



Research on the Impact of Digital Inclusive Finance Development on Urban Economic Resilience

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Abstract. Based on a sample of 189 prefecture-level cities from 2011 to 2019, this paper studies the impact of digital inclusive finance on urban economic resilience. This paper expands the relevant mechanism of urban economic resilience from the perspective of digital inclusive finance, and provides new evidence for the channel through which digital finance acts on the real economy from the perspective of urban economic resilience. According to the research results, digital inclusive finance significantly enhances the resilience of urban economy. Mechanism analysis shows that digital inclusive finance enhances urban economic resilience mainly by promoting financial development, improving regional innovation and narrowing the urban-rural income gap. Heterogeneity analysis shows that the impact of digital inclusive finance on the regions with high degree of marketization is greater than that on the regions with low degree of marketization. It has the most obvious effect on the eastern cities, followed by the central cities, and has no significant effect on the western cities.

Keywords: digital inclusive finance · urban resilience · entropy method · moderating effects

1 Introduction

According to the outline of China's 14th Five-Year Plan, we will build livable, innovative, smart, green, humanistic and resilient cities. In the face of increasingly complex ecological environment, resilient cities are an important consensus and path choice for China to solve the problem of sustainable urban development in the new era. As one of the most important dimensions of urban resilience, economic resilience refers to the resistance and resilience of the economy in the face of various external shocks. Economic resilience is composed of four interacting subsystems, namely, economic structure subsystem, labor market subsystem, government management subsystem and financial subsystem [1]. Financial subsystem is the core of modern economy, which is crucial to promote high-quality economic development and consolidate the material foundation of common prosperity. Digital inclusive finance, for one thing, emphasizes the role of digital technology in promoting the transformation and upgrading of financial formats

and for another, it reflects the inclusiveness and inclusiveness of finance, which provides support for preventing risks in the urban economic system and improving economic resilience.

At present, the research on resilient cities in China is still in its infancy, mainly focusing on theoretical research and the discussion of foreign experience, emphasizing the prevention and governance of natural disasters. In the management of urban system, more attention should be paid to how to deal with the impact of the increasingly frequent, deep and widespread financial crises in human society. Although there have been a lot of studies on the relationship between traditional finance and economy, there is still a lack of systematic research on digital finance under the framework of urban resilience. How digital inclusive finance can promote financial development, expand residents' opportunities for innovation and entrepreneurship, and narrow the urban-rural income gap to better serve the real economy is an issue that must be considered to enhance the effectiveness of China's financial market and improve urban economic resilience.

2 Literature Review

In terms of urban resilience research, due to the diversity and uncertainty of the sources of crisis, the construction of resilient cities is a complex and systematic project. Resilience was originally used to describe the resistance and resilience of materials to external shocks. In 1973, the concept of resilience was first extended to the field of ecology, emphasizing the ability of ecosystems to recover from external shocks [2]. In 1998, "resilience" was introduced into urban research for the first time, and "evolutionary resilience" was derived, which emphasized the self-organization and adaptive ability in the process of maintaining the steady state of the system, abandoned the pursuit of simple equilibrium, regarded disturbance as normal, and regarded coping with risks as part of the system, which met the learning, adaptability and dynamic response requirements of modern cities in the face of complex and multiple risks. Martin et al. defines economic resilience as the ability of regions to withstand shocks, restore growth, and restructure paths in competitive markets, and refers to it as adaptive resilience [3]. Domestic empirical studies on urban economic resilience mainly focus on the spatial effect and mechanism of economic resilience. Zhu et al. studied the spatial and temporal evolution characteristics of urban resilience in China's three urban agglomerations and the factors affecting urban resilience [4]. Feng Yuan et al. used Shift-share decomposition to decompose economic resilience into industrial structure and competitiveness [5]. Zhang et al. discussed the industrial agglomeration and spatial spillover effect of economic resilience [6]. Xu et al. used GMM-SL-SAR-RE model to measure urban economic resilience and used industrial diversification to explain urban economic resilience [7].

