RESEARCH ON THE IMPACT OF DIGITAL ECONOMY ON RURAL CONSUMPTION UPGRADING: EVIDENCE FROM CHINA FAMILY PANEL STUDIES

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Abstract. This paper examines the digital economy's impact on rural household consumption upgrading. Existing studies remain mainly at the level of rural consumption scale and rarely address the consumption structure. The specific impact of the development of the digital economy on rural consumption upgrading and its mechanisms of action deserves in-depth study and consideration. We analyzed the related content using the fixed-effect model, the instrumental variable method (IV), the mediation effect model, and three-year panel data from the China Family Panel Studies (CFPS). This study found that, at the scale level, the digital economy contributes to expanding rural household consumption. At the structural level, the digital economy significantly increases the share of enjoyment-oriented household consumption but has no significant effect on development-oriented consumption. Income is an important transmission mechanism for the digital economy to improve rural household consumption. Besides, the impact of the digital economy on the upgrading of rural consumption varies according to income level and age.

Keywords: digital economy, rural consumption upgrading, consumption scale, development-oriented consumption, enjoyment-oriented consumption.

JEL Classification: D10, O18, R20.

Introduction

In most developing countries, consumption by rural residents is critical to national economic growth, and China is no exception. China is a big agricultural country, and the consumption potential in rural areas is enormous. In China, boosting rural consumption has become an inevitable prerequisite for promoting and realizing the new development pattern. In an economic environment where consumption has become the focus for expanding domestic demand, and against the realistic background of low rural consumption, promoting adequate growth of rural consumption and optimizing the consumption structure have become vital issues.

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China's digital economy has developed rapidly in recent years, providing a solid impetus for social and economic development. Especially during the epidemic, the digital economy played an important role. As one of the critical components of the digital economy, mobile payments overcome time and space constraints and complete the transformation from offline consumption to online consumption, effectively meeting the consumption needs of residents (Liu et al., 2020; Zhou, 2022) and contributing essentially to economic recovery. China's 14th Five-Year Plan explicitly refers to accelerating digital progress and building digital China. The digital economy is a significant advance direction now and in the future. So, against the backdrop of the booming digital economy, can be the upgrading of rural consumption further enhanced through the development and popularity of the digital economy?

The literature examining the impact of the digital economy on rural household consumption is relatively limited. According to Rayna and Striukova's (2021) study, digital technology is essential for increasing consumption. Information technology boosts economic growth and per capita consumption by accelerating the dissemination of information and improving job matching (Zhang et al., 2020). The digital economy facilitates communication between suppliers and customers (Forman et al., 2005) and provides more employment opportunities (Aker & Mbiti, 2010; Kuhn & Mansour, 2014). Besides, research has shown that digital finance mainly increases household expenditure (Li et al., 2020; He et al., 2022). Song et al. (2020) analyzed digital and traditional finance in the same framework. It showed that digital finance could significantly increase household consumption and substantially impact rural and poorer households in China. Digital finance can improve consumer confidence among rural populations and reduce precautionary savings (Choi et al., 2017; Bommier & Grand, 2019). Rural residents are self-sufficient in developed areas with digital finance inclusion (Yang et al., 2022). Yu et al. (2022) further investigated the impact and mechanism of digital finance on improving consumption in rural China. They found that digital finance significantly boosts development consumption but has no significant impact on subsistence and enjoyment consumption.

Research on how the digital economy affects consumption upgrading at the micro-level needs to be improved, and more in-depth analysis is needed. The impact of digital economy development on improving rural consumption and its mechanisms of action deserves in-depth study and examination. Does the digital economy play a significant role in the magnitude and structural dimension of rural consumption upgrades? If so, is this impact a constant contributor, or does it vary? What is the impact mechanism?

Based on the above questions and existing studies, this paper uses panel data from the China Family Panel Studies for 2014, 2016, and 2018 to empirically analyze the impact of digital economy development on rural household consumption by matching macro- and micro- data. Compared to existing studies, this paper can make the following contributions: (1) Existing studies have mainly been analyzed holistically, with few relevant studies on rural areas. This paper focuses on rural households and examines the impact of digital economy development on improving rural household consumption at the scale and structural level, providing micro evidence of the impact of the digital economy on rural household consumption. (2) According to household and individual characteristics, we identified the differential impact of the digital economy on rural household consumption.

