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Research on the Impact of Digital Finance on the High-Quality Development of Regional Economy: An Empirical Analysis Based on Provincial Panel Data

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Abstract: As a product of the combination of digital technology and traditional finance, the vigorous development of digital finance in the context of the digital economy era will certainly have a great impact on the high-quality development of the economy. Based on the panel data of 31 provinces from 2011 to 2020, this paper adopts the entropy value method to determine the economic development index of the region, and applies the two-way fixed effect model to explore the impact of the development of digital finance on the regional economic development. It is found that the rapid development of digital finance has a positive role in promoting the economic development of the region and changes with the level of openness to the outside world as well as the level of human capital, and that the innovation effect update of the region plays an intermediary role as an intermediary variable in the impact of digital finance on the economic development of the region. There is significant heterogeneity in the economic development of digital finance on different regions, with the highest in the east and the lowest in the center. Reasonable suggestions are made for the better development of the economy of each region, thus promoting the high-quality development of the economy of each region.

Keywords: Digital Finance; Regional Economic Development; Fixed Effects Model; Level of Openness to the Outside World; Level of Human Capital.

1. Introduction

With the continuous application of technologies such as the Internet, artificial intelligence and blockchain in today's era, China's economy is characterized by digitalization. With the continuous application of digital technology, the problem of information asymmetry has been alleviated, and the combination of traditional finance and digital technology has led to the improvement of its exclusivity characteristics, giving rise to a new financial model-digital finance. The report of the 20th Party Congress puts forward that high-quality development is the primary task of comprehensively building a socialist modernized country and the essential requirement of China's modernization, and the report of the 19th Party Congress puts forward that China's economy has transformed from the stage of high-speed growth to the stage of high-quality development, and puts forward that it is necessary to realize that the economy has transformed from being factor-driven to being efficiency-driven. Therefore, how to realize the high-quality development of the region's economy has become the primary issue in China.

China has made high-quality economic development a top priority, and while considering the overall economy, it is also necessary to consider the high-quality development of the regional economy, and in particular to consider the differences in the regional economy. Although China's economy as a whole presents a growth stage, the economy of different regions in China presents large differences, especially the unbalanced economic development of the eastern and western hair, and the unbalanced economic development of the north and south. The emergence of digital finance is a good solution to this problem, because digital finance based on digital technology can well reduce the cost of information search, alleviate the problem of information asymmetry, reduce the transaction cost of financial institutions and the cost of financial services, improve the utilization rate of funds, increase sectoral productivity, enhance the internal drive of economic development, so that the regional economy can be developed at the same time, reducing the differences in the regional economy[1] .

The problem of the wide gap between urban and rural economies has become more serious in the past few years, and China has issued a number of policies on poverty alleviation in the past, as well as a number of poverty alleviation tasks, with the aim of improving the economies of poor areas and narrowing the gap between urban and rural incomes. The emergence of digital finance based on Internet technology can improve this problem. The development of digital finance can lead to inclusive growth, i.e. increasing income while adjusting income distribution, thus reducing the urban-rural gap or regional gap[2]. The digital transformation of traditional industries is also a way to achieve high-quality economic development, which can be achieved by combining digital finance with traditional industries, so that traditional industries can undergo digital transformation, thus improving the productivity of the industries, and then leading to high-quality development of the region's economy[3] .

While the development of digital finance can lead to high-quality economic development, it can also create a large number of financial risks. While it is true that the development of digital finance can increase the accessibility of financial services for low-income groups and lower the threshold and cost of access for these groups, it also creates a large number of financial risks, such as information leakage, fraud and other problems. Without government intervention and regulation, the development of digital finance may lead to a "digital divide"[4] . Based on the specific data of each province, this paper utilizes the two-way fixed effect model

and the mediation effect model to study the impact of digital finance on the high-quality development of each region's economy, which is of great significance and influence in promoting the coordinated development of digital finance and each region's economy.

2. Literature Review

In the literature related to the study of the relationship between traditional finance and economic growth, most scholars believe that financial development will promote economic development. Zhang (2018) believes that financial institutions and financial markets have an important impact on economic growth, and generally speaking, countries with developed financial systems and financial markets and stable development of financial institutions will also have rapid economic development. The reason is that the development of the financial system and financial market solves the problem of financing constraints of the vast majority of enterprises, expands their sources of financing, increases the output rate of enterprises, and then promotes the rapid development of the region's economy. And the rapid development of traditional finance will bring about the increase and development of the real economy. The real economy is the basis for the development of traditional finance, while at the same time traditional finance will serve the real economy and bring about the development of the real economy[5] .

