

Investment-driven Effects of Digital Inclusive Finance: Theory and Empirical Evidence

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Abstract

Against the background of rapid development of digital economy and transformation and upgrading of economic structure, digital inclusive finance, as a new mode of fusion of financial technology and inclusive finance, is of great significance in promoting investment growth. This paper empirically investigates the impact of digital financial inclusion on investment and its mechanism of action based on panel data of 30 provinces in China from 2011 to 2022. The study finds that: first, digital inclusive finance has a significant role in promoting investment. Second, the investment-driving effect of digital financial inclusion shows regional heterogeneity, with a decreasing impact on the eastern, central and western regions, reflecting the differences in the level of digital financial inclusion between regions. Third, financial regulation and financial marketization have negative and positive moderating effects on the investment effect of digital inclusive finance, respectively, and over-regulation may inhibit innovation vitality, while market-oriented reforms can strengthen its positive impact. Based on this, this paper proposes that digital inclusive finance should be comprehensively promoted, regional differentiation policies should be optimized, financial regulation and innovation should be balanced, and market-oriented reforms should be deepened in order to give full play to the supportive role of digital finance to the real economy.

Keywords

Digital Inclusive Finance, Investment-Driven Effect, Regional Differentiation, Financial Regulation, Financial Marketization.

1. Introduction

Over the past 40 years of reform and opening up, China's economy has continued to deepen innovation in its institutions and mechanisms, and its GDP growth rate has been consistently higher than the world average. In particular, since entering the new era, led by the innovation-driven development strategy, the quality of economic development has been significantly improved, and significant progress has been made in the construction of a modernized economic system. Against this backdrop, China's economic development has demonstrated strong resilience and unique advantages. As one of the core engines of economic growth, investment not only provides key support for the sustained and healthy development of the economy, but is also an important driving force for upgrading the industrial structure and improving production efficiency. According to data from the National Bureau of Statistics (NBS), it is found that China's current investment in fixed assets across the whole society has been growing steadily, and in 2024, the national investment in fixed assets (excluding farm households) amounted to 514,374,000,000 Yuan, an increase of 3.2% over the previous year (2024). Investment in the primary and secondary industries as well as some sectors of the tertiary industry all showed some degree of growth compared to the previous year. The simultaneous growth of investment in the three industries not only reflects the optimization

and adjustment of China's economic structure, but also signals that the endogenous momentum of economic growth is being strengthened. However, in the economic “high-speed growth” at the same time, we should also pay attention to the economic “high-quality development”. At present, China's economy is in a period of structural adjustment, with traditional growth momentum weakening and new momentum not yet fully formed. With the current adjustment of industrial structure, investment is facing a series of difficulties and challenges. Problems such as slowing down of investment growth, limited investment space and irrational investment structure are becoming more and more prominent[1]. Therefore, how to further stimulate investment and improve the efficiency and returns of investment has become an important issue in the current economic development.

With the continuous upgrading and development of the Internet and digital technology, digital technology based on artificial intelligence, cloud computing, big data, Internet of Things, blockchain and so on, is gradually combined with the traditional financial industry, thus forming a digital financial form of emerging financial technology. Digital finance is rapidly expanding to the entire category of finance and various industry sectors. And digital inclusive finance relies on its advantages of low cost, high efficiency, strong security, etc. to bring high-quality financial services to small and medium-sized micro-enterprises as well as individuals[2]. At the level of national development strategy, the development of digital finance responds to the inherent needs of high-quality economic development. This development trend is in line with China's “14th Five-Year Plan” strategy of “developing digital industrialization and industrial digitization”. At the enterprise level, it empowers enterprise innovation through big data, artificial intelligence and other cutting-edge technologies, and promotes the optimization and upgrading of financial services through its “universality”. At the individual level, digital financial services provide users with more comprehensive and timely financial information through online channels, effectively expanding residents' investment and financial management choices; moreover, through its wide coverage and digitalization, it can narrow the income gap between urban and rural areas and enhance people's sense of well-being[3].

Compared with traditional finance, the transformative impact of digital finance on investment is mainly reflected in the following aspects. Mobile payment and Internet wealth management platforms enable individual investors to participate in various types of investment at any time, expanding investment channels; big data analysis and the ability to provide timely investment information and investment advice, optimizing investment decisions[4]. Digital finance is mainly used to alleviate corporate financing constraints by expanding sources of funds and improving the quality and efficiency of financial institutions' services, which in turn improves the efficiency of corporate investment[5]. Based on this, the study of the investment-driven effect of digital finance is of great significance in expanding the application of digital finance in the field of investment, increasing investment returns and optimizing investment decisions. In recent years, experts' research on digital finance has mostly focused on its development status and its role in promoting innovation and entrepreneurship, promoting the development of small and micro enterprises, and promoting the high-quality development of the economy. The research on the impact of digital finance on investment and the role of investment between different regions is still in the early stage. Therefore, this paper conducts an empirical study based on the “Peking University Digital Inclusive Finance Index” and investment data of provinces, and adopts a fixed-effect model to explore the effects of the total digital finance index and various dimensions on investment, so as to further investigate the investment-driven effects of digital finance on various provinces and regions.