The rest of this paper is structured as follows: Section 1 provides the literature review. Section 2 introduces the methodology and model. Section 3 shows the results. Section 4 is the discussion. The last section is conclusions and recommendations.

1. Literature review

Consumption plays a crucial supporting role in the national economy. Several scholars have probed around the factors influencing consumption, including house prices and fiscal spending (Aron et al., 2012; Son & Park, 2020; Suari-Andreu, 2021; Liu & Chang, 2021; Wang et al., 2021; Galí et al., 2007; Marattin & Salotti, 2014). With the development of the digital economy, many scholars have analyzed the specific impact of the digital economy on the consumption of rural residents. The application of a series of digital technologies has changed people's behaviour to a certain extent, affecting residents' consumption habits and concepts (Zhang & Ma, 2022). Mobile payment plays a vital role in the digital economy (Yang et al., 2023), and it has become the most popular payment method in China (Zhao et al., 2022). Compared with traditional transaction methods, mobile payment has significantly improved the convenience of consumption (Riley, 2018; Boden et al., 2020). It helps save unnecessary transaction costs and improves efficiency (Acker & Murthy, 2020). The popularity of the Internet has facilitated communication between buyers and sellers, and rural residents can use various shopping software to directly communicate with sellers and quickly complete good transactions through the network without leaving home. More and more rural households prefer mobile payments to traditional payment methods when purchasing (Zhao et al., 2022). The convenience of the consumption process helps to increase rural residents' desire to consume.

In addition, many scholars have analyzed the impact mechanism of the digital economy on the upgrading of rural residents' consumption structure from an income perspective. Both absolute and relative income theories suggest that income is the primary source of consumption. The change in income will have a direct impact on consumption. Weather affects agricultural production profoundly (Khanal et al., 2019). Natural disasters have also significantly affected agricultural production, with 11.739 million hectares of rural China affected in 2021 (Han et al., 2023). So the income of rural residents is highly uncertain (Bahmani-Oskooee & Maki Nayeri, 2020). The digital economy provides multiple sources of income for rural households (Huang & Zhang, 2022). E-commerce has expanded the market for selling agricultural products (Wan et al., 2021), sped up the flow of local agricultural products to the domestic market, and increased rural household income significantly. The penetration of the digital economy into vast rural areas has, to a certain extent, promoted cooperation between farmers and related enterprises, realizing the leap from traditional agriculture to e-commerce. Digital inclusive finance facilitates the accumulation of human capital in rural areas (Li et al., 2022), which promotes the economic development of rural areas and thus increases local income levels. Therefore, the digital economy helps to increase rural residents' income, and according to Keynesian consumption theory, an increase in income level is conducive to promoting consumption.

2. Methodology

2.1. Data and variables

(1) Dependent variable. The dependent variable is the upgrading of the rural household consumption. We choose the total household consumption expenditure, the percentage of developmental consumption, and the percentage of hedonic consumption to measure consumption upgrading. The sum of household equipment, education, transportation, communication, and healthcare expenditures calculates developmental consumption. The sum of cultural and entertainment expenditures and tourism expenditures calculates enjoyment consumption.

(2) Core explanatory variable. The core explanatory variable is the digital economy. CFPS only contains household information on the province, district, and village. Referring to existing studies (Zhao et al., 2020), we use the entropy weight method to measure the level of digital economy development in each province and then match it with household data.

(3) Mediation variable. The mediation variable is income. We select household income as the mediation variable.

(4) Control variables. Individual control variables included gender, age, marital status, education level, level of confidence in the future, social status, and health status. Household control variables include population size, total cash and savings, ownership of current household housing, per capita household income, government subsidies, the proportion of the number of older people, the proportion of the number of children, expenditure on human gifts, the money given by relatives; the money given by others, and indebtedness. The regional control variables include the level of economic development, financial support to agriculture, and the CPI index.