Digital finance offers greater advantages than traditional finance. Digital finance has both retained the original nature of traditional finance and improved its existing shortcomings. The service cost of traditional finance is higher, and the higher cost fee inhibits the inclusive nature of infectious finance, but based on the digital era background, the digital finance formed by the combination of the Internet and traditional finance has lowered the threshold of financial services, and at the same time, lowered the high cost of financial services, thus making the inclusive character more prominent. Therefore, the emergence of digital finance has changed the service mode of traditional finance and improved the deficiencies in traditional financial services. Digital finance has the characteristics of universality, efficiency, sharing and convenience, and it is these characteristics of digital finance that make digital finance have an important impact on economic development. Digital finance can provide diversified and personalized financial services, expand the scope of financial services, alleviate the problem of information asymmetry, improve the income and consumption ability of residents, and innovation of financial products and services, breaking through the time and geographical limitations, so that people can use today's services anytime and anywhere. Nie Yumi believes that digital finance can alleviate the problem of financial constraints, and it can utilize big data mining technology to obtain users' needs and consumption preferences at low cost, so that remote areas, poor areas and low-income groups can also have access to financial services, and the emergence of digital finance can be a good solution to the problem of the large gap between urban and rural areas, narrowing the gap between urban and rural areas[6] . Xie Gloria et al. believe that the development of digital finance has a significant role in promoting entrepreneurship, and the depth, degree of coverage, and degree of use of digital finance have a significant role in regional entrepreneurial activities, driving regional economic development[7] . According to Penny, digital finance can solve the problem of financial mismatch and optimize the allocation of resources, thus reducing the cost of financial services. The emergence of digital finance improves the shortcomings of traditional finance, thus creating a competitive relationship with traditional finance, so that people's demand for and use of finance no longer depend on traditional financial institutions, and people's access to information is easier, no longer relying on the information released by traditional financial institutions, which improves the efficiency of the use of finance, and has a significant effect on the high-quality development of the regional economy[8] . Zhou Renyuan, Zhang Xiangjian et al. (2022) argued that based on the development of the Internet, the new and efficient financial service platform provided by digital finance can promote economic development. The scholar discusses the impact of digital finance on shared development in terms of industrial structure, consumption structure and consumption level, and concludes that digital finance can promote economic development by optimizing the industrial structure and consumption structure and improving the consumption level of residents[9] . Xu Guangshun and Feng Lin (2022) studied the impact of digital finance on the urban-rural income gap, and they concluded that the degree of coverage, depth, and use of digital finance can reduce the urban-rural income gap by influencing the investment in human capital of farmers, thus bringing about the economic uplift of the region[10] . Some scholars believe that digital finance will not only bring positive impacts to regional economic development, but also bring negative impacts. The continuous development of digital finance will not only bring positive impacts, but also bring unpredictable financial risks. Financial risk has uncertainty, seriousness of consequences and hidden, financial risk will be generated with the development of financial institutions and financial products, financial risk has proliferation, so the identification and control of financial risk is crucial, which gives domestic financial regulators a wake-up call to pay attention to the identification of financial risk, measurement and control, in order to bring the development of digital finance at the same time the regional economic development. economic development[11] . Wang Xiuhua and Zhao Yaxiong (2020), through the study of digital finance, found that there is a "Matthew effect" in the impact of digital finance on poor households and non-poor households, that is, both of them can accept digital financial services unconditionally, but the financial services brought by digital finance for both of them are not equal. Poor households have little impact on changing their household income through digital financial services, while non-poor households can not only bring about a greater increase in their household income through digital financial services, but also utilize digital financial services for risk prevention and recreation.[12] .

In summary, as shown in the above, affected by China's poverty alleviation policy, the larger gap between urban and rural areas has received more attention from scholars, so most of the existing literature studies the impact of digital financial development on the urban-rural income gap and provides relevant recommendations to carry out the reduction of the urban-rural income gap. However, the existing literature rarely studies the heterogeneity of the impact of digital finance on regional economic development, i.e., it studies the impact of digital finance on the economic development of different regions. China is recently increasing its development efforts in the west, so studies on different regions should be considered. In this paper, in addition to considering the degree

of coverage, depth and use of digital finance on regional economic development, we also study the innovation effect of the region as a mediating variable on regional economic development and the heterogeneous impact of digital finance on the east, the west and the center of the country, so as to put forward reasonable suggestions for the government to deepen the economic reforms and promote the regional economic development.

3. Theoretical Analysis and Research Hypothesis

Digital finance, as a new financial service model, is a combination of digital technology and traditional finance, breaking the situation of traditional financial institutions dominating the financial market and enabling people to receive financial services without discrimination. The rapid development of digital finance in just recent years has brought about the rapid development of China's economy. For this reason, digital finance can promote economic innovation, thus creating more new types of financial products, satisfying more suitable people and promoting economic development. Digital finance can also improve the quality of financial services and financial products, solve the problems of geographical restrictions and time limitations of traditional finance, provide more accurate and diversified financial services, solve the problem of information asymmetry, reduce the cost of financial transactions, improve the utilization rate of funds, and promote the development of the local economy[13] .