Existing research on digital inclusive finance mainly focuses on its impact at the micro level. Digital inclusive finance generally refers to the use of digital technology by traditional financial institutions and Internet companies to achieve financing, payment, investment and other new financial business models [8]. At the level of residents, digital inclusive finance can promote residents' innovation and entrepreneurship and improve residents' income level. Digital inclusive finance promotes the entrepreneurial behavior of households with low physical capital or low social capital through credit constraint

mitigation mechanism, information constraint mitigation mechanism and social trust strengthening mechanism [9], and has inclusive effect and poverty reduction effect on residents' income [10, 11]. Yi et al. 's research shows that digital inclusive finance promotes household consumption by alleviating liquidity constraints and facilitating residents' payment [12]. At the enterprise level, digital inclusive finance promotes entrepreneurship mainly by alleviating external financing constraints. Tang et al. believe that the development of digital finance can effectively solve the problem of difficult and expensive financing of enterprises, drive enterprises to deleverage, stabilize their financial status [13]. Wan et al. found that the innovation incentive effect of digital finance is stronger for micro, small and medium- sized enterprises and private enterprises [14], and similarly Xie found that this effect is more obvious in provinces with low urbanization rate [15].

There are few empirical studies on the impact of digital inclusive finance on urban economic resilience, which leaves room for demonstration in this paper. Qian et al. demonstrated the promoting effect of digital finance on economic growth by using instrumental variable method and difference-in-differences method [16]. However, the indicator of economic growth is measured by per capita GDP, which is different from the systematic multi-dimensional kernel of economic resilience. Gao et al. analyzed the spatial evolution characteristics of economic resilience and found the spatial spillover effect and threshold effect of digital finance [17]. Li et al. believed that digital inclusive finance can affect the economic resilience of China's megacities by alleviating financing constraints and improving the level of innovation and entrepreneurship [18]. Cui studied this channel from the perspective of narrowing the urban-rural income gap, improving the efficiency of capital allocation and leading to consumption upgrading [19]. The existing studies have two main defects. First, they all use provincial panel data or megacities data, resulting in small sample size. Second, they ignore the heterogeneity caused by different degrees of marketization in cities.

The possible marginal contributions of this paper are as follows. From the perspective of research, it pays attention to both macro and micro impacts of digital inclusive finance. At the data level, the use of panel data of prefecture-level cities makes the results more robust. And in terms of mechanism and heterogeneity analysis, it is theoretically deduced that digital finance acts on urban economic resilience through financial development effect, innovation effect and income effect, and the above influence mechanism is verified empirically.

3 Theoretical Analysis and Research Hypotheses

The financial system plays a key role in enhancing economic resilience. In a sense, strong finance means strong economy. The essence of finance is the efficient allocation of resources, that is, the effective supply corresponds to the effective demand. However, the cost of information search and the risk of default lead to the imbalance between supply and demand in the traditional financial system. In the financial market, banks "dislike the poor and love the rich". In the labor market, a large part of the labor force has unstable income and lacks necessary insurance and financial services. As a result, income inequality in the whole society has widened. The development of digital inclusive finance is not only an effective supplement to traditional finance, but also a strong support

for urban economic resilience. At the macro level, the development of digital inclusive finance is conducive to expanding the coverage of financial services and building a multi-level financial system, thus realizing the sustainable development of the financial system. At the micro level, digital inclusive finance plays an important role in the innovation and entrepreneurship, consumption and income of enterprises and residents. Therefore, this paper proposes the following hypotheses:

Hypothesis 1: Digital inclusive finance can significantly enhance urban economic resilience.

Digital finance can effectively absorb financial resources in the market and transform them into effective supply. Because the demanders of digital finance have the characteristics of “many, small and scattered”, the traditional financial market needs to pay high information search and transaction costs to include such investors, so there are financial exclusion such as credit rationing and financing constraints. With the support of emerging technologies such as big data, artificial intelligence and cloud computing, digital finance can process massive data on the basis of low cost and low risk. Of course, digital inclusive finance is not limited to “incremental supplement” to the financial system, that is, to lower the threshold for the long-tail group to use financial products and services; There is also “stock optimization”, that is, the reshaping and transformation of traditional financial services. The penetration of Internet platform companies and fintech companies into payment, insurance, wealth management and other financial services. On the one hand, it forces traditional financial institutions to improve their business capabilities and deepen financial model innovation and on the other hand, it pushes financial regulators to improve supervision and risk management system. Under the financial system with the participation of multiple actors and the complementary development of multiple models, Internet platform companies and fintech companies explore new models of financial business, greatly improving the convenience of financial services and the diversity of choices. Traditional financial institutions improve the capital market system, expand the scale of direct financing, and enhance the depth of inclusive finance. All entities will work together to improve financial services for the real economy. Based on the above analysis, this paper proposes the following hypotheses:

Hypothesis 2: Digital inclusive finance enhances urban economic resilience by promoting financial development.