Table 1 presents the descriptive statistics for all variables. The average value of the total consumption expenditure is 10242, so the average consumption expenditure of each household member must be less than or equal to 10,242 yuan, implying that rural residents' consumption expenditure is lower than the national average significantly. The average age in the used sample is 51.5 years old, with 47.75% of male household heads and 42.89% of married household heads. The average year of education is 6.221 years, and 20.04% had no education, which directly reflects the low education level of rural areas. The self-rated health scores of household heads and their confidence in the future scores are at a medium level. The mean value of the elderly dependency ratio is 10.257%. The percentage of households with full home ownership is 90.6%, while 16.95% of rural households suffer from varying degrees of debt.

The data in this paper mainly come from the China Family Panel Studies (CFPS), Statistical Yearbook of China's provinces and the *Wind* database. We adopt the survey data of three years in 2014, 2016 and 2018. After excluding the urban household sample and processing the missing values for matching, this paper finally gets panel data for 2380 rural households for three years.

Table 1. Descriptive statistics of variables

Variable Type	Variable Name	Variable Symbol	Mean	Minimum	Maximum	Sample
Dependent Variable	total household consumption expenditure	ypce	10.242	8.052	12.316	7140
	development-oriented consumption	ydev	3.369	1.508	4.499	7140
	enjoyment-oriented consumption	yenj	9.517	0.000	67.399	7140
Explanatory Variable	The Digital Economy	xdig	14.534	6.932	27.963	7140
Mediation Variable	Income	med	10.377	7.003	12.337	7140
Control Variable -Individual Control Variable	Age	cage	51.512	17.000	91	7140
	Gender: Men are recorded as 1, women as 0	cgender	0.567	0.000	1	7140
	Education level: Illiterate/semi-literate is 0; elementary school is 6; middle school is 9; high school/junior college/technical school/higher vocational is 12; college is 15; undergraduate is 16; master is 19; doctor is 22.	cnewedu	6.221	0.000	16	7140
	Marriage Status: Married (with a spouse) is recorded as 1, others as 0	cmarry	0.438	0.000	1	7140
	Confidence in the future: Score for the question "Confidence in your future" in the questionnaire	cconfid	4.018	1.000	5	7140
	Self-assessment of social status: Score of the question "Your social status in the local community" in the questionnaire	clevel	3.134	1.000	5	7140
	Health Status: Score of the question "How do you consider yourself to be healthy"	chealthy	2.85	1.000	5	7140

Variable Type	Variable Name	Variable Symbol	Mean	Minimum	Maximum	Sample
Control Variable -Family Control Variable	Population size: number of family members	cfamsize	4.067	1.000	16	7140
	Total cash and deposits	cxianjin	21.131	0.000	230	7140
	The family's current housing ownership: the family owns the full property right is recorded as 1, other is recorded as 0	chou	0.921	0.000	1	7140
	Per capita net household income	cperinco	9.086	5.991	11.116	7140
	Government grants: 1 for grants received, 0 for other cases	cgov	0.70556	0.000	1	7140
	Elderly dependency ratio: Proportion of Population Aged 65 and Over in Total Households	celd	10.257	0.000	100	7140
	Child Support Ratio: The proportion of children aged 16 and under in the total household size	cyoung	14.529	0.000	60	7140
	Social networks: household spending on human gifts	cemot	3.807	0.000	24	7140
	Money was given by relatives	crelat	0.442	0.000	11.4	7140
	Money was given by others	cother	0.134	0.000	50	7140
	Debt profile: non-housing financial liabilities	cdebt	11.033	0.000	200	7140
Control Variables -Regional control variables	Economic development: Per capita GDP	ceconmy	3.719	3.200	4.606	7140
	Financial support for agriculture: the share of budget expenditures for agriculture and forestry	cgovagr	2.468	1.613	2.83	7140
	Consumer Price Index	cprice	4.623	4.611	4.636	7140

2.2. Models

We established the models shown below:

$$ypce_{it} = a + \beta xdig_{it} + \gamma con_{it} + \lambda_i + \mu_t + \varepsilon_{it};\tag{1}$$

$$ydev_{it} = a + \beta xdig_{it} + \gamma con_{it} + \lambda_i + \mu_t + \varepsilon_{it};\tag{2}$$

$$yenj_{it} = a + \beta xdig_{it} + \gamma con_{it} + \lambda_i + \mu_t + \varepsilon_{it},\tag{3}$$

where *ypce*, *ydev*, and *yenj* are dependent variables, denoting total consumption expenditure, the percentage of developmental consumption, and the percentage of hedonic consumption of rural households, respectively. *xdig* is the core explanatory variable and represents the level of digital economic development. *Con* represents a set of control variables. μ_t denotes the year-fixed effects, λ_i denotes the household fixed effect, and ε_{it} is a random disturbance term.

