

The Impact of Digital Literacy on Consumption Inequality

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ABSTRACT

In the context of accelerating digital transformation and the imperative to expand domestic demand, this study examines how digital literacy influences household consumption inequality. Using nationally representative panel data from the China Family Panel Studies (CFPS) from 2014 to 2022, the authors construct a multidimensional digital literacy index. The empirical results show that digital literacy significantly reduces consumption inequality. Mechanism analysis reveals that this effect operates through reducing income inequality, improving employment quality, and lowering barriers to online consumption. Heterogeneity analysis indicates that the effect is more pronounced among households without computer use at work and those with longer internet usage duration. Further results show stronger equalizing effects for low- and middle-consumption groups and for developmental and hedonic consumption. The findings highlight digital literacy's role in promoting inclusive consumption and reducing inequality in the digital economy.

KEYWORDS

Digital Literacy, Consumption Inequality, Income Inequality, Employment Quality, Online Consumption

INTRODUCTION

Against the backdrop of heightened global economic uncertainty and structural transformation, consumption inequality has become increasingly salient, undermining the role of consumption as a driver of economic growth and posing challenges to social stability. Disparities in consumption are evident across and within countries. For instance, according to NIQ's *Purchasing Power Europe 2025* report, per capita purchasing power in Europe ranges from €71,130 in Liechtenstein to €2,946 in Ukraine, a gap exceeding 24-fold. In 2025, urban per capita consumption in China was roughly 1.8 times that of rural residents despite faster rural consumption growth, according to data from the National Bureau of Statistics of China, reflecting a persistent urban–rural consumption divide. Existing cross-country research has confirmed that economic and educational endowments at the national

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level give rise to macro-level digital divides (Cruz-Jesus et al., 2018). From a micro perspective, heterogeneity in individual digital literacy may further create a second layer of digital usage gaps within households, which can ultimately translate into disparities in household consumption allocation and thereby contribute to consumption inequality.

Digital literacy has emerged as a critical form of human capital in the digital economy, shaping individuals' access to information, services, and economic opportunities. Early studies conceptualized digital literacy primarily in terms of basic operational and technical skills, such as the ability to use computers and the internet for information processing (Eshet, 2004). More recent research, however, extends this concept to encompass broader cognitive and social dimensions, including digital ethics, responsible use, and equitable access to digital resources. The OECD emphasizes that literacy, numeracy, and problem-solving skills are key to fully leveraging the Internet in *OECD Skills Outlook 2019: Thriving in a Digital World*, while the 2025 report *How's Life for Children in the Digital Age?* shows that children from higher socio-economic backgrounds spend more time on digital devices, suggesting that economic inequality may affect digital literacy development. Existing research further indicates that disparities in digital literacy can exacerbate inequality by constraining labor market participation among low-skilled groups (Wang et al., 2025), while digital inclusion plays an important role in addressing these gaps, particularly in rural areas of China (Yue & Cui, 2024).

Technological and financial support is a key driver of digital innovation, and digital capabilities have become core human capital affecting microeconomic behaviors of households and enterprises (Shao et al., 2025). A growing body of literature shows that digital literacy shapes economic outcomes by influencing how individuals access and use digital resources. Individuals with higher digital literacy are more likely to engage in learning-oriented and information-intensive activities (Moravec et al., 2024), achieve better labor market outcomes (Raileanu Szeles & Simionescu, 2022), strengthen entrepreneurial capacity (Wang et al., 2025), and enhance household financial resilience (Li et al., 2024). As digital platforms increasingly reshape economic activities and value creation (He et al., 2025), effective engagement with digital systems has become increasingly important.

Despite these advances, existing research has emphasized external digital conditions more than individuals' capability to convert those conditions into welfare. One stream examines how infrastructure and platforms improve information and labor-market access: government social media can facilitate knowledge acquisition (Wan et al., 2023), and broadband can improve employment and wages by lowering information and matching frictions (Bu & Tang, 2023). Another stream shows that e-commerce expands purchasing opportunities (Liu et al., 2024), digital finance supports risk diversification and consumption smoothing (Chen et al., 2024; Zhou et al., 2023), and platform design shapes technology adoption, perceived fairness, and value co-creation (Chakraborty et al., 2023; Yang et al., 2022; Jebarajakirthy et al., 2022). Yet access to the same infrastructure or platform does not guarantee equal benefits. Households differ in the skills needed to transform digital access into productive opportunities and effective consumption decisions. How this capability-conversion process affects the distribution of household consumption therefore remains insufficiently understood.

To address this gap, we develop an integrative digital capability-conversion framework explaining how households translate digital access into welfare. Productive digital skills enhance income and employment opportunities, while consumption-related capabilities improve information search, comparison, risk assessment, and platform use. The multidimensional Digital index contains operational, application, and cognitive indicators relevant to both domains, while the mechanisms connect the framework to observable resources, employment, and online-participation conditions. Whether digital literacy narrows consumption gaps also depends on opportunities and complementary resources. This perspective yields three contributions. First, it extends digital-divide research from access and use to unequal consumption outcomes by identifying capability conversion as the micro-level link. Second, it extends human-capital analysis beyond earnings by showing how digital literacy shapes consumption inequality through income distribution, employment quality, and online

consumption. Third, it explains why the equalizing role of digital literacy varies across work and digital-use contexts.

THEORETICAL ANALYSIS AND RESEARCH HYPOTHESES

The Effect of Digital Literacy on Consumption Inequality

Human-capital theory views skills as investments that enhance productivity, earnings, and economic opportunities (Becker, 1993). Digital-divide research distinguishes inequalities in digital access from disparities in skills and use (Scheerder et al., 2017). Differences in digital skills may further lead to unequal tangible outcomes from internet use (van Deursen & Helsper, 2015). Supported engagement can also strengthen individuals' confidence and practical ability to use digital technologies (Jacobs et al., 2014). Building on these insights, the digital capability-conversion framework distinguishes two conceptually related pathways through which digital literacy may influence consumption inequality. This distinction is particularly relevant because consumption is a relatively stable indicator of long-term household welfare and exhibits substantial intergenerational persistence (Attanasio & Pistaferri, 2016).