The following marginal contributions may exist in this study: for one, this paper builds on previous research to establish a link between digital finance and investment-driven effects. Based on the total digital inclusive finance index and the three sub-dimensions of breadth of coverage, depth of use, and degree of digitization provided by Peking University, it explores the

overall investment-driven effect of digital finance using investment data from thirty provinces as an entry point. It enriches the existing research on digital finance and investment. Second, this paper also incorporates the roles of the government and the market in the research process, and explores the synergy between the government and the market mechanism in the process of digital finance affecting investment. It reveals the guiding effect of policy regulation on the development of digital finance and provides a new theoretical perspective for understanding the investment effect of digital finance. Third, this paper also reveals the differentiated impact mechanism of digital finance on investment in eastern, central and western provinces, enriching the existing theoretical research on the regional effects of digital finance. Meanwhile, this study identifies two key regulating variables, financial regulation and financial marketization, which provide an expandable theoretical analysis framework for subsequent research on the investment-driven effects of digital finance.

2. Literature Review and Theoretical Analysis

The study of the impact mechanism of digital inclusive finance on investment behavior has become a cutting-edge topic in the field of financial economics. Existing literature mainly explores two key dimensions: on the one hand, it focuses on the influencing factors of traditional investment decisions, systematically examines the development lineage from neoclassical investment theory to modern financing constraint theory, and reveals the shaping role of core variables such as the cost of capital, market expectations and institutional environment on investment behavior; on the other hand, it analyzes the multi-level economic effects of digital finance in depth, including the comprehensive impacts of enterprise financing at the micro level, improvement and optimization of household asset allocation, industrial structure upgrading at the meso level, and total factor productivity enhancement at the macro level. On the other hand, the multi-level economic effects of digital finance are analyzed in depth, including the improvement of enterprise financing and optimization of household asset allocation at the micro level, the upgrading of industrial structure at the meso level, and the enhancement of total factor productivity at the macro level.

The theoretical basis of investment decision mainly originates from three classical theoretical systems. Jorgenson put forward the theory of user cost of capital, which argues that the optimal investment level of enterprises depends on the marginal output of capital equal to its user cost, thus systematically linking the investment decision with factors such as interest rates, depreciation rates and taxes, and establishing the decisive role of the cost of capital and the rate of return on investment[6]. Second, firms' investment decisions are affected by the linkage between the financial asset market and the real economy. Tobin's Q-theory states that firms' investment depends on the ratio of capital market valuation to replacement cost, connecting the financial market to real investment behavior[7]. It is also important to note that Fazzari and others have proposed a theory of financing constraints: investment is highly sensitive to cash flow[8]. Firms with sufficient internal funds invest more aggressively, while firms with limited external financing face stronger investment constraints. Together, these theories form the theoretical basis for investment decisions. However, with the development of the digital economy, traditional investment theories are facing new challenges. The following section describes the influences on investment in three dimensions.

First, the impact of supply-side factors on investment is reflected in existing research. In terms of the cost of capital, changes in interest rates have a significant impact on fixed asset investment through the channel of the user cost of capital, with cross-country data showing that for every 1 percentage point increase in real interest rates, investment by manufacturing firms will fall by 0.4-0.6 percentage points. This transmission mechanism is more pronounced in developing countries[9]. Jin Qinglu et al. find that monetary policy tightening significantly

reduces private firms' investment efficiency by exacerbating financing constraints[10]. In terms of technological conditions, existing research focuses on the “enabling effect” of digital infrastructure, that is the upgrading of digital infrastructure to enhance the capabilities of economic agents, which in turn promotes the efficiency of investment, innovation, etc.[11]. Firms' digital inputs also contribute to investment growth by reducing the cost of access to information, optimizing production processes, and expanding market boundaries[12].

Second, the impact of demand-side factors on investment has also been theorized more systematically. On the one hand, there are market expectations, a mechanism of influence systematically explained in the seminal study of Bloom, who constructs an index of economic policy uncertainty (EPU) that shows that for every standard deviation rise in uncertainty, business investment will fall by 4.7%[13]. As for the driving role of consumption, the theoretical model of Acemoglu and Zilibotti reveals that demand growth induces an increase in business investment in equipment through the “market expansion effect”[14], and the empirical study of Xu Xiaobing and Yang Huigang further shows that China's consumption upgrading is significantly more powerful than that of traditional industries in terms of its ability to drive investment in high-tech industries[15].

