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Analysis of Digital Finance, Regional Heterogeneity and Urban Household Consumption Based on Chinese Financial Panel Data

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Abstract: *Consumption plays an important role in economic growth. Using the Chinese panel data, we examined digital finance's influence on urban household consumption at the national and regional levels. Digital finance is conducive to increasing urban residents' consumption. The impact of the coverage breadth, usage depth, and digitization level of digital finance on household consumption is stronger in East China than in middle China and West China. In East China, the impact of the digital financial payment business, insurance business, and monetary fund business on household consumption is positive. Overall, digital financial products have a stronger role in increasing household consumption in East China than in other regions.*

Keywords: *digital finance, urban household consumption, regional heterogeneity*

1. Introduction

The Chinese household consumption rate has been at a relatively low level for the past 40 years and has shown a downward trend. In the 1980s, the average household consumption rate was 51.4%, and it decreased to 37% between 2010 and 2019. In 2018, the household consumption rate in China was 38.5%, compared with 68.2% in the US and 65.5% in the UK in the same period. The low consumption rate means that the consumption demand is inadequate and it is an important factor restricting the economic development of China. The slow growth rate of household consumption has become a characteristic of China's economy in the new normal. China needs to stimulate consumption to realize economic recovery [1–4].

Digital finance is a new financial service mode to realize payment and other financial businesses relying on big data and digital technology [5]. As shown in Fig.1, it has developed rapidly in the past decade [6].

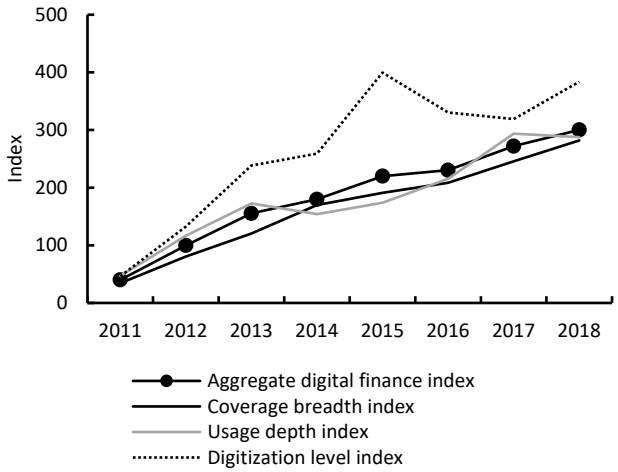

Figure 1: Trend of Chinese digital finance index.

At present, the nexus between digital finance and consumption has received extensive attention from scholars. These studies have made valuable conclusions and laid a good foundation for subsequent research. However, there has not been much literature focusing on the impact of digital finance's

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dimensions and formats on household consumption and the regional differences in these impacts. Therefore, we examined digital finance's influence on urban household consumption taking into account the regional heterogeneity. This will further enrich the research on consumption, and support government policies.

2. Methods

2.1. Models

To examine digital finance's impact on the consumption of urban residents, the following model is established.

$$cons_{it} = \beta_0 + \beta_1 digf_{it} + \beta_2 x_{it}' + u_i + \varepsilon_{it} \quad (1)$$

where *cons* is the consumption of urban residents, *digf* is the digital finance index, and *x* represents the control variables that have effects on consumption. The subscript i refers to the region and t refers to the year. u_i indicates unobserved regional effects and $\mathcal{E}_{it}$ represents the random disturbance term.

2.2. Data

2.2.1. Explained variable

For consumption of urban residents (*cons*), the per capita expenditure of urban residents is used as its proxy variable, and the consumer price index (1978=100) is used to convert the nominal value into the real value.

2.2.2. Core explanatory variables.

The digital finance index of Peking University is used to represent the digital finance level in China. The aggregate digital finance index (*agg*) represents digital finance's overall development level. It includes three dimensions: the coverage breadth index (*cov*), the usage depth index (*usa*), and the digitization level index (*dig*). Specifically, the digital finance coverage breadth index reflects the coverage of digital finance. The digital financial usage depth index reflects the actual use of Internet finance by consumers, mainly covering six digital financial services: payment service (*pay*), monetary fund service (*mon*), credit service (*cre*), insurance service (*insu*), investment services (*inv*) and credit investigation services (*crei*). The digitization level index reflects the convenience and efficiency of digital financial services.