H1: The development of digital finance can contribute to the rise of economic standards

Technological innovation has a positive effect on the economic development of the region. With the rapid development of science and technology driving the development and innovation of digital finance, the digital finance industry is constantly exploring and innovating, injecting new vitality into traditional finance. Digital finance is not only affected by the development of science and technology, but also promotes the development of technological innovation. Digital finance will provide financial support for relevant enterprises and promote the development of new products and innovative technologies. Based on the technology of digital finance, such as artificial intelligence, cloud computing and big data mining and other new technologies, digital finance itself can promote technological innovation, digital finance will be applied to financial institutions and the financial market, the production of new financial products, improve the efficiency of financial services and the productivity of financial products, and reduce the transaction cost of finance and the cost of information acquisition. It also drives the technological innovation and development of other industries, injects new vitality into the economy, and promotes the improvement of the economic level[14] .

H2: Digital finance can contribute to rising economic standards by fostering technological innovation

The impact of digital finance on economic development varies from place to place in various regions of China because of geographic differences, unbalanced distribution of resources and different levels of development. Most of the existing literature only considers the problem of urban-rural income gap and thinks about how to reduce the problem of large urban-rural income gap. Zhang He, Bai Qinxian (2018) concluded that the application of digital finance can effectively solve the problem of the large urban-rural gap through the three major effects derived from the basic functions of digital finance: the inclusion effect, the poverty reduction effect and the growth effect [15] . However, few scholars have examined the mechanism of the impact of digital finance on economic development in different regions, due to the differences in the distribution of resources, the level of financial markets and technological innovation, the size of the labor force owned and the degree of construction of infrastructure in the east, central and western regions, resulting in different impacts of digital finance on economic development.

H3: Heterogeneity in the impact of digital finance on economic development in different regions

4. Empirical Design

4.1. Modeling

(1) Baseline model

In order to study the impact of digital finance on regional economic development, this paper refers to the existing literature [16], constructs a two-way fixed effect model based on the panel data of 31 provinces, and studies the relationship between digital finance and regional economic development by constructing the following model:

$$Eco_{i,t} = \beta_1 \ln f_{i,t} + \beta_0 + \alpha_1 Con_{i,t} + \gamma_t + \mu_i + \varepsilon_{i,t} \quad (1)$$

where i denotes province; t denotes year;Con denotes a series of control variables measuring the degree of government intervention, industrial structure, human capital level, transportation network density, and openness to the outside world, respectively;γ_t denotes region fixed effects;μ_t denotes year fixed effects;$\varepsilon_{i,t}$ denotes a random error term.

(2) Mediating effects model

In this paper, according to the research of Jiang Boat [17] , the mediation effect model is introduced to verify the role mechanism of digital finance on regional economic development, and the model is as follows:

$$\ln C_{i,t} = \omega_1 \ln f_{i,t} + \omega_0 + \sigma_1 Con_{i,t} + \tau_t + \varphi_i + \varepsilon_{i,t} \quad (2)$$

$$Eco_{i,t} = \rho_1 \ln f_{i,t} + \rho_2 \ln C_{i.t} + \partial_1 Con_{i,t} + \rho_0 + \tau_t + \varphi_i + \varepsilon_{i,t} \quad (3)$$

where C is the mediating variable and the mediating variable is technological innovation ($\ln C$), theω, ρ is the parameter to be estimated, and the other variables are the same as shown in (1).

4.2. Description of Variables

(1) Explained variable - economic development level (Eco). The level of high-quality economic development is difficult to be measured by the per capita GDP of each province, this paper refers to the conclusions of Zhou Chenying, Tian Fa (2022) and other studies, and utilizes the entropy value method to measure the level of high-quality economic development of each province based on 1 first-level index, 5 second-level indexes, and 18 third-level indexes[18] , see Table 1.

(2) Explanatory variables. The explanatory variables in the paper are the digital financial inclusion index ($\ln f$), degree of digital financial inclusion coverage ($\ln cov$), depth of use of digital financial inclusion ($\ln dep$), the degree of digitization of digital financial inclusion ($\ln d$), and the index and its sub-dimensions are logarithmized for better application to the model.