On the production side, digital literacy enables individuals to use online information, software, and platforms for learning, job search, employment, and entrepreneurship. It can expand access to labor-market and entrepreneurial opportunities, particularly among disadvantaged households with limited offline resources (Wang et al., 2024). Digital capabilities may also reduce information and matching frictions and facilitate transitions into employment among disadvantaged groups (Raileanu Szeles & Simionescu, 2022). In addition, digital literacy may promote intergenerational mobility by broadening access to information and reducing dependence on parental social capital (Wang et al., 2024). By improving employment quality, income opportunities, and economic mobility, digital literacy may reduce the resource disparities underlying unequal consumption.

On the consumption side, digital literacy strengthens individuals' ability to process information, allocate resources, and manage economic risks, thereby reducing vulnerability to income shocks and stabilizing consumption (Zhang & Li, 2026). Participation in online markets can reduce geographical constraints and broaden access to goods and services (Zhang & Qu, 2024). Digital capabilities may also facilitate product comparison, lower transaction costs, and improve the efficiency with which household resources are converted into consumption (Li et al., 2024). At the broader market level, stronger digital capabilities can promote participation in digital markets and foster more inclusive economic activity (Irfan et al., 2022). Among older households, digital literacy may further promote consumption upgrading through reduced precautionary saving and changes in mental well-being (Li & Shao, 2025). Because lower-resource households generally face greater employment, information, and market-access constraints, these production- and consumption-side benefits may generate larger marginal gains for them and thereby narrow consumption disparities.

H1: Digital literacy mitigates consumption inequality.

Mechanism Analysis of Digital Literacy on Consumption Inequality

Income Inequality

Income inequality is a key determinant of consumption inequality, as larger income gaps typically translate into wider consumption disparities, particularly when driven by persistent factors such as skills and education rather than temporary shocks (Attanasio & Pistaferri, 2016). Wealth and opportunity inequality further reinforce this pattern (Fisher et al., 2022; Jin et al., 2011). Relative-income concerns also shape household consumption and financial decisions (Bricker et al., 2021). In addition, high-income households are more likely to engage in development- and enjoyment-oriented

consumption, while low-income households face binding budget constraints that limit consumption upgrading (Lu et al., 2022). Financial access gaps also exacerbate these disparities, as disadvantaged groups face greater barriers to credit and financial services (Hunt & Ritter, 2024).

Productive digital skills may narrow income disparities by improving access to digital financial services (Lai et al., 2020). They can also strengthen households' capacity to smooth income shocks (Zhou et al., 2023), expand access to low-cost financial tools in less-developed regions (Qin & Liu, 2025), and broaden employment opportunities (Wang et al., 2025). These benefits may be larger for households with limited offline finance, information, and social networks. By narrowing persistent resource gaps and stabilizing disposable resources, digital literacy may weaken the transmission of income inequality into consumption inequality (Li et al., 2025).

Employment Quality

Employment quality is an important determinant of household consumption inequality because individuals' evaluations of promotion opportunities and career development affect their expectations of future labor income. More favorable promotion prospects can strengthen income confidence, reduce uncertainty, and support longer-term consumption decisions. In contrast, limited perceived career advancement may increase precautionary saving and constrain discretionary consumption. When promotion opportunities are concentrated among advantaged workers, differences in perceived employment quality may therefore reinforce household consumption disparities.

Productive digital skills may improve perceived employment quality by expanding access to employment information, training resources, and career-development opportunities. They can reduce job-search and information frictions, help workers understand changing skill requirements, and improve their ability to identify suitable employment and promotion opportunities (Sun et al., 2023; Wang et al., 2026). Digital skills may also broaden access to remote, platform-based, and technology-intensive work, thereby improving perceived flexibility and career prospects (Graham et al., 2017). These benefits may be particularly important for rural and low-skilled workers with limited offline employment networks, as digital capabilities can increase their perceived opportunities for occupational mobility and advancement (Wang et al., 2025). By improving expected employment opportunities and career progression, digital literacy may strengthen the negative association between perceived employment quality and consumption inequality.

Online Consumption

Digital access alone can have unequal consumption effects. E-commerce broadens product choice and lowers geographic barriers, but households with higher income and stronger digital capabilities are better positioned to capture price advantages, personalized recommendations, and higher-quality products (Wu et al., 2023; Liu et al., 2024). Recommendation systems, platform value co-creation, and pricing or fairness perceptions can further differentiate benefits across consumers (Jebarajakirthy et al., 2022; Yang et al., 2022). Thus, when access expands faster than the capabilities needed for effective use, online markets may reproduce or even amplify existing consumption disparities.

Conceptually, consumption-related digital capabilities can counter this risk by helping households search across sellers, compare total prices and quality, verify product information, recognize fraudulent content, and use digital financial tools prudently (Li et al., 2024; Lai et al., 2020). Evidence on digital-payment penetration links it to regional consumption inequality (Qin & Liu, 2025), while domain-specific research associates digital financial inclusion with household energy efficiency through changes in shopping and consumption patterns (Zhang et al., 2025). Business investment in customers' digital literacy has also been associated with greater digital transactions in a developing-country context (Irfan et al., 2022). These capabilities may improve the value obtained from a given budget, particularly where local product variety and offline information are limited (Zhang & Qu, 2024; Chen & Hu, 2025).

Based on the above, we propose:

H2: Digital literacy can mitigate consumption inequality by reducing income disparities, improving employment quality, and narrowing gaps in online consumption capacity.

Heterogeneity Analysis of the Impact of Digital Literacy on Consumption Inequality

The conversion of digital literacy into consumption outcomes is context dependent. The digital capability-conversion framework identifies three boundary conditions: institutional substitution, organizational complementarity, and opportunities for skill application. Workplace digital exposure may substitute for individual digital literacy, organizational resources may complement digital skills, and frequent internet use may facilitate the repeated application needed for digital capabilities to generate welfare gains.