Finally, the institutional environment, as an important exogenous variable in investment decisions, is also rich in studies related to its impact on investment. From the perspective of financial regulation, the study by Barth et al. found that prudential regulation has an inverted U-shaped relationship with investment growth[16]. And in China, the implementation of macroprudential policies has led to a downward trend in overinvestment in the real estate sector[17]. And from the perspective of industrial policy, Li Ping and Jiang Feitao found that the “Ten Industries Revitalization Plan” played a significant role in maintaining growth and expanding domestic demand, which led to an increase in the growth rate of investment in the industry, but did not reach the expected goal in adjusting the structure, and then declined in the later stage[18]. Recent studies have begun to focus on the interaction between the institutional environment and digital technology, such as Chen Hong et al., who found that the institutional environment is an important exogenous variable that affects corporate investment[19]. In particular, uncertainty in the institutional environment affects the internal control of enterprises, making them more cautious in their investment decisions and limiting their long-term investment behavior.

Existing studies show that digital finance impacts the economy at the micro, meso and macro levels. At the micro level, digital finance significantly improves the corporate finance environment and household financial behavior. Chappell et al.'s study confirms the role of digital transformation in lowering costs and increasing efficiency[20], while Gupta et al. find that mobile payments lead to an increase in household participation in formal financial markets to increase[21]. Wan Jiayu et al. point out that digital inclusive finance can alleviate the financing pressure of innovative entities, promote the high-quality development of the economy, and play an important role in stimulating the vitality of microeconomic agents[5]. This shows that digital finance at the micro level can effectively reduce the threshold of financial services, enhance the accessibility of financial services, and provide more convenient and efficient financial support for enterprises and households.

At the meso level, digital finance plays an enabling role in terms of industry and market structure. At the meso level, digital finance plays a key role in boosting in terms of industry and market structure. McKinsey's global research shows that industrial internet platforms have raised the utilization rate of manufacturing equipment from 58% to 79%, which has strongly promoted the upgrading of industrial structure[22]. Nie Xiuhua and Wu Qing found that the innovation incentive effect of digital finance has significant spatial spillover characteristics, affecting the level of regional technological innovation through the dual spillover paths of intra- and extra-region, which in turn promotes industrial development[23]. Digital inclusive finance

can indirectly promote the formation of new quality productivity by promoting the optimization of industrial structure, boosting the transformation and upgrading of traditional industries and the development and growth of new industries, promoting the advanced industrial structure, and thus promoting the high-quality development of the economy[24]. All these studies show that digital finance can promote the optimal allocation of resources at the meso level, promote industrial innovation and upgrading, and reshape the market competition pattern.

At the macro level, Qian Sitong's study shows that the digital finance development index strongly contributes to the improvement of total factor productivity[25]. studies by BIS and the World Bank also point out that digital finance plays an important role in economic cycle regulation and development inclusiveness, respectively[26]. Digital finance can promote technological progress, drive high-quality development of the economy, and improve the quality and efficiency of economic growth[3]. It can also promote common wealth, promote the overall balanced development of the society[27], and is important for the coordinated development of macro-regions[28]. The research of Lv Jianglin et al. found that the synergistic development of digital inclusive finance and the real economy plays a positive role in promoting China's social and economic growth, reflecting the important role of digital finance in promoting the development of the real economy and economic growth from a macro perspective[29].

Theoretically speaking, the impact of digital finance on investment can be reflected in improving investment efficiency, broadening investment channels and lowering the investment threshold. First of all, digital finance significantly reduces the cost of loans and improves investment efficiency, providing investors with accurate risk-return assessment through big data analysis and intelligent algorithms processing massive information in real time, effectively alleviating the information asymmetry problem in traditional finance[30]. Internet financial platforms integrate multi-dimensional corporate data, enabling investors to quickly access comprehensive information, significantly reducing the cost of information search and analysis, while improving the timeliness of investment decisions[31]. Second, digital finance greatly broadens investment channels, enabling investors to conveniently access new financial products such as P2P, crowdfunding, and cross-border investment[32], and promoting diversified asset allocation. Furthermore, digital finance promotes the development of inclusive finance by lowering the investment threshold, and innovative models such as Internet fund sales and project splitting enable small investors to participate in high-quality project investment[33]. Research shows that digital inclusive finance significantly improves the efficiency of residents' financial asset allocation[34]. Finally, digital finance has strengthened risk management capabilities by using artificial intelligence and big data technology, constructing dynamic risk assessment models through machine learning algorithms[35] and combining with smart investment advisors to provide personalized asset allocation advice to help investors optimize their decisions and diversify their risks. However, digital finance also brings new challenges such as algorithmic homogenization[36], and needs to prevent potential systemic risks while enhancing market efficiency. Therefore, this paper proposes the following research hypotheses:

Hypothesis 1: The development of digital finance has a significant contribution to investment. The development of digital finance has profoundly changed the mode of operation of the traditional financial system, while the interaction between government regulation and market-based forces together shape the mechanism of its impact on investment. Through financial regulation, governments play a dual role in the development of digital finance. On the one hand, the application of RegTech such as compliance automation, dynamic testing, and regulatory sandboxes can mitigate information asymmetry and reduce systemic financial risks, thereby enhancing investor confidence[37]. On the other hand, over-regulation may inhibit innovation,

so categorized regulation and differentiated policies become key to balancing innovation and stability. For example, China has gradually established an “inclusive and prudent” regulatory model after the regulation of Internet finance, which not only prevents risks, but also provides room for the development of compliant fintech firms[39].