Besides, to test the specific impact mechanisms, we established the mediation effect model in the form shown in Eqs (4)–(6):

$$y_{it} = a + \beta x dig_{it} + \gamma con_{it} + \lambda_i + \mu_t + \varepsilon_{it};$$ (4)

$$med_{it} = a + \beta x dig_{it} + \gamma con_{it} + \lambda_i + \mu_t + \varepsilon_{it};$$ (5)

$$y_{it} = a + \beta x dig_{it} + \delta med_{it} + \gamma con_{it} + \lambda_i + \mu_t + \varepsilon_{it}.$$ (6)

Among them, *y* represents rural household consumption; *med* represents the mediating variable.

3. Results

3.1. Benchmark regression results

Table 2 shows the benchmark regression results for the impact of the digital economy on improving rural household consumption. In columns (1) and (2), the dependent variables are hedonic consumption and development consumption, respectively. In column (3), we use the extent of household consumption as the dependent variable. After controlling for individual characteristics, household characteristics, and the economic characteristics of the region, the regression coefficient of digital economy development in column (1) is 0.437 and significant at the 5% level, showing that the digital economy has a significant positive effect on promoting rural households' enjoyment-oriented consumption. The regression coefficient of the digital economy in column (3) is also significant at the 5% level, showing that the digital economy also contributes significantly to the expansion of the consumption scale. Based on the regression coefficient's value, the digital economy's impact on the total consumption expenditure is much smaller than household enjoyment-oriented consumption. The probable reason is that with the rapid economic development, rural residents' needs for clothing, food, and housing have been satisfied, so the marginal enhancement effect of the digital economy on them is weak. According to the initial descriptive statistical analysis, the consumption of rural households is mainly survival-oriented, and the elasticity of demand for such consumption goods is low. Column (2) presents the impact of the digital economy on developmental consumption. Its regression coefficient does not pass the significance test, showing that the impact of the digital economy on rural households' developmental consumption is not significant.

Regarding the control variables, in columns (1) and (2), most of the coefficients of the variables concerning individual characteristics are insignificant. Education is a critical factor affecting household consumption: the higher the education level of the household head, the larger the household consumption. Marital status also significantly affects household consumption: married households have less enjoyment-oriented consumption than unmarried households. The household head's health status significantly affects household consumption. Among the household characteristic variables, the larger the family population, the greater the total consumption expenditure and the proportion of enjoyment-oriented consumption. A higher level of social network relationships will also expand the scale of household consumption. These results are consistent with expectations.

Table 2. The impact of digital economy on rural consumption upgrading: benchmark regression results

Variables	(1) Enjoyment-oriented consumption	(2) Development-oriented consumption	(3) Household consumption scale
The Digital economy	0.437**	−0.0202	0.025**
	(0.217)	(0.013)	(0.012)
Average per capita household income	−0.625**	−0.014	0.067***
	(0.246)	(0.013)	(0.013)
Housing ownership	−0.521	−0.035	0.021
	(0.706)	(0.039)	(0.041)
Government Subsidy	0.314	0.010	0.023
	(0.462)	(0.022)	(0.023)
Elderly dependency ratio	−0.013	−0.001	−0.001
	(0.008)	(0.001)	(0.001)
Child Support Ratio	−0.046**	0.0015*	−0.002**
	(0.019)	(0.001)	(0.001)
Social networks	−0.064	0.006**	0.021***
	(0.053)	(0.003)	(0.003)
Money given by relatives	−0.031	0.009*	0.018***
	(0.085)	(0.005)	(0.005)
Household debt	−0.011*	0.001***	0.002***
	(0.007)	(0.000)	(0.000)
Number of family members	0.803***	0.015	0.128***
	(0.177)	(0.010)	(0.011)
Total cash and deposits	0.008	−0.000	−0.000
	(0.005)	(0.000)	(0.000)
Money given by others	−0.192***	0.007	0.005
	(0.064)	(0.006)	(0.005)
Gender	−0.312	−0.023	0.060**
	(0.491)	(0.025)	(0.026)
Education level	0.012	−0.002	0.009**
	(0.086)	(0.004)	(0.005)
Age	−0.056**	−0.0003	−0.008***
	(0.028)	(0.001)	(0.002)
Health Status	−0.002	−0.048***	−0.017*
	(0.172)	(0.009)	(0.009)
Degree of confidence in the future	−0.297	0.003	0.010
	(0.182)	(0.010)	(0.010)