Due to the “wealth threshold” effect in the traditional financial market, low-income groups have low access to formal financial products and services and high transaction costs. They often have to turn to informal financial products such as private lending or usury when they have financial needs, which brings moral hazard and adverse selection problems to the financial system, increasing the financial systemic risk.

Under the condition of controlling systemic risks, inclusive finance reduces the threshold for the use of financial products through financial model innovation, expands the radiation scope of the financial system, and creates equal financing opportunities for production, operation and investment for the originally financially excluded groups. In the end, the financing constraints of enterprises can be alleviated, and the enthusiasm of urban low-income groups for self-reliance, innovation and entrepreneurship can be enhanced. Huang believes that digital finance can alleviate the financing constraints of enterprises through the macro path of improving the marketization level and the micro

path of reducing the financing cost and leverage level of enterprises [20]. Jiang found that digital finance can promote technological innovation of enterprises, and thus improve the total factor productivity of enterprises [21]. Ren found that digital inclusive finance mainly promotes the improvement of regional innovation level through two paths: human capital supply and industrial upgrading [22]. Based on the above theoretical and empirical research, this paper puts forward hypothesis 3:

Hypothesis 3: Digital inclusive finance enhances urban economic resilience by expanding innovation and entrepreneurship opportunities for enterprises and residents.

The dynamic relationship between financial development, economic growth and income distribution has been well demonstrated at home and abroad. Greenwood et al. confirmed that financial development and urban-rural income distribution follow an “inverted U- shaped” curve [23]. Dollar et al. believed that financial development is an important factor in reducing poverty [24]. Sarma et al. found that a country’s income equality is directly proportional to the development of financial inclusion [25]. Karlan studied the higher consumption, income and investment brought about by financial accounts [26]. Zhang found that the development of digital finance has increased household income, and the benefits of low-income groups in rural areas are more significant [10]. Zhou Li et al. also concluded that digital inclusive finance has a “digital dividend” rather than a “digital divide” by constructing a credit threshold model and quantile regression for urban and rural households [27]. Based on the above research, this paper puts forward hypothesis 4:

Hypothesis 4: Digital inclusive finance enhances urban economic resilience by promoting equitable income distribution and narrowing the urban-rural income gap.

4 Research Design

4.1 Data Sources

This paper selects the panel data of prefecture-level cities in China from 2011 to 2019. The data mainly come from China Regional Economic Database and China City Statistical Yearbook. The core explanatory variables come from the Digital Inclusive Financial Index of Peking University, and the indicators of marketization degree come from the annual Marketization Index Report of China’s Provinces compiled by the Research group of China Economic Reform Research Foundation. Missing values were filled by linear interpolation method.

4.2 Model Construction

According to the previous theories and hypotheses, and in order to avoid the reverse causality effect of economic resilience in the previous period on digital inclusive finance, all explanatory variables are lagged by one period. In addition, all the regressions in this paper control the dual fixed effects of individual and time in order to make the regression results more robust.

$$\text{res}_{i,t} = \alpha_0 + \alpha_1 \text{index}_{i,t-1} + \text{Controls}_{i,t-1} + \varphi_i + \gamma_t + \zeta_{i,t} \quad (1)$$

$Resi_{i,t}$ is the explained variable urban economic resilience, $index_{i,t-1}$ represents the core explanatory variable digital inclusive finance, $Control_{i,t-1}$ denote the control variable, φ_i , γ_t and $\zeta_{i,t}$ Represents the individual effect, time effect and random disturbance term, respectively.

1) Explained variables:

There is no unified standard for the measurement of urban resilience, which mainly includes the process-based single indicator method and the state-based multiple indicator method. The core variable of the former is usually employment rate or economic growth rate, while the latter usually adopts entropy method or principal component analysis method to construct economic resilience indicators. In order to measure the dynamic evolution process of the city’s response to the crisis and construct a multi- level and multi-dimensional comprehensive index, this paper uses the entropy method to measure the urban economic resilience from three dimensions of resistance, resilience and renewal according to Martin’s statement. As seen in Table 1, the core of the three dimensions is resilience, followed by resistance, and finally revival. Just like the human body, the disease comes like a mountain, and goes like a silk. The recovery stage needs the most adjustment factors and the longest time.