Workplace computer use provides structured exposure to digital tools, employer support, and learning-by-doing opportunities. For workers who regularly use computers, some information-processing and digital-task capabilities are already integrated into their work environment. Thus, additional improvements in individual digital literacy may generate smaller marginal benefits for household consumption decisions. In contrast, workers without workplace computer access lack such institutional support and face greater initial digital constraints. Their own digital literacy may therefore serve a stronger compensatory function, producing larger inequality-reducing effects.

Firm size captures the availability of complementary organizational resources. Larger firms are more likely to provide digital infrastructure, employee training, standardized information systems, and career-development opportunities. These resources can enhance the returns to individual digital literacy by helping workers transform digital skills into higher productivity, better career prospects, and more stable income. Smaller firms, however, may provide fewer opportunities for skill application, limiting the translation of digital literacy into household welfare. Therefore, organizational context influences the effectiveness of digital literacy in reducing consumption inequality (Shi, 2024).

Internet usage intensity reflects the frequency of digital skill application and may shape the distributional effects of digital literacy (Huang & Quan, 2025). Frequent internet use enables households to acquire updated information, understand platform mechanisms, compare consumption and employment opportunities, and accumulate practical experience. Accordingly, households with higher internet usage intensity are more likely to convert digital literacy into tangible consumption benefits, suggesting a stronger inequality-reducing effect.

Based on the above, we propose:

H3: The effect of digital literacy on consumption inequality is heterogeneous and is shaped by computer use at work, firm size, and internet usage intensity.

RESEARCH DESIGN

Data Source

The data are from the China Family Panel Studies (CFPS), funded by Peking University and the National Natural Science Foundation of China. The CFPS is maintained by the Institute of Social Science Survey of Peking University. Due to changes in the household consumption questionnaire in 2012, we use data from five waves of the survey conducted between 2014 and 2022. Province-level variables are drawn from the statistical yearbooks of provinces, autonomous regions, and municipalities. The final dataset includes 11,874 observations, forming an unbalanced panel.

Variable Selection

Dependent Variable

The dependent variable in this study is consumption inequality (*Kakwani*). Following Chen et al. (2024), household consumption inequality is measured using the Kakwani index. Among commonly used individual-level measures, such as the Yitzhaki index, the Podder index, and the Kakwani index, the former two do not satisfy normalization properties; therefore, the Kakwani index is adopted.

The CFPS provides detailed information on household expenditures. According to the *Classification of Household Consumption Expenditure (2013)* issued by the National Bureau of Statistics of China, consumption is aggregated into eight categories: food, clothing, housing, household equipment and services, transportation and communication, education and recreation, healthcare, and others. Total household consumption is obtained by summing these categories and dividing by household size to calculate per capita consumption. The Kakwani index is then computed using per capita consumption within each county–year group, with values ranging from 0 to 1. For ease of interpretation in regression analysis, the index is multiplied by 100.

Independent Variable

The independent variable in this study is digital literacy (*Digital*), which is constructed based on financial respondents' answers to internet-related questions. Following Wang et al. (2025), we measure digital literacy in three dimensions: digital operational literacy, digital application literacy, and digital cognitive literacy (as shown in Table 1).

Since CFPS internet-related questions changed over the sample period, several adjustments were made. From 2018 onward, the original question “Do you access the internet?” was split into computer and mobile internet use; we combined these responses into a single indicator of internet access for 2018–2022. Additionally, prior to 2020, internet usage frequency was measured on a seven-level scale, whereas from 2020 onward it was recorded as daily usage (yes/no). Accordingly, responses from 2014–2018 were recoded into a binary 0–1 variable representing daily usage. To better capture the effect of digital access, the digital cognitive literacy scale was adjusted to range from 0 to 5, with 0 representing no internet use, 1 representing “very unimportant,” and 5 representing “very important.”

A composite digital literacy index is constructed using factor analysis. The suitability of factor analysis is confirmed by the Kaiser–Meyer–Olkin (KMO) test and Bartlett's test of sphericity. The KMO statistic is 0.8898, exceeding the conventional threshold of 0.6, and Bartlett's test is statistically significant, indicating strong inter-item correlations. Based on the Kaiser criterion (eigenvalues greater than 1) and the cumulative percentage of variance explained, three factors were retained. Weighted factor scores are then used to construct the household-level digital literacy index.

Table 1. Digital Literacy Measurement Index

Dimension	Variable Name	Specific Question	Value Range
Digital Operational Literacy	<i>Useweb</i>	Whether you use the internet	0-1
Digital Application Literacy	<i>Entertain</i>	Whether you use the internet for entertainment	0-1
	<i>Study</i>	Whether you use the internet for learning	0-1
	<i>Social</i>	Whether you use the internet for socializing	0-1
	<i>Work</i>	Whether you use a computer at work	0-1
	<i>Everydayentertain</i>	Whether you engage in online entertainment daily	0-1
	<i>Everydaystudy</i>	Whether you engage in online learning daily	0-1
	<i>Everydaysocial</i>	Whether you engage in online socializing daily	0-1
	<i>Everydayshop</i>	Whether you engage in online shopping daily	0-1
Digital Cognitive Literacy	<i>Webentertain</i>	The importance of the internet for entertainment	0-5
	<i>Webstudy</i>	The importance of the internet for learning	0-5
	<i> Websocial</i>	The importance of the internet for socializing	0-5
	<i>Webshop</i>	The importance of the internet for shopping/ daily life	0-5
	<i>Webwork</i>	The importance of the internet for work	0-5

Mechanism Variables

This study employs income inequality (*Gini*), employment quality (*Employ*), and online consumption (*Onlineshop*) as mechanism variables. Income inequality is measured by the county-level Gini coefficient, ranging from 0 (perfect equality) to 1 (complete inequality). Based on total household income, households are ranked within each county-year, cumulative income shares are calculated, and the Gini coefficient is derived from the area between the Lorenz curve and the line of perfect equality. Employment quality is proxied by respondents' job promotion satisfaction in CFPS. This variable reflects individuals' subjective evaluation of their career advancement and perceived job conditions, which capture the perceived dimension of employment quality. Online consumption reflects shifts in consumption patterns and serves as a key channel through which the digital economy influences household welfare. It is measured by the share of online shopping expenditure in total consumption using CFPS data for 2014–2018, as this variable is not available in subsequent waves.