End of Table 2

Variables	(1) Enjoyment-oriented consumption	(2) Development-oriented consumption	(3) Household consumption scale
Self-assessment of social status	0.168	−0.007	0.005
	(0.172)	(0.009)	(0.009)
Marriage Status	−0.546*	−0.004	−0.021
	(0.330)	(0.017)	(0.017)
Economic development	6.875***	0.179	0.096
	(2.467)	(0.117)	(0.119)
Consumer Price Index	7.234	−3.497	7.130**
	(61.497)	(3.184)	(3.262)
Financial support for agriculture	6.460**	0.106	0.145
	(3.223)	(0.164)	(0.165)
Year Fixed Effects	Yes	Yes	Yes
Family Fixed Effects	Yes	Yes	Yes
N	7140	7140	7140

Note: Robust standard errors are in parentheses; ***, **, and * denote significance at 1%, 5%, and 10%, respectively.

3.2. Two-stage least squares regression (2SLS)

The above benchmark regression results may have endogenous problems. On the one hand, individual consumption habits, local traditional culture, and other factors affecting consumption are difficult to measure. In addition, in the era of online shopping, with the increase in consumption activities, individuals' demand for digital technology and digital tools also grows gradually, which can further force the development and popularization of the digital economy to a certain extent. Therefore, we use the two-stage least squares (2SLS) method for regression.

We choose the interaction term between the number of fixed telephones per 100 people in each province of China in 1984 and the number of Internet accesses in each province in the previous year as the instrumental variable (Nunn & Qian, 2014; Huang et al., 2019). In terms of correlation, the popularity of the Internet began with dial-up access to telephone lines; the higher the penetration rate of landline telephones, the more beneficial to the development of the digital economy, and it is unlikely that the number of landline telephones and the number of Internet users in the previous year had a direct impact on the consumption of rural households in the province, satisfying the correlation and exogenous principle of the instrumental variables.

Table 3 shows the results of the 2SLS. The digital economy significantly expands the scale of rural household consumption and promotes enjoyment-oriented consumption, while the effect on development-oriented consumption remains insignificant. The results of the 2SLS are in line with the results of the benchmark regression.

Table 3. The impact of digital economy on rural consumption upgrading: 2SLS

Variables	(1) Digital economy (First Stage)	(2) Household consumption scale	(3) Digital economy (First Stage)	(4) Enjoyment-oriented consumption	(5) Digital economy (First Stage)	(6) Development-oriented consumption
The Digital Economy		0.015*** (0.002)		1.759** (0.871)		0.034 (0.033)
Instrumental Variable	6.8916*** (1.4311)		6.8916*** (1.431)		6.8916*** (1.4311)	
Control Variable	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Family Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
KP LM	9.434{0.0021}		9.434{0.0021}		9.434{0.0021}	
KP Wald F	23.189[16.38]		23.189[16.38]		23.189[16.38]	
N	7140		7140		7140	

Note: Robust standard errors are in parentheses; p-values are in curly brackets; critical values corresponding to the tests are in square brackets; ***, **, and * denote the 1%, 5%, and 10% levels, respectively.

3.3. Robustness test

According to the benchmark regression results, the digital economy is conducive to expanding the scale of rural consumption and increasing enjoyment-oriented consumption. To verify the reliability of this finding, we conduct the following robustness tests in this section:

(1) Excluding the sample of municipalities directly under the central government. Since municipalities directly under the central government have special administrative status and differ significantly from other cities regarding policy implementation, we remove the samples of municipalities directly under the central government. According to columns (1) and (2) of Table 4, the regression coefficient of the digital economy is still significantly positive, consistent with the benchmark regression results.