2) Core explanatory variables.

Referring to previous studies, this paper selects the data of “Peking University Digital Inclusive Financial Index” divided by 100 as the core explanatory variable of this study. There are three sub-dimensions under the inclusive finance index, which are the coverage breadth of digital finance, the depth of the use of digital finance and the digitalization degree of inclusive finance.

Table 1. Indicators and weights of urban resilience

Target layer	Criterion layer	Weights	Indicator layer
Urban economic resilience	Resistance	0.303534	GDP per capita (RMB)
			Average salary of employees (RMB)
			Population density (people/km ²)
	Resilience	0.544783	Investment in fixed assets (RMB ‘0000)
			Total retail sales of consumer goods (RMB ‘0000)
			Revenue /Expenditure from general budget of local finance (%)
	Revival	0.544783	Number of beds per capita (units)
			Insurance per capita (copies)
			Green coverage rate (%)

3) Control variable.

In order to ensure the accuracy of the regression results, this paper selects foreign capital dependence, industrial optimization, human resources and economic agglomeration as control variables, using the amount of foreign capital actually utilized/GDP, the added value of the tertiary industry/secondary industry, the ratio of teachers and students in colleges and universities, the ratio of urbanization rate, and the per capita road area to measure them.

4) Moderating Variable.

This paper uses the balance of deposits and loans of financial institutions at the end of the year, the number of patents granted and Theil index to measure the level of financial development, regional innovation vitality and income inequality.

Table 2 shows the descriptive statistics of each variable.

5 Empirical Analysis

5.1 Baseline Regression Analysis

In Table 3, (1) shows that digital inclusive finance has a significant role in promoting urban economic resilience. (2) shows that the results are still significant after adding control variables, and the coefficient of core explanatory variable digital finance has also increased. As seen in (3), all explanatory variables are lagged one period to alleviate the reverse causality effect, and the coefficient of digital finance is slightly lower than numbers in (2), yet it is still significant at 1%. The results in (4) - (6) show that the three sub-dimensions of digital inclusive finance have significantly positive effects on urban economic resilience, and the coefficients of coverage breadth, depth of use and degree of digitalization are decreasing in turn. This is in line with the expectation. The coefficient of coverage breadth is higher than that of use depth because digital finance has a more obvious effect on the long-tail customers who suffer from financial discrimination. The lower coefficient of digitization degree may be caused by the strong collinearity between digital finance and human capital or other variables. The insignificant coefficient of foreign capital dependence and industrial upgrading may be caused by the heterogeneity between cities. Different marketization degree and location, foreign capital dependence and industrial upgrading level have different effects on economic resilience. The coefficient of human capital is not only large, but also significant at the level of 1%, which reflects the positive spillover effect of education. The coefficient of urbanization is not significant, which may be caused by its effect being absorbed by other independent variables. The economic agglomeration effect is significant at least at the level of 10% in each regression, which is consistent with the expectation.

5.2 Moderating Effect

The results of (1)-(4), (5)-(8) and (9)-(12) in Table 4 examine the regression of digital finance and its three sub-dimensions under the three moderating effects, respectively. The results show that the coefficients of the three moderating variables are all significant at the level of 1%. When the moderating variable is the level of financial development,

Table 2. Descriptive statistics of variables

Variables	Indicators	Observations	Mean	Median	Standard	Minimum	Maximum
Urban Economic resilience	Urban Economic resilience	1774	0.197	0.171	0.099	0.039	0.738
Digital finance	Digital financial inclusion index /100	1774	1.682	1.731	0.664	0.195	3.217
Breadth of coverage	Breadth of coverage /100	1774	1.579	1.628	0.647	0.019	3.109
Depth of use	Depth of use /100	1774	1.688	1.627	0.688	0.125	3.32
Degree of Digitization	Digitization /100	1774	2.014	2.341	0.827	0.034	5.812
Foreign capital dependence	The amount of foreign capital utilized/GDP	1774	0.021	0.012	0.043	0	0.741
Industrial optimization	Added value of the tertiary industry/secondary industry	1774	0.915	0.846	0.417	0.204	4.932
Human resources	Teacher-student ratio of colleges	1774	0.055	0.054	0.015	0.004	0.297
Urbanization	Urbanization rate	1774	0.549	0.529	0.14	0.214	1
Economic agglomeration	Road area per capita (square meters)	1774	0.179	0.165	0.07	0	0.464
Vitality of innovation	Number of patents granted (ten thousand)	1774	0.618	0.173	1.247	0.002	16.66
Financial Development	Deposit and loan balance/GDP	1774	2.354	2.073	1.047	0.764	11.17
Inequality	Theil index	1774	0.079	0.069	0.044	0.005	0.279