Control Variables

To mitigate omitted variable bias, this study controls for ten variables at the individual, household, and provincial levels. Individual-level controls include the financial respondent's age (*Age*) and its squared term (*Age*²) to capture potential nonlinear effects; gender (*Gender*); marital status (*Marriage*); health status (*Health*); education (*Edu*); and household registration (*Urban*). These variables account for heterogeneity in preferences, economic conditions, and access to digital resources that may influence consumption behavior.

Household-level and provincial-level controls include household income (*Fincome*), which determines consumption capacity; household size (*Familysize*), capturing differences in total and per capita expenditure; and provincial total retail sales of consumer goods (*Retail*), reflecting the regional economic environment and consumption conditions. Detailed variable definitions are reported in Table 2.

Table 2. Detailed Variable Definitions

Variable	Variable symbol	Variable name	Description
Dependent variable	<i>Kakwani</i>	Consumption inequality	Per capita Kakwani index $\times 100$
Independent variable	<i>Digital</i>	Digital literacy	Composite index constructed via KMO and Bartlett's tests
Mechanism variables	<i>Gini</i>	Income inequality	County-level Gini index
	<i>Employ</i>	Employment quality	Job promotion satisfaction of respondent
	<i>Onlineshop</i>	Online consumption	Ratio of online consumption to total household expenditure
Control variables	<i>Age</i>	Age	Respondent's age
	<i>Age²</i>	Age squared	Respondent's age squared / 100
	<i>Gender</i>	Gender	Respondent's gender
	<i>Marriage</i>	Marital status	Whether respondent is married
	<i>Health</i>	Health status	1 = very healthy, 5 = unhealthy
	<i>Edu</i>	Education level	1 = illiterate, 9 = PhD
	<i>Urban</i>	Household registration	0 = rural, 1 = urban
	<i>Fincome</i>	Total household income	Logarithm of total household net income
	<i>Familysize</i>	Household size	Number of family members sharing the same household
	<i>Retail</i>	Retail sales of consumer goods	Logarithm of total retail sales of consumer goods (100 million RMB) at provincial level

Descriptive Statistics

As shown in Table 3, the mean level of consumption inequality (Kakwani) is 31.6208, while the average level of digital literacy (Digital) is 0.0450. Variance inflation factor (VIF) tests are conducted for all variables except the squared age term, with a maximum VIF of 1.96, well below the threshold of 5, indicating that multicollinearity is not a serious concern.

Table 3. Descriptive Statistics of Main Variables

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
<i>Kakwani</i>	11874	31.6208	23.1837	0.0000	96.6282
<i>Digital</i>	11874	0.0450	0.6642	-0.8315	1.7261
<i>Gini</i>	11874	0.3572	0.1373	0.0000	0.8135
<i>Employ</i>	11874	1.4831	1.7749	0.0000	5.0000
<i>Onlineshop</i>	7274	0.0298	0.1400	0.0000	7.6052
<i>Age</i>	11874	40.4974	11.0107	16.0000	86.0000
<i>Age²</i>	11874	17.6126	9.5441	2.5600	73.9600
<i>Gender</i>	11874	0.5565	0.4968	0.0000	1.0000
<i>Edu</i>	11874	3.7640	1.4414	1.0000	9.0000

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Table 3. Continued

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
<i>Marriage</i>	11874	0.9486	0.2208	0.0000	1.0000
<i>Health</i>	11874	2.8100	1.0573	1.0000	5.0000
<i>Fincome</i>	11874	11.3554	1.0040	0.0000	16.0302
<i>Urban</i>	11874	0.7117	0.4530	0.0000	1.0000
<i>Familysize</i>	11874	3.6509	1.6788	1.0000	15.0000
<i>Retail</i>	11874	9.4262	0.7391	6.5691	10.7118

Model Setting

Benchmark Regression Model

To test Hypothesis 1, namely that digital literacy mitigates household consumption inequality, we construct the following baseline model to examine the effect of digital literacy on consumption inequality:

$$Kakwani_{it} = \alpha_0 + \alpha_1 Digital_{it} + \beta Control_{it} + \varphi_i + \varphi_t + \varepsilon_{it} \quad (1)$$

In equation (1), i denotes the household and t denotes the year. φ_i represents family fixed effects, φ_t represents time fixed effects, and ε_{it} is the random error term. *Control* denotes the set of control variables. $Kakwani_{it}$ measures the level of consumption inequality for household i in year t , and $Digital_{it}$ represents the digital literacy level of household i in year t . Model (1) examines the effect of digital literacy on household consumption inequality. The coefficient α_1 captures the impact of digital literacy on consumption inequality; a significantly negative α_1 would indicate that higher digital literacy mitigates consumption inequality.

Mechanism Testing Model

To test Hypothesis 2, which proposes that digital literacy reduces household consumption inequality through multiple mechanisms, we follow Wang et al. (2024) and specify the following mediation model:

$$Kakwani_{it} = \alpha_0 + \alpha_1 Digital_{it} + \alpha_2 Med_{it} + \alpha_3 Med_{it} \times Digital_{it} + \beta Control_{it} + \varphi_i + \varphi_t + \varepsilon_{it} \quad (2)$$

Equation (2) extends equation (1) by including the mechanism variables and their interactions with digital literacy. The coefficient α_3 captures how digital literacy affects household consumption inequality through the specified mechanism variables.