(2) Replacement of the study period. The industry believes that the construction of China's digital economy began in 2015, so we only keep the data for 2016 and 2018 for estimation. According to the results of columns (3) and (4) of Table 4, the digital economy significantly expands the consumption scale and promotes enjoyment-oriented consumption, which remains consistent with the previous findings.

Table 4. The impact of digital economy on rural consumption upgrading: robustness test

Variables	Excluding the sample of municipalities directly under the central government		Replacement of period	
	(1) enjoyment-oriented consumption	(2) household consumption scale	(3) enjoyment-oriented consumption	(4) household consumption scale
Digital economy	0.504* (0.257)	0.019*** (0.004)	0.311* (0.321)	0.016*** (0.006)
Control variables	Yes	Yes	Yes	Yes
N	7015	7015	4760	4760

Note: Robust standard errors are in parentheses; ***, ** and * denote significance at the level of 1%, 5% and 10%, respectively. Hereinafter the same.

3.4. Heterogeneity analysis

(1) Differences in Household Income

The impact of the digital economy on household consumption may exhibit variability across income classes. To examine this difference in impact, according to the average income level of the sample, we divided the sample into high-income household groups and low-income household groups for analysis. Table 5 presents the regression results. The digital economy shows a significant expansion effect on the sum of consumption expenditure of low-income households.

Table 5. Heterogeneity analysis: household income differences

Variables	High-income households			Low-income household		
	(1)	(2)	(3)	(4)	(5)	(6)
	Enjoyment-oriented consumption	Development-oriented consumption	Household consumption scale	Enjoyment-oriented consumption	Development-oriented consumption	Household consumption scale
Digital economy	0.4141 (0.277)	−0.0243 (0.019)	0.0243 (0.016)	0.1866 (0.426)	−0.0165 (0.023)	0.0485** (0.024)
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Family Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
N	4032	4032	4032	3108	3108	3108
R^2	0.0184	0.0316	0.0988	0.0434	0.0241	0.0869

(2) Differences in age groups of household heads

Because of the different backgrounds of the times in which people live, there are significant differences in the consumption concepts of people of different ages. Therefore, we classify households whose head is over 65 years old as elderly-headed households and others as non-elderly-headed households. Table 6 presents the relevant results. Columns (1)–(3) show that the digital economy significantly expands the household consumption scale in elderly-headed households but does not significantly affect developmental and enjoyment consumption. Regression results for non-elderly-headed households are just the opposite. According to columns (4)–(6), for non-elderly-headed households, the digital economy has no significant effect on household consumption scale and developmental consumption but considerably promotes enjoyment-oriented consumption. In China, older rural people have a frugal spending philosophy, and they tend to save their excess money to save for emergencies and necessary spending. In contrast, non-elderly groups, especially teenagers, are more receptive to new things, concepts, and ideas, and they will increase their leisure and entertainment spending with the rapid development of the digital economy. Thus, the digital economy's impact on elderly-headed households' consumption is mainly to expand consumption, while the impact on the consumption of non-elderly-headed households is mainly to promote enjoyment-oriented consumption.

Table 6. Heterogeneity analysis: differences in age groups of household heads

Variables	Elderly-headed households			Non-elderly headed households		
	(1)	(2)	(3)	(4)	(5)	(6)
	Household consumption scale	Development-oriented consumption	Enjoyment-oriented consumption	Household consumption scale	Development-oriented consumption	Enjoyment-oriented consumption
Digital Economy	0.03*** (0.010)	−0.0105 (0.0097)	−0.321 (0.6205)	0.0193 (0.0133)	−0.0115 (0.0142)	0.572** (0.2467)
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
N	1121	1121	1121	6019	6019	6019
R^2	0.3933	0.0699	0.1085	0.3477	0.0129	0.0033

3.5. Mechanism test

This section conducts mechanism tests using income as a mediating variable. Table 7 demonstrates the results of the mechanism test. Income is an essential path for the digital economy to influence the consumption upgrade of rural households. The digital economy can significantly expand household consumption by increasing income. Household income plays a vital role in the digital economy's influence on enjoyment-oriented consumption. The increase in income directly increases the spending power of rural residents. Thus, the digital economy can expand the household consumption scale and promote hedonic consumption by increasing income.