Table 1. Evaluation system for high-quality economic development of the Yangtze River Delta city cluster

Level 1 indicators	Secondary indicators	Tertiary indicators	Measurement
High-quality economic development	Innovative development	GDP growth rate	Regional CDP growth rate
		R&D investment intensity	R&D expenditures of industrial enterprises above large scale/regional GDP
		Investment efficiency	Incremental Capital Output Rate (ICOR) = investment rate/regional CDP growth rate
		Technology transaction activity	Technology transaction turnover/regional GDP
	Coordinated development	Demand structure	Total retail sales of consumer goods/regional GDP
		Urban and rural structures	urbanization rate
		industrial structure	Increase in the share of the tertiary sector in regional GDP
		Government debt burden	Government debt balance/regional GDP
	Green development	Energy consumption elasticity coefficient	Growth rate of energy consumption/gross regional product
		Wastewater per unit of output	Total wastewater discharge/regional GDP
		Exhaust gas per unit of output	Sulfur oxide emissions/regional GDP
	open development	External trade dependence	Total exports and imports/regional CDP
		Share of foreign investment	Actual utilization of foreign investment/regional CDP
		marketability	Area marketization index
	Shared development	Share of workers' compensation	Labor compensation/regional GDP
		Elasticity of population income growth	Growth rate of disposable income per capita/regional GDP growth rate
		Urban-rural consumption gap	Consumption expenditure per urban resident/consumption expenditure per rural resident
		Share of fiscal expenditure on people's livelihoods	Percentage of local budget expenditures on education, health care, housing security, social inclusion and employment in local budget expenditures

(3) Mediating variable - technological innovation ($\ln C$)**.** Technological innovation uses the number of patents granted in the China Regional Innovation and Entrepreneurship Index compiled by the Enterprise Big Data Research Center of Peking University[19] and takes the logarithm.

(4) Control variables

(1)the level of government intervention (G), measured by the ratio of local government's fiscal expenditure to GDP;**(2) the level of industrial structure (**$\ln I$**)**, measured by the logarithm of the ratio of the city's tertiary industry output to the secondary industry output; **(3) the level of infrastructure (**$\ln T$**)**, measured using the logarithmic value of the ratio of regional road mileage to the area of the administrative region; **(4) the level of human capital (P), measured by the ratio of the number of students enrolled in higher education to the total population**; **(5)** the level of openness to the outside world ($\ln O$), measured using the logarithm of the ratio of the amount of goods imported and exported to the gross regional product.

4.3. Data Sources

The raw data for the explanatory and control variables in this paper are obtained from the 2011-2020 China Statistical Yearbook and the National Bureau of Statistics. The explanatory variable digital finance index and the 3 sub-dimensions (breadth of digital finance coverage, depth of digital finance use, and degree of digitization) are adopted from the 2020 provincial digital finance index [20] compiled by the Digital Finance Research Center of Peking University. The descriptive results are shown in Table 2.

5. Results and Analysis

5.1. Benchmark Regression

In order to test the impact of digital finance on the high-quality development of the regional economy, this paper utilizes a two-way fixed-effects model for the basic regression, and the results obtained are shown in Table 3. Columns (1)-(4) in the table show the results of the impact of the core explanatory variable, the total digital finance index, and its three sub-dimensions on the high-quality development of the economy. According to column (1), after controlling for time and city, the regression results are significant and positive at the 1% level, and each unit increase in the total digital finance index leads to a 0.018 unit increase in the index of high-quality development of the regional economy. According to column (2), the regression results are significant at the 5% level, which is manifested in the fact that for every unit of the sub-index of the degree of coverage of digital finance, it will lead to an increase in the index of high-quality development of the regional economy by 0.004 units. According to column (3), the regression results are significant at the 5% level, as shown by the fact that in every unit of improvement of the depth of digital finance use sub-index, it will lead to the improvement of the index of high-quality development of the regional economy by 0.010 units. According to column (4), the regression result is significant and negative at the 1% level, indicating that the digitization of digital finance inhibits the high-quality development of the economy, and every unit increase in the sub-index of the digitization of digital finance leads to a decrease in the index of high-quality development

of the regional economy by 0.011 units.

Table 2. Results of descriptive statistics

variable name	notation	sample size	average value	(statistics) standard deviation	minimum value	upper quartile	maximum values
explanatory variable							
Economic Quality Development Index	Eco	310	0.2301	0.098	0.10	0.20	0.58
Core explanatory variables							
Digital Inclusive Finance Index	Ln(f)	310	5.2116	0.676	2.79	5.41	6.07
Level of digital financial inclusion coverage	Ln (cov)	310	5.0598	0.844	0.67	5.29	5.98
Depth of use of digital financial inclusion	Ln (dep)	310	5.2055	0.647	1.91	5.32	6.19
Digital Inclusion Level of financial digitization	Ln (d)	310	5.5102	0.698	2.03	5.78	6.14
control variable							
Level of government intervention	G	310	0.2807	0.195	0.11	0.23	1.33
Level of industrial structure	Ln(I)	310	0.1030	0.412	-0.66	0.07	1.67
technological innovation	C	310	2.2277	0.187	1.48	2.26	2.51
Level of infrastructure	Ln (T)	310	-0.3220	0.867	-2.96	-0.08	0.80
degree of openness to the outside world	Ln(O)	310	-1.8197	0.967	-4.88	-1.96	0.44
Level of human capital	P	310	0.3825	0.068	0.22	0.39	0.54

