, helping them plan assets, use funds efficiently, and narrow the consumption gap. Middle-income households already have assets and stable income, so better digital financial literacy mainly offers more choices and convenience.

High-income households have some financial foundation, so marginal benefits are less clear. They weigh multiple factors in consumption decisions. Better digital financial literacy brings more information and tools, yet its impact on overall consumption inequality remains limited. Their financial needs are complex, covering asset preservation, tax planning, and wealth inheritance. These often require professional advisors, not digital tools alone.

5.4.3. Regional Heterogeneity

Regional and urban-rural gaps in consumption and inequality have long drawn academic and policy attention. Differences in economic development, industrial structure, and financial ecology shape consumption patterns, while urban-rural gaps in infrastructure, public services, and culture also influence consumption decisions. The sample is therefore divided into four regional groups (eastern, central, western, northeastern) and two urban-rural groups. This grouping reveals how regional and urban-rural factors affect consumption inequality and supports region-specific policies and coordinated development. The following analysis examines heterogeneity across both dimensions.

Table 12. Regional Heterogeneity Analysis

/	Dependent variable: <i>rdkak</i>					
	Grouped by region				Grouped by urban-rural	
	(1)	(2)	(3)	(4)	(5)	(6)
	Eastern	Central	Western	Northeastern	Urban	Rural
<i>sy_t</i>	-0.0194***	-0.0350***	-0.0255***	-0.0303***	-0.0179***	-0.0651***
/	(0.0038)	(0.0053)	(0.0052)	(0.0102)	(0.0027)	(0.0070)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Province fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
<i>N</i>	4615	3172	3450	979	7866	4350
<i>R</i> ²	0.2958	0.3329	0.3186	0.3125	0.2740	0.3322

Note. Standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

From columns (1)-(4) of Table 12, it can be found that the digital financial literacy has a significant negative impact on consumption inequality in all regions. Regional heterogeneity is clear. The effect of relief is the most pronounced in the central area (coefficient -0.035). Western region is -0.0255, northeastern region is -0.0303, and eastern region is -0.0194. The effect on the eastern region is rather weak. The central region shows the strongest reduction because digital finance coverage is uneven, and rising literacy helps previously inexperienced residents use digital tools and plan consumption better. The eastern region has a developed financial market and high average literacy, so the marginal effect is small. The west and northeast lag in economic development and financial infrastructure, so the improvement effect is weaker than in the central region.

The effect of digital financial literacy on alleviating consumption inequality is more significant in rural areas than in the urban-rural comparison, as shown in Columns (5) and (6) of Table 12. The coefficient is -0.0651, significant at the 1% level, because rural financial infrastructure is

weak and digital tool use is low. Better literacy helps rural residents overcome geographic barriers, access more services, and reduce consumption inequality substantially. Urban areas have developed services and higher literacy, so the effect is modest.

Digital financial literacy affects consumption inequality differently across individuals, households, and regions. Policies should target specific groups and regions, provide digital finance training, and improve infrastructure in central, western, and rural areas. This promotes fair access and reduces consumption inequality. Future research should explore more factors to support inclusive digital finance and consumption fairness.

6. Further Discussion: A Consumption-type Perspective

Building on the analysis of DFL and the overall inequality of consumption, this part analyzes different types of consumption. This helps to explain the functioning of DFL in the household consumption structure. The consumption is divided into subsistence consumption and development-enjoyment consumption. The first is the basic needs of life. The latter refers to quality of life and spiritual enjoyment. The two types differ in demand elasticity and decision-making. So, DFL can have different effects on their inequality. This section develops the internal logic of DFL on consumption inequality by sharpening the types of consumption [12].

Overall consumption is the sum of subsistence consumption and consumption for enjoyment of development. There are four types of outlays: food, clothing, housing and transportation. Subsistence consumption. Development - enjoyment consumption is the remainder of total consumption after the deduction of subsistence consumption. After distinguishing between the two types, the Kakwani index is calculated separately for regression analysis.

Table 13. Further Analysis from the Perspective of Consumption Type

/	Dependent variable: <i>rdkak</i>	
	Subsistence consumption	Development-enjoyment consumption
/	(1)	(2)
<i>sy_t</i>	-0.0194***	-0.0323***
/	(0.0026)	(0.0032)
Control variables	Yes	Yes
Province fixed effects	Yes	Yes
<i>N</i>	12216	12216
<i>R</i> ²	0.5325	0.3755

Note. Standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

As for the influence of DFL on different consumption inequality, Maslow's hierarchy of needs theory can give theoretical guidance. The subsistence, the main consumption, is to meet the physiological and safety needs, the most basic needs. Development-enjoyment consumption is more associated with social, esteem and self-actualization needs which are higher order needs. DFL plays a significant role in terms of physiological and safety needs. The coefficient for inequality of subsistence consumption is -0.0194. Each one unit increase in DFL reduces the inequality of subsistence consumption by 0.0194. People with a relatively high DFL are proficient at utilizing online financial tools. They manage personal finance more efficiently, they have steady flow of income. This meets basic subsistence needs, such as food and housing. It effectively alleviates survival difficulties caused by funding shortages. This narrows subsistence consumption inequality.