Table 7. Regression results of mediating effect

Variables	Enjoyment-oriented consumption			Household consumption scale		
	(1)	(2)	(3)	(4)	(5)	(6)
	Enjoyment-oriented consumption	Income	Enjoyment-oriented consumption	Household consumption scale	Income	Household consumption scale
Digital Economy	0.437** (0.217)	0.004* (0.002)	0.403* (0.216)	0.025** (0.012)	0.004* (0.002)	0.023* (0.012)
Mediator			8.099*** (1.514)			0.415*** (0.100)
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
N	7140	7140	7140	7140	7140	7140
R^2	0.015	0.983	0.020	0.103	0.983	0.108

4. Discussion

Previous studies on the digital economy and residents' consumption have been analyzed mainly at the micro and macro levels, and the relevant studies have mainly examined the total consumption and seldom addressed the consumption structure. In order to fill the existing research gap, from the micro household perspective, we analyze the specific impact of digital economy development on rural residents' consumption in terms of quantity and structure, respectively. The results show that the digital economy positively affects the consumption upgrading of rural residents. Since implementing China's rural revitalization strategy, rural areas have developed rapidly. In recent years, the popularity of the digital economy has also boosted the economic development of rural areas, and the income of rural residents has increased significantly. The basic needs of rural residents for food, clothing, housing, and transportation have been met. More and more residents begin to pursue a high quality of life. Therefore, the consumption focus of rural residents is gradually shifting to the development of enjoyable goods.

Taking 164 administrative villages in Zhejiang Province in China as an example, Zhang and Ma (2022) examined the impact of "digital village" on the consumption upgrading of rural residents. They found that constructing digital villages is conducive to promoting consumption upgrading, which is consistent with our research findings. Another piece of literature similar to the content of this paper is the study by Yu et al. (2022). They used the China Household Finance Survey (CHFS) and empirically analyzed the impact of digital finance on the consumption upgrading of rural households. They found that digital finance shows a significant promotion effect on enjoyment-oriented consumption but has no significant effect on hedonic consumption, which is inconsistent with the findings of this paper. Yu, Jia, Li, and Wu (2022) focused on the impact of digital finance on the consumption upgrading of rural households. The digital economy is different from digital finance, so we came to different conclusions.

Some limitations exist in this study. Other factors may influence the digital economy's contribution to rural consumption upgrading, which could be further analyzed in subsequent studies. In addition, this paper mainly focuses on rural China, and the findings may be inappropriate for other countries. We can extend research on similar topics to other countries.

Conclusions and policy recommendations

This paper explores the effect of the digital economy on rural households' consumption upgrading. The empirical analysis shows that the digital economy is conducive to expanding rural consumption expenditure and promoting enjoyment-oriented consumption. This fundamental conclusion still holds significantly after excluding possible endogenous problems. The mechanism analysis shows that income is a crucial mechanism through which the digital economy affects rural households' consumption upgrading. The digital economy can expand consumption expenditure and significantly promote rural households' enjoyment-oriented consumption by increasing income. From the heterogeneity analysis results, the digital economy's effect on consumption upgrading varies considerably by income and age. The digital economy is likelier to expand consumption scale among low-income rural households. Regarding elderly-headed and non-elderly-headed households, the digital economy is conducive to expanding the consumption scale of elderly-headed rural households. Its influence on non-elderly-headed households is mainly promoting enjoyment-oriented consumption.

This paper puts forward the following recommendations: (1) Strengthen digital infrastructure construction. The digital economy can have a positive effect on the consumption of rural households. As the underlying foundation for the development of the digital economy, digital infrastructure directly affects the role of the digital economy. Therefore, the authorities should implement a reasonable plan to provide a good foundation for further expanding the scale of rural consumption, especially in rural areas. (2) Improve the income level of rural residents and enhance income stability. Income is the key influencing mechanism. Relevant departments must implement policies to promote rural residents' income increases steadily. Besides, it is necessary to strengthen skills training for rural residents who go out for employment and promote their stable employment. Focusing on low-income households and implementing appropriate subsidies to ensure primary household consumption is also essential.

Conflicts of interest

No conflict of interest exits in the submission of this manuscript.

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