2.2.3. Control variable

For income (*inc*), per capita disposable income of urban residents is used to represent the income. The consumer price index (1978=100) is used to convert the nominal value of income to the real value.

For education (*edu*), the average amount of students in universities and colleges per 100,000 persons is used to represent education.

For population structure, the child dependency ratio (%) (*chi*) and the elderly dependency ratio (%) (*old*) are to measure the population structure.

For social security (*secu*), the number of people insured by urban basic medical insurance is used to measure the level of social security.

The data is collected from Peking University and the China Statistical Yearbook each year. Since variables may have heteroscedasticity, we take the logarithm of related variables to weaken the influence of heteroscedasticity. Based on the availability of data, 31 Chinese provinces were selected as study subjects with a sample range from 2011 to 2018. Given the large differences in the economic and social development level in different regions of China, the consumption effect of digital finance may have area differences. Therefore, samples were divided into three parts for analysis: east region, middle region, and west region.

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3. Results and Discussion

3.1. National Level

First of all, the aggregate digital finance index is used to test digital finance's consumption effect. The OLS, fixed effect model (FE), and random effect model (RE) were used respectively to make regression. Regression results are shown in Table 1.

Table 1: Digital finance's impact on consumption

	OLS	**FE**	**RE**
agg	0.6418*** (0.2321)	1.5082*** (0.6189)	0.7289*** (0.2273)
inc	0.6094*** (0.0156)	0.5123*** (0.0467)	0.5936*** (0.0232)
edu	-0.0054 (0.0229)	-0.1539 (0.1452)	-0.0055 (0.0418)
chi	-13.9991*** (2.7977)	9.8696 (9.4219)	-8.1084 (5.0681)
old	-14.0366*** (4.7602)	-10.7435 (9.0404)	-8.9792 (6.5536)
secu	-0.0060 (0.0061)	-0.0090 (0.0070)	-0.0108* (0.0063)
Constant	791.4791*** (125.5136)	881.7114 (520.4838)	659.4102*** (203.6389)
Hausman test		14.06***	
F		328.59	
R^2	0.9574	0.9525	0.9559

Note: ***, ** and *indicate significance level respectively 1%, 5%, and 10% . Robust standard errors are given in parentheses. Hereafter the same.

According to the Hausman test result, analyses are based on fixed effect regression results. The estimated aggregate digital finance index coefficient is positive and significant, indicating digital finance development helps to increase urban residents' consumption. The development of digital finance provides residents with wealth management platforms and improves residents' financial assets. The convenient digital payment application software frees residents from the shackles of cash, reduces transaction costs, and facilitates consumption. The Internet credit application software alleviates liquidity constraints. Digital finance has spawned many internet insurance businesses that reduce the uncertainty of residents' expectations. These factors are all conducive to promoting household consumption.

To analyze the digital financial coverage, usage depth, and digitization level's effects on urban residents' consumption, regression analysis is conducted from the three dimensions. Table 2 reports the random effect results. Coefficient estimates are all positive and significant statistically. The result indicates that the expansion of digital finance coverage and increase in financial services and deepening of facilitation are conducive to improving the consumption of urban residents.

Table 2: Three digital finance dimensions' impact on consumption

	Cov	**Usa**	**Dig**
digital finance dimensions	0.0129*** (0.0052)	0.0145*** (0.0072)	0.0112*** (0.005)
controls	yes	yes	yes
Constant	0.5829**	0.3866	0.38
Hausman test	10.27	9.27	6.72
R^2	0.9537	0.9534	0.9534

To study the influence of digital finance forms on household consumption, regressions with the OLS, FE, and RE were examined. Hausman test results show that we must use FE to analyze digital payment business's effect on consumption. The random effect model is adopted to analyze the other five services' impact. According to regression results, the estimated coefficients of digital payment, digital insurance, digital credit, the monetary fund, and credit investigation service are positive. The coefficient estimates of digital financial payment and digital insurance are positive and statistically significant. This shows that digital financial payment services and insurance services can significantly improve household consumption. Electronic payment can greatly reduce transaction costs. Consumers can easily purchase

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goods and services through online platforms. Trade locations are no longer rigid constraints for consumption. Digital payment software such as Alipay is convenient for online and offline transactions. Internet insurance meets the diversified needs of consumers. Thus, it can slow down income volatility caused by uncertainty.