Table 3. Benchmark regression results

variant	(1)	(2)	(3)	(4)
	Eco	Eco	Eco	Eco
Ln(f)	0.018***			
-	(0.005)			
Ln(cov)		0.004**		
-		(0.002)		
Ln(dep)			0.010**	
-			(0.004)	
Ln(d)				-0.011***
-				(0.004)
G	-0.022	-0.021	-0.023	-0.028
-	(0.024)	(0.024)	(0.024)	(0.024)
Ln(I)	0.022***	0.022***	0.020***	0.020***
-	(0.006)	(0.006)	(0.006)	(0.006)
Ln(T)	0.019	0.024**	0.024**	0.022*
-	(0.012)	(0.012)	(0.012)	(0.012)
Ln(O)	0.025***	0.024***	0.025***	0.024***
-	(0.002)	(0.002)	(0.002)	(0.002)
P	0.008	0.008	0.009	0.010
-	(0.017)	(0.017)	(0.017)	(0.017)
time fixed effect	containment	containment	containment	containment
urban fixed effect	containment	containment	containment	containment
N	310.000	310.000	310.000	310.000

Note: * p<0.1, ** p<0.05, *** p<0.01

In terms of control variables, the level of government intervention is not significant and the coefficient is negative, although the government's intervention in the economy will certainly have a certain impact, but because of the changes in macroeconomic factors and China's national conditions change from time to time, so that the government's intervention in the economy is not significant, and if the government intervenes in the economy excessively, it will have a negative impact on the high-quality development of the economy. The level of industrial structure is significant and the coefficient is positive, indicating that structural innovation and transformation of industries have a positive impact on the economy, and industries should be digitally transformed in line with the times, which not only optimizes the allocation of resources, but also improves the effect of production, reduces the cost of production, and has a positive impact on the high-quality development of the economy. The regression coefficient of the level of infrastructure is positive

and more significant, indicating that the improvement of China's infrastructure construction has a positive effect on the high-quality development of China's economy, and the improvement of the level of infrastructure can improve the quality of life of the people and narrow the gap between urban and rural areas, which in turn has a positive effect on the economy. The regression coefficient of the degree of openness to the outside world is positive and highly significant, increasing the size of China's degree of openness to the outside world, strengthening the links and transactions with other countries, and thus attracting more external capital inflow and foreign investment, promoting China's economic development. The regression coefficient of human capital level is positive but not significant. China's educational resources are limited, but the country's population is large, which does not allow everyone to receive a good education, restricting the cultivation of high-quality talents in China, which in turn makes the role of human capital level on China's economic development not obvious.

5.2. Robustness Tests

The model may generate endogeneity problem, that is, the high-quality development of the economy will be affected by digital finance, and also affect the development of digital finance, in order to prevent the inaccuracy of the model results due to the endogeneity problem, and to further test the reliability and accuracy of the conclusions of this paper, this paper adopts the method of changing the number of sample sizes and the lag period to carry out the robustness test.

5.2.1. Sample of Cities with Large Differences in Economic Development Excluded

There are large differences in the economic level between different cities in China, especially the first-tier cities, such as Shanghai, Beijing and other first-tier cities with higher economic level, faster development of digital finance, and municipalities are supported by economic policies, the level of high-quality economic development is higher. Therefore, this paper excludes the four municipalities of Beijing, Shanghai, Tianjin and Chongqing, and verifies whether the results of the model and the conclusions of this paper are still consistent after the exclusion of the four municipalities. Table 4 shows that the significance of the regression results and the size of the parameters of the model after the removal of the samples have not changed significantly, which proves the accuracy of the conclusion.

Table 4. Regression results excluding the sample of cities with large differences in economic development

variant	(1)	(2)	(3)	(4)
	Eco	Eco	Eco	Eco
Ln(f)	0.020***			
-	(0.006)			
Ln(cov)		0.004*		
-		(0.002)		
Ln(dep)			0.009**	
-			(0.004)	
Ln(d)				-0.010***
-				(0.004)
G	-0.034	-0.033	-0.036	-0.040*
-	(0.024)	(0.025)	(0.024)	(0.024)
Ln(I)	0.022***	0.023***	0.020***	0.020***
-	(0.006)	(0.006)	(0.006)	(0.006)
Ln(T)	0.018	0.023*	0.022*	0.020
-	(0.012)	(0.013)	(0.012)	(0.012)
Ln(O)	0.024***	0.024***	0.024***	0.023***
-	(0.002)	(0.002)	(0.002)	(0.002)
P	0.027	0.026	0.027	0.026
	(0.017)	(0.018)	(0.018)	(0.018)
time fixed effect	containment	containment	containment	containment
urban fixed effect	containment	containment	containment	containment
N	280.000	280.000	280.000	280.000