Table 3. Baseline regression

Variables	(1)	(2)	(3)	(4)	(5)	(6)
Economic resilience	No control variables	Have control variables	First-order lag	Digital finance sub-dimension 1	Digital finance sub-dimension 2	Digital finance sub-dimension 1
Digital finance	0.032*** (0.001)	0.146*** (0.027)	0.112*** (0.026)			
Breadth of coverage				0.067**		

(continued)

Table 3. (continued)

Variables	(1)	(2)	(3)	(4)	(5)	(6)
				(0.026)		
Depth of use					0.046***	
					(0.011)	
Degree of digitization						0.014**
						(0.005)
Foreign capital dependence		-0.058	-0.066	-0.076	-0.068	-0.055
		(0.044)	(0.045)	(0.05)	(0.048)	(0.047)
Industrial optimization		-0.001	-0.004	-0.007	-0.006	-0.005
		(0.006)	(0.005)	(0.006)	(0.006)	(0.006)
Human resources		0.224***	0.222***	0.226***	0.232***	0.230***
		(0.079)	(0.084)	(0.077)	(0.084)	(0.085)
Urbanization		0.01	0.045	0.022	0.089	0.053
		(0.087)	(0.087)	(0.097)	(0.096)	(0.105)
Economic agglomeration		-0.093***	-0.069**	-0.071**	-0.069**	-0.078**
		(0.028)	(0.031)	(0.033)	(0.032)	(0.031)
Constant	0.138***	0.076*	0.092**	0.131***	0.103**	0.142***
	(0.005)	(0.043)	(0.043)	(0.045)	(0.049)	(0.051)
Observations	1774	1774	1574	1574	1574	1574
R ²		0.537	0.454	0.429	0.433	0.428
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
City fixed effects	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors in parentheses.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

the coefficient of the core explanatory variable digital finance increases, indicating that digital finance and traditional finance complement and promote each other. The coefficients of innovation vitality and innovation vitality \times digital finance are both significant, indicating that innovation vitality itself and the regulation of digital finance on innovation activities both play a role in promoting economic resilience. The coefficients of inequality and inequality \times digital inclusive finance in (9) - (12) are significantly negative, indicating that residents' income inequality makes urban economy more vulnerable, and digital finance can reduce this inequality and enhance economic resilience. The coefficient of digitalization degree or coverage breadth in (8) and (10) are no longer significant because of the multicollinearity after adding the two moderator variables of innovation vitality or inequality. The results in Table 4 show that digital inclusive finance has a moderating effect on urban economic resilience by improving the level of financial development,

promoting regional innovation vitality and alleviating the income inequality of urban residents.

5.3 Heterogeneity Test

The financial infrastructure in the regions with high degree of marketization is better, and the role of digital finance in promoting the economy is greater. That's why the role of digital inclusive finance in promoting resilience on regions with high degree of marketization is almost three times that in regions with low degree of marketization, as seen in Table 5 (1) (2). Refer to (3) - (5), the impact of digital finance in the eastern region is the largest, and its coefficient is more than twice that in the benchmark regression; the coefficient in the central region is similar to that in the benchmark regression; however, the influence of the western region is not significant. This coincides with the results in (1) (2), because the eastern region tends to be those cities with higher marketization degree and better financial infrastructure. The coefficient of industrial optimization is positive in the regions with a high degree of marketization and the eastern region, which indicates that the service industry in these regions is more developed and contributes more to the economy. The negative index in the regions with low marketization degree and the western region indicates that these regions are more dependent on the manufacturing industry, and the transformation and upgrading of the manufacturing industry and the stability of the industrial chain have a greater impact on the economic resilience. The insignificance of the coefficient in the central region indicates that the service industry and manufacturing industry do not have obvious advantages in the central region. The above analysis also supports the explanation that the coefficient of industrial optimization in the basic regression is not significant in Table 3. Heterogeneity analysis shows that urbanization has a significant effect on economic resilience, and the effect is more obvious in cities with low marketization degree and in central China. What's more, the coefficient of economic agglomeration is only significant in cities with low degree of marketization and in central China.