The coefficient of development-enjoyment consumption inequality is -0.0323 for social, esteem and self-actualization needs, which goes further. It implies that in this domain DFL

improvement has a large effect in reducing inequality. People with high DFL use online wealth management, mobile payment and other tools. They are easily adapted to new consumption scenarios. They engage in luxury cultural entertainments, tourism and other development-enjoyment activities. This adds to social interaction and fulfills the needs for belonging and love. Consumption experiences give them recognition and self-esteem. They move an inch closer to self-actualization. In contrast, limited DFL groups have knowledge gaps and operational barriers. They have problems of access to these development-enjoyment activities. They fall short of meeting higher order needs. This accentuates the inequality in development - enjoyment consumption.

The results show that the absolute value of the coefficient of inequality in development - enjoyment consumption is larger. This is because DFL plays a more important “screening” role in demand areas of higher order. DFL can be used for subsistence consumption to meet basic living needs, but basic needs are relatively fixed. In this way, individual differences in this domain are less visible. In the consumption of development enjoyment, DFL directly determines whether individuals can enter high-end and emerging consumption fields. And it also decides whether they can express value through consumption and satisfy higher-level psychological needs. This leads to greater differentiation of consumption.

Based on regression results from the consumption-type perspective and Maslow’s hierarchy of needs, DFL reduces both types of consumption inequality. The reduction effect is more pronounced for development-enjoyment consumption inequality. This is because the rigid nature of subsistence consumption limits DFL’s role. In contrast, development-enjoyment consumption relates to higher-level needs. DFL can therefore influence consumption behavior in this area to a greater extent. This produces a more significant effect on its inequality.

7. Conclusion

7.1. Research Conclusion

This paper studies the effect of DFL on consumption inequality. It draws a series of significant conclusions through rigorous theoretical analysis, model construction and empirical testing.

The empirical results show that the baseline regression model has significant negative relation between DFL and consumption inequality. More precisely, a rise in the individual DFL greatly reduces consumption inequality in the region or group. This result confirms the significance of advancing DFL for the optimization of the consumption structure and the promotion of consumption equity. The heterogeneity analysis shows that the effect of DFL on consumption inequality varies across different dimensions.

From the age perspective, the improvement effect of DFL on consumption inequality is more obvious for those over 60. From the gender perspective, males have higher participation in financial markets. The improvement of DFL gives them greater advantages in investment and wealth management. They can optimize consumption decisions more effectively and alleviate consumption inequality more significantly. From the marital status perspective, married groups have more complex household consumption decisions than single groups. They can collaboratively use digital financial tools to improve overall household consumption quality. This narrows the gap in living quality with high-income households and effectively alleviates household consumption inequality. From the education perspective, low-education groups are limited by insufficient financial knowledge and weak digital technology application ability. Their improvement in DFL has a stronger marginal effect on alleviating consumption inequality. From the household income perspective, improving DFL of low-income families helps them optimize capital allocation efficiency. Through reasonable wealth management, it enhances household economic resilience. This significantly narrows the consumption gap with high-income groups. From the regional perspective, rural areas and remote towns in central and

western China lack infrastructure and financial knowledge. Improving DFL helps residents overcome geographical limits, obtain broader financial services, and optimize consumption decisions. It also significantly alleviates consumption inequality.

Further analysis shows that the impact of DFL on different consumption types varies. Specifically, improving individual DFL effectively alleviates inequality in development and enjoyment consumption. Its impact on subsistence consumption inequality is relatively small.

7.2. Policy Recommendations and Implications

Based on the conclusions, this paper argues that alleviating individual consumption inequality and promoting common prosperity requires joint efforts. These efforts should come from national policies, the financial industry, and micro-level individuals. They should also promote high-quality development of digital finance.

At the national policy level, DFL cultivation should be incorporated into the national strategy. Digital finance courses should be embedded in the education system. Age-friendly training should be provided for the elderly to narrow the intergenerational digital divide. Investment in digital financial infrastructure in underdeveloped areas such as central and western China and rural areas should be increased. Differentiated regional policies should be implemented to improve financial service accessibility. Meanwhile, digital financial regulatory laws should be improved. A penetrative regulatory framework should be built to prevent systemic risks and protect consumer rights.

At the financial industry level, financial institutions should actively fulfill social responsibilities. They should promote innovation and optimization of digital financial services. They should carry out precise product design based on gender, education level, and other dimensions. They should provide suitable financial service plans for different groups. An online-offline integrated investor education system should be built. Big data should be used to achieve precise dissemination of financial knowledge and dynamic risk warnings. Financial technology should optimize service processes. Service efficiency and risk prevention capabilities should be improved while ensuring information security.

At the micro-individual level, a lifelong learning awareness should be established. Individuals should actively participate in financial knowledge training. They should comprehensively evaluate personal financial status in consumption and investment decisions. They should maintain rational judgment. They should strengthen personal information protection awareness and standardize the use of digital financial services. They should also focus on sharing financial knowledge within the family. This can improve overall family financial literacy and risk response capacity through intergenerational transmission.

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