Note: * p<0.1, ** p<0.05, *** p<0.01

5.2.2. Lag Method Estimates

The lag estimation method is utilized to verify whether the model has endogeneity problems [21], and the relevant variables, core explanatory variables, and explanatory variables lagged by one, two, and three periods are introduced into the model and the benchmark regression is conducted, and the results obtained are shown in Table 5. It is found that, according to the results in columns (1)-(4), the significance and parameter values of the total index of digital financial inclusion have not changed significantly, indicating that after the introduction of the three lagged variables into the model, the conclusion of the baseline regression still holds, which proves the accuracy of the conclusion as well as its robustness.

5.3. Heterogeneity Analysis - Heterogeneity of Regions

Due to the different resource allocation as well as development levels in different regions, the impact of digital finance on the high-quality development of the economy in different regions is also different. Therefore, this paper divides the 31 provinces into three regions according to geographic location, namely, the east, the center and the west, to verify the regional heterogeneity of digital finance on the high-quality development of the economy, and the results are shown in Tables 6, 7 and 8, which show that the regression coefficients of the western region are highly significant and

have a larger value, indicating that the digital finance in the west has a greater degree of influence on economic development, and verifying the existence of regional economic heterogeneity. The reason for this is that the eastern and central regions have a higher level of digital financial development, more resource allocation, and the local financial system and infrastructure is more complete, the digital economy has been fully developed, the economic development of the region can only rely on the superior geographical location, the degree of government intervention, the level of human capital and the degree of openness to the outside world to influence economic development, the impact of digital finance on economic development is smaller. The impact of digital finance on economic development is relatively small. The development of infrastructure and financial system in the western region is not perfect, and there are no sufficient resources to promote the local economic level, but the coverage of digital finance, the depth of use and the degree of digitalization, the rapid development of local digital finance, which in turn affects the digital finance in various fields, the marginal promotion of digital finance is larger, and the promotion of high-quality economic development is more obvious.

Table 5. Regression results estimated by the lag period method

variant	(1)	(2)	(3)	(4)
	Eco	Eco	Eco	Eco
Ln(f)	0.018***			
	(0.005)			
Ln (L.f)		0.024***		
		(0.005)		
Ln (L2.f)			0.024***	
			(0.005)	
Ln (L3.f)				0.020***
				(0.005)
G	-0.022	-0.025	-0.034	-0.037
	(0.024)	(0.023)	(0.022)	(0.023)
Ln(I)	0.022***	0.021***	0.019***	0.016**
	(0.006)	(0.006)	(0.006)	(0.007)
Ln (T)	0.019	0.010	0.001	-0.006
	(0.012)	(0.012)	(0.012)	(0.013)
Ln(O)	0.025***	0.025***	0.024***	0.024***
	(0.002)	(0.002)	(0.002)	(0.003)
P	0.008	0.011	0.007	0.004
	(0.017)	(0.017)	(0.016)	(0.018)
time fixed effect	containment	containment	containment	containment
urban fixed effect	containment	containment	containment	containment
N	310.000	279.000	248.000	217.000

Note: * p<0.1, ** p<0.05, *** p<0.01

Table 6. Benchmark regression results for the Eastern Region

variant	(1)	(2)	(3)	(4)
	Eco	Eco	Eco	Eco
Ln(f)	-0.013			
-	(0.011)			
Ln(cov)	-0.001	-0.001		
-		(0.002)		
Ln(dep)	0.002		0.002	
-			(0.006)	
Ln(d)	-0.012			-0.012
-				(0.008)
G	0.004	0.002	0.002	-0.001
-	(0.015)	(0.015)	(0.015)	(0.015)
Ln(I)	0.014*	0.015*	0.015*	0.015*
-	(0.008)	(0.008)	(0.008)	(0.008)
Ln(T)	-0.002	-0.001	-0.001	-0.001
-	(0.002)	(0.002)	(0.002)	(0.002)
Ln(O)	0.023***	0.024***	0.025***	0.025***
-	(0.003)	(0.003)	(0.003)	(0.003)
P	0.024	0.025	0.025	0.026
-	(0.017)	(0.017)	(0.017)	(0.016)
time fixed effect	containment	containment	containment	containment
urban fixed effect	containment	containment	containment	containment
N	110.000	110.000	110.000	110.000