3.2. Regional Level

3.2.1. Agregate digital finance index

In 2018, the index of eastern China was the highest, and that of western China was the lowest. The index of the eastern region was higher than the national level, while that of the middle and western regions was lower than the national level. In terms of the growth rate, the index of the western region increased the fastest, increasing from 27.85 in 2011 to 280.36 in 2018, an increase of 9 times. The index of the eastern region increased the slowest from 59.16 in 2011 to 327.78 in 2018 by 4.5 times. The western and middle regions developed faster than the national level, while the eastern region developed slower than the national level.

Table 3: Digital finance's impact on consumption by regions

	East		**Middle**		**West**	
	OLS	RE	OLS	FE	OLS	RE
agg	0.0891*** (-0.0162)	0.0564*** (0.0213)	0.0001 (0.0229)	-0.0085 (0.0194)	0.0530*** (0.0165)	0.0179 (0.0144)
controls	Yes	Yes	Yes	Yes	Yes	Yes
Constant	1.3723	0.7197	1.5874	0.3999	2.8693***	0.7569
	(-0.5027)	(0.625)	(0.891)	(0.7838)	(0.7773)	(0.6339)
Hausman test				37.71***		
F	276.64		302.57	1457.39	82.46	
R^2	0.9711	0.9654	0.9401	0.8086	0.8974	0.8728

In this study, OLS, fixed effects, and random effects methods are used to regress the regional sample data, and the results are presented in Table 3. In East China, digital finance conduces to promoting household consumption. Financial development in the eastern part of China is relatively fast. In recent years, digital finance had wide coverage and convenient application and has been widely recognized by people. Residents' consumption awareness is relatively advanced, and they can accept new things and adopt new consumption methods. They are willing to use digital financial services for convenient consumption and easing liquidity constraints, thereby unleashing consumption potential.

Digital finance's impact on household consumption in the middle region is not significant. The Hausman test result was not significant for the western region data, and the random effect model was used to make regression and analyses. After considering the individual heterogeneity, the estimate of the digital finance coefficient is positive but is not significant statistically.

3.2.2. Different digital finance dimensions

From 2011 to 2018, digital finance's three dimensions grew the slowest in East China. The coverage breadth index grew the fastest in western China. The usage depth index and digitization level index grew fastest in middle China. In 2018, the three indices of eastern China were the highest and were higher than the national average level. Those of western China were the lowest and below the national average level.

Regional regression results are shown in Table 4. For eastern China, the coefficient estimates are greater than zero and significant statistically. For middle China, the three dimensions do not affect household consumption. For the western region, the coefficient estimate of the coverage breadth index is statistically significant. Considering individual effects, the usage depth index coefficient estimate and the digitization level index coefficient estimate are not significant. On the whole, the digital financial coverage breadth, usage depth, and digitization level have stronger impacts on household consumption in East China than in middle and West China.