5.4 The Robustness Test

1) Endogeneity problem.

In the above empirical test, the core explanatory variables are lagged by one period to eliminate the endogeneity problem caused by the reverse causality that "the stronger the economic resilience is, the higher the development level of digital inclusive finance is". However, even so, there will still be endogenous bias such as missing variables in the empirical regression equation. Refers to the method of Huang et al., this paper uses the post and telecommunications business volume of each city in 1984 as the exogenous instrumental variable of digital finance development [28]. Since this data is cross-sectional data, panel data are obtained by multiplying it with the digital inclusive finance at the national level in that year. The historical data cannot affect the urban economic resilience today, and the digital inclusive financial index at the national level has little correlation with the economic resilience of a single city, which meets the exogeneity. The more the number of posts and telecommunications in a city's history is, the better its digital financial infrastructure is, which meets the correlation. Refer

Table 4. Moderating effect

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Total index	Sub 1	Sub 2	Sub 3	Total index	Sub 1	Sub 2	Sub 3	Total index	Sub 1	Sub 2	Sub 3
Economic resilience	0.131*** (0.023)				0.081*** (0.018)				0.078*** (0.021)			
Digital finance												
Breadth of coverage		0.100*** (0.022)				0.062*** (0.016)				0.034 (0.021)		
Depth of use			0.053*** (0.010)				0.037*** (0.008)				0.032*** (0.010)	
Degree of digitization				0.013*** (0.005)				0.006 (0.004)				0.011*** (0.004)
Financial development	-0.004 (0.004)	-0.004 (0.005)	-0.002 (0.005)	-0.003 (0.005)								
Financial development × digital finance	0.011*** (0.003)	0.012*** (0.003)	0.012*** (0.003)	0.013*** (0.003)								
Innovation vitality					0.007** (0.003)	0.007** (0.003)	0.007** (0.003)	0.008*** (0.003)				
Innovation vitality × digital finance					0.010*** (0.002)	0.010*** (0.002)	0.011*** (0.002)	0.011*** (0.002)				
Inequality									-0.284*** (0.085)	-0.306*** (0.087)	-0.283*** (0.088)	-0.295*** (0.088)
Inequality × digital finance									-0.276*** (0.052)	-0.308*** (0.055)	-0.294*** (0.053)	-0.307*** (0.054)
Constant term	-0.027 (0.022)	0.003 (0.021)	-0.023 (0.022)	-0.001 (0.023)	-0.037* (0.022)	-0.019 (0.021)	-0.039* (0.022)	-0.025 (0.023)	0.070** (0.035)	0.096*** (0.035)	0.072** (0.036)	0.097*** (0.034)
Observations	1574	1574	1574	1574	1574	1574	1574	1574	1569	1569	1569	1569
R2	0.634	0.579	0.421	0.466	0.474	0.436	0.471	0.491	0.489	0.475	0.480	0.479

(continued)

Table 4. (continued)

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Control explanatory variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
City fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

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

Table 5. Heterogeneity test

Variables	(1)	(2)	(3)	(4)	(5)
Economic resilience	High degree of marketization	Low degree of marketization	East	Central	West
Digital Universal Finance	0.219 ^{***}	0.067 ^{**}	0.248 ^{***}	0.104 ^{**}	0.045
	(0.037)	(0.029)	(0.044)	(0.042)	(0.039)
Foreign capital dependence	0.026	0.021	0.002	0.042	0.031
	(0.056)	(0.021)	(0.095)	(0.089)	(0.032)
Industrial optimization	0.028 ^{**}	0.012 ^{**}	0.034 ^{**}	0.005	0.022 ^{**}
	(0.013)	(0.006)	(0.017)	(0.007)	(0.010)
Education	0.328 ^{***}	0.168 ^{***}	0.342 ^{***}	0.079 ^{***}	0.266 ^{**}
	(0.062)	(0.020)	(0.081)	(0.096)	(0.121)
Urbanization	0.234 ^{***}	0.266 ^{***}	0.183 ^{***}	0.262 ^{***}	0.161 ^{***}
	(0.049)	(0.047)	(0.052)	(0.074)	(0.039)
Economic aggregation	0.041	0.100 ^{***}	0.038	0.097 ^{***}	0.055
	(0.043)	(0.037)	(0.065)	(0.037)	(0.069)
Constant term	0.099 ^{***}	0.013	0.089 ^{**}	0.005	0.048 [*]
	(0.031)	(0.028)	(0.043)	(0.043)	(0.026)
Observations	763	699	535	616	311
Year fixed effects	Yes	Yes	Yes	Yes	Yes
City fixed effects	Yes	Yes	Yes	Yes	Yes