Note: * p<0.1, ** p<0.05, *** p<0.01

Table 7. Benchmark regression results for the western region

variant	(1)	(2)	(3)	(4)
	Eco	Eco	Eco	Eco
Ln(f)	0.047***			
-	(0.012)			
Ln(cov)		0.026***		
-		(0.006)		
Ln(dep)			0.042***	
-			(0.015)	
Ln(d)				-0.007**
-				(0.003)
G	0.039***	0.033***	0.040***	0.034***
-	(0.012)	(0.012)	(0.013)	(0.013)
Ln(I)	0.006	0.009	0.003	0.015
-	(0.014)	(0.014)	(0.015)	(0.015)
Ln(T)	0.003	0.003	0.003	0.002
-	(0.002)	(0.002)	(0.002)	(0.002)
Ln(O)	0.022**	0.023**	0.025**	0.023**
-	(0.009)	(0.009)	(0.010)	(0.010)
P	-0.045***	-0.046***	-0.044***	-0.048***
-	(0.011)	(0.011)	(0.011)	(0.012)
time fixed effect	containment	containment	containment	containment
urban fixed effect	containment	containment	containment	containment
N	110.000	110.000	110.000	110.000

Note: * p<0.1, ** p<0.05, *** p<0.01

Table 8. Benchmark regression results for the central region

variant	(1)	(2)	(3)	(4)
	Eco	Eco	Eco	Eco
Ln(f)	-0.006			
-	(0.030)			
Ln(cov)		-0.001		
-		(0.002)		
Ln(dep)			-0.005	
-			(0.011)	
Ln(d)				0.031***
-				(0.010)
G	-0.020	-0.020	-0.019	-0.010
-	(0.015)	(0.014)	(0.014)	(0.014)
Ln(I)	0.003	0.002	0.004	0.017
-	(0.011)	(0.012)	(0.012)	(0.012)
Ln(T)	0.000	0.000	0.000	-0.000
-	(0.002)	(0.002)	(0.002)	(0.002)
Ln(O)	0.006	0.007	0.006	0.009
-	(0.008)	(0.008)	(0.008)	(0.008)
P	0.010	0.009	0.010	0.013
-	(0.011)	(0.011)	(0.011)	(0.010)
time fixed effect	containment	containment	containment	containment
urban fixed effect	containment	containment	containment	containment
N	90.000	90.000	90.000	90.000

Note: * p<0.1, ** p<0.05, *** p<0.01

6. Analysis of Intermediation Effects

In order to verify whether technological innovation can have an impact on the high-quality development of regional economy, this paper takes technological innovation as a mediating variable and applies the mediating effect model to verify whether technological innovation will have an impact on the high-quality development of regional economy. The results are shown in Table 9. The coefficients of technological innovation and digital finance both passed the significance test, and comparing the coefficients of the digital finance index in Column 1 with those in Column 3, it is found that the coefficients decreased from 0.020 to 0.019, and technological innovation plays a partial role of mediating effect. Under the condition that other variables remain unchanged, for every unit increase in the digital financial index, the index of high-quality development of the regional economy increases by 0.019 units, and for every unit increase in technological

innovation by 0.005 units, the index of high-quality development of the regional economy increases by 0.0068 units, which indicates that technological innovation has a significant positive facilitating effect on the high-quality development of the regional economy. Technological innovation can improve the resource allocation efficiency of enterprises, and at the same time produce new production methods, technology, forcing backward enterprises to carry out digital transformation, improve production efficiency and competitiveness of enterprises, and continue to innovate and develop in the competition. At the same time, the application of new technologies can narrow the gap between urban and rural areas, the application of new technologies in rural areas can change the traditional rural development model, the application of digital technology in traditional industries, not only can improve their production efficiency, reduce production costs and the cost of access to information, and can improve people's quality of life and income level, promote the high-quality development of the local economy, narrow the gap between urban and rural areas.

Table 9. Results of the analysis of intermediation effects

variant	(1)	(2)	(3)
	Eco	Eco	Eco
Ln(f)	0.020***	0.357***	0.019***
	(0.005)	(0.128)	(0.005)
C			0.005*
			(0.003)
G	-0.004	0.213	-0.005
	(0.007)	(0.176)	(0.007)
Ln(I)	0.021***	-0.583***	0.023***
	(0.006)	(0.140)	(0.006)
Ln(T)	0.001	0.084***	0.000
	(0.001)	(0.029)	(0.001)
Ln(O)	0.024***	0.017	0.024***
	(0.002)	(0.055)	(0.002)
P	0.004	0.376**	0.002
	(0.006)	(0.149)	(0.006)
time fixed effect	containment	containment	containment
urban fixed effect	containment	containment	containment
N	310.000	310.000	310.000