EMPIRICAL ANALYSIS

Benchmark Regression Results

Table 4 presents the estimation results on the impact of digital literacy on household consumption inequality, with digital literacy (*Digital*) as the key explanatory variable. Column (1) reports the baseline specification without fixed effects; column (2) introduces year fixed effects; column (3) further adds family and year fixed effects; and column (4) additionally incorporates control variables. Across all specifications, digital literacy consistently exhibits a statistically significant negative effect on consumption inequality at the 1% level, and the results remain robust to the inclusion of fixed effects and

additional controls. In column (4), the coefficient on *Digital* is -2.1604 , implying that a one-unit increase in digital literacy is associated with a 2.1604-unit reduction in consumption inequality. The sample standard deviation of digital literacy is 0.6642. Accordingly, a one-standard-deviation increase in digital literacy is associated with a 1.435-point decrease in the Kakwani index. This means that when a household's digital literacy increases by an amount comparable to the typical variation observed in the sample, its level of consumption inequality is, on average, lower by 1.435 points. This reduction represents approximately 4.5% of the sample mean of the Kakwani index.

The control variables generally align with prior expectations. Health status (*Health*) is negatively associated with consumption inequality, suggesting that poorer health conditions increase mandatory medical spending and reduce discretionary consumption, leading to a more homogeneous consumption structure across households and thus lower measured inequality. Household income (*Fincome*) also shows a negative relationship, indicating that consumption inequality declines as income increases within a certain range. In contrast, household size (*Familysize*) has a significant positive effect, implying that larger households tend to experience higher consumption inequality, likely due to greater consumption needs and associated costs. Finally, provincial retail sales of consumer goods (*Retail*) is positively associated with consumption inequality, suggesting that regions with higher overall consumption levels tend to exhibit more pronounced inequality.

Table 4. Benchmark Regression Results

Variables	(1)	(2)	(3)	(4)
	Kakwani	Kakwani	Kakwani	Kakwani
<i>Digital</i>	-7.6829***	-8.2165***	-2.7746***	-2.1604***
	(0.3132)	(0.3259)	(0.5884)	(0.5920)
<i>Age</i>				-0.4650
				(0.2991)
<i>Age</i> ²				0.6843**
				(0.3374)
<i>Gender</i>				0.3189
				(0.7846)
<i>Edu</i>				-0.2661
				(0.4701)
<i>Marriage</i>				-1.0493
				(2.0615)
<i>Health</i>				-0.6796**
				(0.3223)
<i>Fincome</i>				-3.1685***
				(0.5346)
<i>Urban</i>				0.6822
				(1.4520)
<i>Familysize</i>				4.6284***
				(0.4232)
<i>Retail</i>				4.8448***

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Table 4. Continued

Variables	(1)	(2)	(3)	(4)
	Kakwani	Kakwani	Kakwani	Kakwani
				(1.6706)
Cons	32.1189***	30.9020***	28.6200***	12.5967
	(0.2347)	(0.3551)	(0.4289)	(17.5647)
Family FE	NO	NO	YES	YES
Year FE	NO	YES	YES	YES
N	11874	11874	11874	11874
Adj. R ²			0.0166	0.0662

Note: Robust standard errors clustered at the household level are reported in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively; the same applies to the tables below.

Robustness Checks

This study conducts robustness checks by replacing the dependent variable, replacing the key explanatory variable, and applying propensity score matching (PSM). The results remain consistent with the baseline estimates.

Replacing the Dependent Variable

Alternative measures of consumption inequality are employed. As shown in Table 5, columns (1)–(4) use the Yitzhaki index, Podder index, within-county-year percentile ranking of household consumption, and the variance of log per-capita consumption as dependent variables, respectively. Table 5 reports the corresponding results.

The findings indicate that the negative effect of digital literacy on consumption inequality is robust across alternative measures. When the Yitzhaki and Podder indices are used, the coefficients on digital literacy remain significantly negative, suggesting that improvements in digital literacy reduce households' relative consumption deprivation. Similarly, using the variance of log consumption as the dependent variable, digital literacy significantly decreases the dispersion of consumption within regions, indicating a narrowing of overall consumption gaps. By contrast, the effect on consumption percentiles is statistically insignificant, implying that digital literacy does not significantly alter households' relative positions within the consumption distribution. Overall, digital literacy primarily reduces consumption inequality by compressing within-distribution disparities rather than reshaping relative rankings.

Table 5. Results with Alternative Dependent Variables

Variables	(1)	(2)	(3)	(4)
	Yitzhaki	Podder	Percentile	Var_logconsume
Digital	-0.0160***	-0.0019***	0.6777	-0.0255***
	(0.0039)	(0.0005)	(0.6278)	(0.0078)
Cons	0.1056	0.0147	69.1199***	0.6420**
	(0.1112)	(0.0135)	(24.6117)	(0.2661)
Controls	YES	YES	YES	YES

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Table 5. Continued

Variables	(1)	(2)	(3)	(4)
	Yitzhaki	Podder	Percentile	Var_logconsume
Family FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
N	11874	11874	11320	11071
Adj. R ²	0.2929	0.1296	0.6012	0.0912

Replacing the Independent Variable

This study constructs alternative measures of digital literacy. As shown in Table 6, *Digital1* is defined as the sum of five binary indicators capturing whether respondents use the internet and whether they use it for entertainment, learning, social interaction, and work. *Digital2* aggregates four binary indicators reflecting daily engagement in online entertainment, learning, social interaction, and online shopping. *Digital3* measures digital cognitive literacy, defined as the aggregated score of perceived importance of the internet. *Digital4* is constructed via factor analysis by extending the baseline digital literacy indicators with weekly internet usage time (hours) and the number of provincial broadband access ports (ten-thousand units), thereby incorporating both individual usage intensity and regional digital infrastructure. To distinguish between productive and recreational forms of digital engagement, *Digital5* aggregates online learning and online work activities, while *Digital6* aggregates online entertainment and online social activities. Both measures are constructed by summing the products of activity participation dummies and the perceived importance attached to these activities.