Standard errors in parentheses.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

to Table 6 (1)(2), the results of the first stage show that the instrumental variables are significant. In the second stage of regression, although the coefficient of digital inclusive finance has decreased, the results are still significant.

2) Replace the measurement method of the explained variable indicator.

As seen in Table 6 (3), the measurement of urban economic resilience is changed to the principal component analysis method, and the core conclusion of this paper that “digital finance contributes to the enhancement of urban economic resilience” has not changed.

3) Winsorization.

As is shown in Table 6 (4), the main explanatory variables were winnowed at the level of 1%, and the parameter estimates and significance change little.

Table 6. Robustness test

	(1)	(2)	(3)	(4)
	Stage 1	Stage 2	Principal Component Analysis	Winsorization
Variables	Digital finance	Economic resilience	Economic resilience	Economic resilience
Number of post offices × digital finance	0.068 *** (0.008)			
Digital Finance		0.031 * (0.018)	0.097 *** (0.032)	0.109 *** (0.032)
Foreign capital dependence	0.338 (0.298)	0.055 (0.044)	0.079 (0.049)	0.065 (0.056)
Industrial upgrading	0.784 *** (0.050)	0.110 *** (0.016)	0.003 (0.010)	0.002 (0.010)
Education	3.256 ** (1.339)	0.366 * (0.207)	0.200 * (0.113)	0.231 * (0.137)
Urbanization	1.302 *** (0.112)	0.511 *** (0.029)	0.042 (0.101)	0.039 (0.101)
Economic aggregation	1.435 *** (0.225)	0.038 (0.042)	0.076 ** (0.037)	0.077 * (0.042)
Constant term	0.035 (0.107)	0.140 *** (0.016)	0.055 (0.053)	0.110 ** (0.054)
Year fixed effects			Yes	Yes
City fixed effects			Yes	Yes
Observations	1105.000	1105.000	1105.000	1105.000
R ²	0.391	0.519	0.728	0.525

Standard errors in parentheses.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

6 Conclusion

This paper incorporates the impact of digital inclusive finance into the framework of urban economic resilience, discusses the mechanism of digital inclusive finance on economic resilience, and makes heterogeneity analysis combining the degree of marketization and location differences. The following research results are obtained.

- (1) Digital inclusive finance plays a significant role in promoting urban economic resilience. Among the three sub-dimensions of digital inclusive finance, the coverage breadth has the greatest impact on economic resilience, followed by the depth of use and the degree of digitalization.
- (2) Digital inclusive finance mainly promotes urban economic resilience from three channels: financial development, innovation and entrepreneurship, and income equality.
- (3) In the regions with higher marketization degree and the eastern region, the promoting effect of digital finance is more significant. The secondary industry and the tertiary industry have different effects in the regions with different marketization degree and location. Based on this, this paper puts forward the following policy recommendations.

Above all, expand the scope of digital financial services, strengthen its role in promoting financial development, expanding residents' opportunities for innovation and entrepreneurship, and alleviating income inequality. In the second place, we should optimize the resource allocation function of digital inclusive finance, so that scientific and technological innovation enterprises can fully enjoy the inclusive dividend of regional digital finance development, so as to better promote the upgrading of industrial structure. In the end, while promoting the development of digital finance, we should give full play to the "digital dividend", prevent the "digital divide", enhance the construction of financial infrastructure in the central and western regions, improve the availability of digital finance, fulfill the social responsibility of financial services for the real economy, and achieve inclusive growth.

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