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Table 4: Three digital finance dimensions' impact on consumption by regions

	.	Cov		Usa		Dig	
East		OLS	FE	OLS	RE	OLS	RE
	digital finance dimensions	0.0864*** (0.0183)	0.0766** (0.0254)	0.0835*** (0.0177)	0.0465** (0.0212)	0.0481*** (0.0090)	0.0292** (0.0097)
	controls	Yes	Yes	Yes	Yes	Yes	Yes
	Hausman test		16.02**		11.15		9.44
	F	393.56	426.48	238.14		212.5	
	R^2	0.9707	0.959	0.9676	0.9512	0.9704	0.9536
Middle		OLS	FE	OLS	RE	OLS	FE
	digital finance dimensions	-0.0036 (0.0213)	-0.0114 (0.0168)	0.0008 (0.0212)	0.0004 (0.0112)	0.0062 (0.0153)	-0.0152 (0.0181)
	controls	Yes	Yes	Yes	Yes	Yes	Yes
	Hausman test		13.72*		8.52		28.71***
	F	420.48	1092.31	214.78		226.87	3724.71
	R^2	0.9402	0.976	0.9401	0.9743	0.9403	0.9765
West		OLS	RE	OLS	RE	OLS	FE
	digital finance dimensions	0.0420*** (0.0105)	0.0218** (0.0098)	0.0343* (0.0184)	0.0201 (0.0161)	0.0245* (0.0115)	-0.0012 (0.0106)
	controls	Yes	Yes	Yes	Yes	Yes	Yes
	Hausman test		11.67		7.62		
	F	118.38		99		57.89	128.83
	R^2	0.9037	0.9553	0.8904	0.9543	0.8893	0.9536

3.2.3. Different digital financial businesses

From 2015 to 2018, the payment index, insurance index, and monetary fund index grew the fastest in the middle region, while the investment index, credit index, and credit investigation index grew fastest in the western region of China.

Table 5: Digital finance business's impact on consumption by regions

		Pay	Insu	Cre	Crei	Mon	Inv
East		FE	RE	FE	RE	RE	RE
	digital finance businesses	0.1083*** (0.0193)	0.0244** (0.0116)	0.0147 (0.0289)	0.0127 (0.0109)	0.0129** (0.0053)	0.0053 (0.0066)
	controls	Yes	Yes	Yes	Yes	Yes	Yes
	Hausman test	17.09**	11.18	30.66***	11.74	6.51	9.59
	R^2	0.9656	0.9545	0.9479	0.8793	0.9494	0.9191
Middle		FE	RE	RE	RE	FE	FE
	digital finance businesses	0.0306 (0.0176)	0.0013 (0.0035)	0.0071 (0.0151)	0.0017 (0.0081)	-0.0108 (0.0054)	-0.0066 (0.0076)
	controls	Yes	Yes	Yes	Yes	Yes	Yes
	Hausman test	12.29*	7.13	7.73	10.79	29.65***	17.23**
	R^2	0.9773	0.9747	0.9746	0.936	0.9793	0.97
West		RE	RE	RE	RE	RE	RE
	digital finance businesses	0.0494** (0.0193)	0.0047 (0.0093)	0.0216** (0.0105)	0.0036 (0.0050)	0.0042 (0.0043)	0.0021 (0.0067)
	controls	Yes	Yes	Yes	Yes	Yes	Yes
	Hausman test	9.31	7.52	10.77	6.33	6.31	6.79
	R^2	0.9614	0.9527	0.9552	0.8765	0.941	0.9246

Table 5 shows the regional regression results. In East China, the payment business, insurance business, and monetary fund business have a positive effect on consumption. The convenient payment, risk reduction, and liquidity constraints easing effect brought by digital finance effectively promote household consumption. In middle China, the coefficients estimates of various digital financial businesses are not statistically significant. In West China, the empirical results show that the payment business and credit business have significant positive impacts on consumption, and other businesses have no significant impact on consumption. Overall, digital financial businesses have a stronger role in increasing household consumption in East China than in western and middle China.

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4. Conclusion

We estimate digital finance's influence on urban household consumption. The main research conclusions are as follows. Digital finance is conducive to increasing urban residents' consumption. Digital finance's coverage breadth, usage depth, and digitization level have stronger influences on household consumption in East China than in middle and West China. In East China, the digital financial payment business, insurance business, and monetary fund business have positive effects on household consumption. Overall, digital financial products have a stronger role in promoting urban residents' consumption in the eastern area than in the other areas. The Chinese government needs to take measures to improve the network infrastructure in the middle and western regions of China and improve the environment for the use of digital finance.

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