Note: * p<0.1, ** p<0.05, *** p<0.01

7. Conclusion and Suggestions

7.1. Conclusion

This paper uses the panel data of 31 provinces in China from 2011 to 2020, and utilizes the entropy method to measure the economic high-quality development index of each province, so as to more intuitively measure the regional economic development level of each region. A two-way fixed-effects model is used to analyze the impact of digital finance on the high-quality development of the regional economy, and before conducting the benchmark regression, the excluded sample data method and the lag period method are used to conduct a robustness test to check whether the model has endogeneity problems. This paper also adopts the mediation effect model to verify the impact and effect of technological innovation on the high-quality development of the regional economy, and conducts the regional heterogeneity test to verify whether digital finance has the same impact and effect on the high-quality development of the region's economy in different regions. The results are as follows:

(1) Overall, digital finance does have a positive contribution to the high-quality development of the regional economy, but from the point of view of the sub-index of digital finance, the breadth of coverage of digital finance and the degree of use of digital finance have a positive contribution to the high-quality development of the regional economy, but the degree of digitization of digital finance has a negative impact on the high-quality development of the regional economy. The breadth of coverage of digital finance means that digital finance utilizes digital technologies such as cloud computing, big data statistics, and the Internet to expand the scope of financial services and improve financial inclusion, so that more people can enjoy digital financial services and promote the high-quality development of the regional economy. The depth of the use of digital finance i.e. the use of digital finance does not lie in the volume, but in the degree of efficiency and precision, so that financial services can better meet people's needs, reduce the costs arising from access to information, and promote the economic development of the region. The degree of digitalization of digital finance is the degree of digital transformation of traditional enterprises, while the digital transformation of enterprises has an inhibiting effect on the high-quality development of the regional economy because the development of digital infrastructure is not perfect, and cannot fully reflect the efficiency and low cost of the digital economy.

(2) From the point of view of the control variables in this paper, the upgrading of industrial organizations of enterprises and the local openness level of the region have a significant role in promoting the high-quality development of the regional economy. The degree of government intervention, the completeness of infrastructure and human capital do not have a greater impact on the high-quality development of the regional economy.

(3) There is obvious heterogeneity in the high-quality development of regional economy by digital finance, and the results show that the impact of digital finance on the east as well as the center is not as large as that of the west, reflecting

the universality of digital finance.

(4) From the viewpoint of intermediary effect, there is an obvious positive promotion effect of technological innovation on the high-quality development of regional economy. As a mediating variable of the impact of digital finance on the high-quality development of the economy, technological innovation can provide financial support as well as technical support to enterprises, promote the digital transformation of enterprises, optimize the efficiency of resource allocation, improve the productivity of enterprises and the local innovation index, and promote the high-quality development of the local economy.

7.2. Suggestion

(1) Establish a perfect financial regulatory system and strengthen the government's regulatory role. Digital finance has a positive role in promoting the high-quality development of the regional economy, and the greater the degree of coverage and depth of use of digital finance, the more obvious the impact on the local role. However, the inhibitory effect of the degree of digitalization of digital finance on the economy should not be ignored, and the higher the degree of digital transformation of enterprises will, on the contrary, have an inhibitory effect on the economy, so the government needs to strengthen the supervision of the digital transformation of enterprises. In previous years, the government's regulation of finance was not very strict, so digital finance developed rapidly in a more relaxed regulatory environment, setting off a digital economic frenzy and promoting the development of the digital economy. However, the looser regulatory environment can lead to the creation of financial risks, like credit risk, which can lead to debtor or counterparty defaults due to less stringent regulation, causing capital losses to financial institutions as well as counterparties.

(2) Facilitating the digital transformation of traditional enterprises. Although the higher the degree of digitalization of digital finance, i.e., the deeper the degree of digital transformation of enterprises, will have an inhibitory effect on economic development. However, the original development mode and production mode of traditional enterprises, production efficiency is too low and production costs are too high, and they need continuous financial support to stabilize their mode of operation. Only through the completion of the digital transformation of enterprises, to enhance their competitiveness, forcing other traditional enterprises, especially high-carbon enterprises or enterprises that need to consume more resources in order to stabilize the mode of operation or mode of production to carry out digital transformation, optimize the allocation of its resources, enhance the industrial economic structure, in order to achieve the high quality development of the regional economy has a strong positive effect on the promotion of high quality.

(3)The economic development strategy of each region should be formulated and implemented according to local conditions. According to the heterogeneity analysis of this paper, it can be seen that due to the differences in historical heritage and geographic factors, and the development of different regions and different resource allocation, resulting in the impact of digital finance on the high-quality development of the economy in different regions is different. The eastern and central regions have faster development of digital finance and have a molded financial model, while the western region has a different impact on these three regions due to slower development and a smaller degree of national development of the western region. If they are treated according to the same strategy of high-quality economic development, they may have a hindering effect on the high-quality economic development of the region. Therefore, in view of the problem of unbalanced development of economic quality in different regions of China, in order to give full play to the role of digital finance in promoting the development of regional economic quality, it is necessary to formulate the corresponding economic development strategies according to the economic conditions of the eastern, western and central regions.

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