Columns (1)–(3) in Table 6 report coefficients of -0.8453 , -0.7792 , and -0.1669 , which are significant at the 1%, 5%, and 1% levels, respectively. These results suggest that operational and application dimensions of digital literacy exert a stronger mitigating effect on consumption inequality than cognitive literacy. This implies that improvements in practical digital skills are more effective in reducing consumption inequality. Column (4) shows that the coefficient on *Digital4* is -1.8844 and remains significant at the 5% level. This indicates that, after accounting for regional digital infrastructure and individual usage intensity, the estimated effect of digital literacy is somewhat attenuated but remains robust. Columns (5) and (6) report the estimates for *Digital5* and *Digital6*. The coefficients are -0.3052 and -0.2659 , respectively, and both are statistically significant. The slightly larger coefficient for *Digital5* suggests that productive and learning-oriented digital activities may contribute more to narrowing consumption inequality than recreational digital activities.

Table 6. Results Using Alternative Measures of Digital Literacy

Variables	(1)	(2)	(3)	(4)	(5)	(6)
	Kakwani	Kakwani	Kakwani	Kakwani	Kakwani	Kakwani
<i>Digital1</i>	-0.8453***					
	(0.2525)					
<i>Digital2</i>		-0.7792**				
		(0.3345)				
<i>Digital3</i>			-0.1669***			
			(0.0549)			

continued on following page

Table 6. Continued

Variables	(1)	(2)	(3)	(4)	(5)	(6)
	Kakwani	Kakwani	Kakwani	Kakwani	Kakwani	Kakwani
<i>Digital4</i>				-1.8844**		
				(0.9163)		
<i>Digital5</i>					-0.3052***	
					(0.1044)	
<i>Digital6</i>						-0.2659**
						(0.1122)
Cons	15.0435	13.9948	14.4295	16.6354	11.4317	14.2932
	(17.5762)	(17.6464)	(17.5807)	(28.5329)	(17.5622)	(17.6132)
Controls	YES	YES	YES	YES	YES	YES
Family FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
N	11874	11874	11874	6583	11874	11874
Adj. R ²	0.0659	0.0644	0.0655	0.0538	0.0652	0.0646

Propensity Score Matching

To mitigate potential selection bias arising from non-random internet access, a binary indicator capturing whether the financial respondent uses the internet is constructed, and a set of control variables is included as covariates. The nearest-neighbor matching approach is employed, resulting in 11,745 matched observations. As shown in Column (1) of Table 7, the estimated coefficient on *Digital* is -2.1982 and remains statistically significant at the 1% level. This finding confirms that the baseline results are robust to potential selection bias.

Endogeneity Discussion

Following Jin et al. (2026), this study uses the number of post offices per million people in 1984 (*PostOffice1984*) as an instrumental variable for digital literacy. Historical postal infrastructure reflects the early development of local communication networks and is closely associated with the accumulation of digital capabilities, while it is unlikely to directly affect current household consumption inequality. As shown in Table 7, the first-stage results show that the coefficient on the instrumental variable is 0.0024 and is significant at the 5% level, with an F-statistic of 59.81, indicating that the instrument is relevant and not weak. In the second stage, the coefficient on *Digital* is -97.3397 and remains significant at the 10% level, suggesting that digital literacy significantly reduces consumption inequality after accounting for endogeneity. Overall, the IV estimates are consistent with the baseline results.

Table 7. Results of PSM and Endogeneity Tests

Variables	(1)	(2)	(3)
	PSM	Result of first stage	Result of second stage
	Kakwani	Digital	Kakwani
<i>PostOffice1984</i>		0.0024**	
		(0.0011)	
<i>Digital</i>	-2.1982***		-97.3397*
	(0.6020)		(54.6237)
Cons	12.3402	-0.6656	-71.7666
	(18.4056)	(0.6289)	(79.0973)
Controls	YES	YES	YES
Family FE	YES	YES	YES
Year FE	YES	YES	YES
N	11745	9411	9411
Adj. R ²	0.0663	0.2326	

Mechanism Tests

This study conducts mechanism analysis based on econometric model (2). Table 8 reports the results on the channels through which household digital literacy affects consumption inequality.

In column (1), the coefficient on *Gini* is significantly positive, indicating a positive association between income inequality and consumption inequality. The interaction term *Digital* × *Gini* is significantly negative at the 5% level, suggesting that higher digital literacy helps reduce income inequality, thereby indirectly mitigating consumption inequality.

In column (2), the coefficient on *Employ* is negative, implying that improvements in employment quality contribute to lower consumption inequality. The interaction term *Digital* × *Employ* is also negative and significant at the 10% level, indicating that digital literacy enhances employment quality, which in turn alleviates consumption inequality.

In column (3), the coefficient on online consumption (*Onlineshop*) is significantly positive at the 5% level, suggesting that differences in online consumption participation and capability may increase consumption inequality. The interaction term *Digital* × *Onlineshop* is significantly negative, indicating that digital literacy can offset this inequality-enhancing effect. This is likely because higher digital literacy improves households' ability to access digital markets and use online platforms more efficiently by comparing prices, evaluating product information, and avoiding consumption traps. As a result, it reduces capability gaps in online consumption and weakens the distributional disparities associated with digital consumption channels.

Table 8. Results of Mechanism Analysis

Variables	(1)	(2)	(3)
	Kakwani	Kakwani	Kakwani
<i>Digital</i>	-1.3170**	-1.4258**	-1.6616*
	(0.5115)	(0.6945)	(1.0015)

continued on following page

Table 8. Continued

Variables	(1)	(2)	(3)
	Kakwani	Kakwani	Kakwani
<i>Gini</i>	90.8393***		
	(2.7434)		
<i>Digital</i> × <i>Gini</i>	-5.7898**		
	(2.7544)		
<i>Employ</i>		-0.0545	
		(0.2001)	
<i>Digital</i> × <i>Employ</i>		-0.4581*	
		(0.2409)	
<i>Onlineshop</i>			13.8153**
			(6.8496)
<i>Digital</i> × <i>Onlineshop</i>			-13.1963*
			(7.4504)
Cons	23.6507	12.0157	-78.3417*
	(17.2609)	(17.5822)	(43.2657)
Controls	YES	YES	YES
Family FE	YES	YES	YES
Year FE	YES	YES	YES
N	11874	11874	7274
Adj. R ²	0.2916	0.0669	0.0874

Heterogeneity Analysis

The impact of digital literacy on consumption inequality may vary across households due to heterogeneity in occupational characteristics, as reflected in workplace computer use, employer firm size, and internet usage intensity, which may shape the extent to which digital literacy translates into consumption outcomes.

Workplace Computer Use

The sample is divided based on whether the financial respondent uses a computer at work. Table 9 reports the results in Columns (1) and (2). The coefficient on *Digital* is −2.4830 for households without workplace computer use and −0.8757 for those with workplace computer use, with the latter being statistically insignificant. This suggests that digital literacy has a stronger inequality-reducing effect among households without workplace computer use, where digital skills are more crucial for accessing and processing information in consumption decisions.

Firm Size

Using CFPS information on respondents' employer size, the sample is split at the median into larger and smaller firms. Columns (3) and (4) report the results. The coefficient on *Digital* is −2.4786 and significant at the 1% level for households with members employed in larger firms, while it is negative but insignificant for those in smaller firms. This indicates that the effect is more pronounced among households whose members work in larger firms, possibly due to more stable income and better access to formal

resources that enhance consumption smoothing and the translation of digital skills into consumption efficiency.

Internet Usage Intensity

Based on CFPS internet module data, internet usage is constructed as follows: in the 2016–2018 waves, weekly leisure internet hours are converted into average daily usage; in the 2020 wave, internet use is measured as the greater of daily mobile time and computer usage time due to changes in survey design during the pandemic. The sample is then split at the median into high-usage and low-usage groups. Columns (5) and (6) report the results. The coefficient on *Digital* is -1.5044 and significant at the 10% level in the high-usage group, while it is statistically insignificant in the low-usage group, suggesting that digital literacy reduces consumption inequality mainly among households with higher internet usage intensity.

Table 9. Results of Heterogeneity Analysis

Variables	(1)	(2)	(3)	(4)	(5)	(6)
	No computer use at work	Computer use at work	Larger firm	Smaller firm	Higher-usage	Lower-usage
<i>Digital</i>	-2.4830**	-0.8757	-2.4786***	-1.6545	-1.5044*	-2.0181
	(1.2471)	(0.8946)	(0.8849)	(1.0487)	(0.7782)	(1.9364)
Cons	-16.2496	34.3847	46.4723	-29.7863	-9.8274	8.5555
	(33.7110)	(23.9572)	(28.9882)	(30.4349)	(26.1666)	(73.9690)
Controls	YES	YES	YES	YES	YES	YES
Family FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
N	5954	5920	6088	5786	8457	3417
Adj. R ²	0.0690	0.0627	0.0614	0.0767	0.0658	0.0611

FURTHER ANALYSIS

The Impact of Digital Literacy Across Consumption Groups

To further investigate how digital literacy affects consumption inequality, this study proposes two competing hypotheses. The first posits that digital literacy mainly reduces consumption among high-consumption households, thereby narrowing the gap with middle- and low-consumption households and reducing overall inequality in a statistical sense. The second suggests that digital literacy primarily raises consumption among middle- and low-consumption households, narrowing the gap with high-consumption households and reducing inequality through upward convergence. This study employs Equation (3) to estimate the heterogeneous effects of digital literacy across different consumption deciles:

$$\begin{aligned}
 Kakwani_{it} = & \alpha_0 + \alpha_1 Digital_{it} + \alpha_2 Consume_{group_{it}} + \alpha_3 Consume_{group_{it}} \times \\
 & \times Digital_{it} + \beta Control_{it} + \varphi_i + \varphi_t + \varepsilon_{it}
 \end{aligned} \tag{3}$$

In Equation (3), $Consume_group_{it}$ denotes consumption-interval fixed effects. Households are ranked by per-capita consumption each year and divided into ten equal groups, where $Consume_group1$ represents the bottom 10% of the consumption distribution, and so on. The interaction term $Consume_group_{it} \times Digital_{it}$ captures the heterogeneous effects of digital literacy across consumption groups. All other variables are defined as in Equation (1).

Table 10 reports the heterogeneous effects of digital literacy across different consumption groups. In column (1), the coefficient on digital literacy is -4.846 and is significant at the 1% level, indicating that digital literacy significantly reduces consumption inequality for the lowest consumption group. The interaction terms for the higher consumption groups are generally positive and significant, suggesting that this inequality-reducing effect gradually weakens as household consumption levels increase.

To further examine the mechanism, column (2) replaces the dependent variable with the log of per-capita household consumption ($Consume$). The coefficient on digital literacy is 0.0891 and is significant at the 1% level, while all interaction terms are significantly negative at the 1% level, ranging from -0.0649 to -0.1061 . For the highest consumption group, the overall effect is -0.0170 , indicating that digital literacy no longer promotes consumption and may even slightly restrain it.

Overall, the results suggest that digital literacy mainly reduces consumption inequality by increasing the consumption of low- and middle-consumption households, particularly those at the bottom of the distribution, thereby narrowing the overall consumption gap.

Table 10. The Impact of Digital Literacy on Households Across Consumption Levels

Variables	(1)	(2)
	Kakwani	Consume
<i>Digital</i>	-4.8460^{***} (1.1445)	0.0891^{***} (0.0208)
<i>Consume_group1</i>	0.0000 (0.0000)	0.0000 (0.0000)
<i>Consume_group2</i>	-15.8916^{***} (0.9488)	0.4569^{***} (0.0144)
<i>Consume_group3</i>	-23.5634^{***} (0.9640)	0.6964^{***} (0.0139)
<i>Consume_group4</i>	-30.1494^{***} (0.9942)	0.9030^{***} (0.0140)
<i>Consume_group5</i>	-36.6610^{***} (0.9712)	1.0997^{***} (0.0145)
<i>Consume_group6</i>	-41.4764^{***} (1.0242)	1.2740^{***} (0.0143)
<i>Consume_group7</i>	-46.4350^{***} (1.0453)	1.4530^{***} (0.0146)
<i>Consume_group8</i>	-51.3501^{***} (1.0773)	1.6887^{***} (0.0153)
<i>Consume_group9</i>	-57.4770^{***} (1.1046)	2.0044^{***} (0.0164)

continued on following page

Table 10. Continued

Variables	(1)	(2)
	Kakwani	Consume
<i>Consume_group10</i>	-65.1555*** (1.1950)	2.6353*** (0.0231)
<i>Consume_group1#Digital</i>	0.0000 (0.0000)	0.0000 (0.0000)
<i>Consume_group2#Digital</i>	1.9165 (1.5302)	-0.0674*** (0.0232)
<i>Consume_group3#Digital</i>	2.4639* (1.4556)	-0.0649*** (0.0226)
<i>Consume_group4#Digital</i>	3.6526** (1.4938)	-0.0733*** (0.0216)
<i>Consume_group5#Digital</i>	3.2955** (1.4306)	-0.1015*** (0.0230)
<i>Consume_group6#Digital</i>	3.4947** (1.5217)	-0.1011*** (0.0218)
<i>Consume_group7#Digital</i>	5.0617*** (1.4662)	-0.0868*** (0.0223)
<i>Consume_group8#Digital</i>	2.9401** (1.4362)	-0.0867*** (0.0226)
<i>Consume_group9#Digital</i>	4.2560*** (1.4534)	-0.0943*** (0.0233)
<i>Consume_group10#Digital</i>	4.6097*** (1.4147)	-0.1061*** (0.0323)
Cons	30.0804** (13.9837)	8.4295*** (0.1638)
Controls	YES	YES
Family FE	YES	YES
Year FE	YES	YES
N	11874	11874
Adj. R ²	0.5228	0.9149

The Impact of Digital Literacy on Different Types of Consumption Inequality

Household consumption is divided into subsistence, developmental, and enjoyment categories. The results in Table 11 show that digital literacy has a small but significant effect on subsistence consumption inequality, a larger effect on developmental consumption, and the strongest effect on enjoyment consumption.

This gradient pattern can be explained by differences in demand rigidity, information structure, and scope for optimization across consumption types. Subsistence consumption is necessity driven and highly inelastic, leaving limited room for behavioral adjustment even with improved information, so the

inequality-reducing effect is weak. Developmental consumption is more elastic and quality-dependent. In this category, digital literacy improves access to information, reduces search costs, and enhances comparison efficiency, thereby improving allocation decisions. Enjoyment consumption is the most discretionary and market-segmented category, in which information asymmetry and heterogeneous pricing are particularly prevalent. Digital literacy significantly lowers participation barriers, expands feasible consumption sets, and improves matching between preferences and products, leading to the largest reduction in inequality.

Table 11. The Impact of Digital Literacy on Different Types of Consumption Inequality

Variables	(1)	(2)	(3)
	Subsistence consumption	Developmental consumption	Enjoyment consumption
<i>Digital</i>	-0.0099*	-0.0224***	-0.0372***
	(0.0058)	(0.0074)	(0.0081)
Cons	0.0284	0.6394***	0.6194**
	(0.1839)	(0.2236)	(0.2448)
Controls	YES	YES	YES
Family FE	YES	YES	YES
Year FE	YES	YES	YES
N	11861	11860	11857
Adj. R ²	0.0658	0.0302	0.0749

DISCUSSION AND IMPLICATIONS

The findings advance a digital capability-conversion perspective on household consumption inequality by linking productive resource formation, online-market participation, and contextual opportunities.

First, the study extends digital-divide research from access and use to consumption outcomes. The larger gains among lower-consumption households suggest upward convergence rather than uniform benefits. Digital-literacy programs should therefore prioritize disadvantaged households and combine affordable access with practical support for employment, finance, and consumption.

Second, the results extend human-capital logic beyond wages and productivity. Digital literacy is associated with consumption outcomes through income and employment conditions and the effective use of online markets. Policy interventions should integrate productive skills, such as job search and financial management, with consumption-related skills, including information verification, product comparison, and platform use.

Third, contextual opportunities shape capability conversion. The statistically detectable association among households with higher internet use suggests that digital skills generate greater returns when applied frequently. Training should therefore reflect users' work environments and usage patterns while providing repeated opportunities for application.

Fourth, the stronger effects on developmental and enjoyment consumption indicate that digital literacy matters most where product variety, search costs, and quality differences are greater. Policies should improve access to reliable product information and strengthen households' ability to compare products, assess quality, and make informed decisions.

Overall, digital literacy is more likely to reduce consumption inequality when targeted training is supported by affordable access, employment opportunities, reliable information, and repeated practical application.

LIMITATIONS AND FUTURE RESEARCH

Several scope conditions guide the interpretation of the findings and suggest directions for future research.

First, the CFPS-based Digital index captures operational, application, and cognitive literacy. Future studies could incorporate cybersecurity, privacy management, content creation, and the evaluation of algorithmically curated information, while using richer measures of employment quality and within-household consumption allocation.

Second, the study combines family and year fixed effects, PSM, and a historical instrument to address heterogeneity, selection, and endogeneity. Future studies using natural experiments or randomized digital-literacy training could further identify causal effects and distinguish short-term from persistent changes.

Third, the online-consumption analysis is constrained by the availability of relevant CFPS measures, which are only provided up to 2018. Future research could incorporate more recent and extended panel data to further examine the long-term effects of digital literacy on household consumption behavior, including changes in consumption preferences, purchasing channels, and consumption patterns over time.

Fourth, China provides a useful setting because rapid digital expansion coexists with urban–rural, hukou, and employment disparities. Cross-country research could examine how social protection, labor-market institutions, platform governance, and consumer-protection regimes shape the identified mechanisms.

Finally, the findings suggest that digital-literacy training is likely to be more effective when combined with affordable access, employment opportunities, consumer protection, and trustworthy platform governance. Future research could also examine nonlinear, dynamic, and intergenerational effects, particularly under misinformation, fraud, algorithmic discrimination, and digital-credit risk.

CONFLICTS OF INTEREST

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