Market-oriented forces promote the innovation efficiency of digital finance through the competition mechanism and technology diffusion. The development of fintech reduces transaction costs and expands the coverage of financial inclusion[40], thus optimizing capital allocation and improving investment efficiency. Technological applications such as digital payments, blockchain and smart investment advisors[41] have improved the availability of financial services through spontaneous market evolution, especially easing the financing constraints of small and medium-sized enterprises[42]. Ideally, the government and the market should form a dynamic balance of “regulation-innovation” in the development of digital finance[43]. In this way, the government's system can provide support for market innovation, and the development of marketization can urge the government to carry out institutional change. Based on this, this paper puts forward the following hypotheses:

Hypothesis 2: In digital financial development, the government promotes investment through financial regulation, but over-regulation may act as a disincentive; market development will promote investment development through competition mechanism.

3. Empirical Design

3.1. Modeling

In order to test the correctness of hypothesis 1, this paper takes a two-way fixed effects model to construct equation (1).

$$Inv_{it} = \alpha_0 + \alpha_1 Ind_{it} + \alpha_2 Control_{it} + \mu_i + \lambda_t + \varepsilon_{it} \quad (1)$$

where i and t denote province and year, respectively. $Invest$ denotes the logarithm of investment, $Digital$ denotes the digital financial inclusion index, and $Control$ denotes a series of control variables affecting investment. α_0 denotes the constant term, α_1, α_2 indicates unknown regression coefficients. μ, γ denote the presence of province effects and time effects of the model, respectively, ε denotes the perturbation term.

In order to test the correctness of hypothesis 2, this paper adds the variables of “financial regulation” and “financial marketization” on the basis of equation (1), and introduces the interaction terms between these two variables and the digital financial inclusion index, as shown in equations (2) and (3):

$$Inv_{it} = \beta_0 + \beta_1 Ind_{it} + \beta_2 Ind_{it} \times Fin_{it} + \beta_3 Fin_{it} + \beta_4 Control_{it} + \mu_i + \lambda_t + \varepsilon_{it} \quad (2)$$

$$Inv_{it} = \gamma_0 + \gamma_1 Ind_{it} + \gamma_2 Ind_{it} \times Mar_{it} + \gamma_3 Mar_{it} + \gamma_4 Control_{it} + \mu_i + \lambda_t + \varepsilon_{it} \quad (3)$$

Included among these, β_0 and γ_0 denotes constant terms, $\beta_1, \beta_2, \beta_3$ and $\gamma_1, \gamma_2, \gamma_3$ denotes unknown regression coefficients. Fin indicate “financial regulation”, Mar indicates “financial marketization”.

3.2. Selection of Variables

(1) Core Explanatory Variables

The Peking University Digital Financial Inclusion Index (2011-2022) released by the Digital Finance Research Center of Peking University contains digital financial inclusion indices for 31

provinces (autonomous regions and municipalities directly under the central government, except for Taiwan Province and Hong Kong and Macao Special Administrative Regions) in China's mainland. Based on the total index, the group also provides 3 dimensions: digital finance coverage breadth index, digital finance usage depth index and digitalization degree of inclusive finance index. The index is a good measure of the development level of digital inclusive finance in each region. Therefore, this paper adopts the digital financial inclusion index of 30 provinces (excluding Tibet) from 2011 to 2022 to indicate the development status of digital finance in each province.

(2) Explained Variables

This study uses the total investment in fixed assets of the whole society as an explanatory variable to measure the scale of investment in each region. This indicator reflects the capital investment in fixed assets (e.g., infrastructure, real estate, machinery and equipment) by enterprises, governments and residents in the region, and is an important basis for assessing the potential for economic growth and the efficiency of resource allocation. The data are mainly derived from the total investment in fixed assets of the whole society in the EPS database (China's economic statistics database), which covers all provinces of the country and has a high degree of authority and continuity. For the data after 2017, the previous year's investment amount and the officially announced growth rate are used for extrapolation to ensure the integrity of the time series. Subsequently, the natural logarithm of the data is further taken to reduce heteroskedasticity and facilitate the interpretation of the coefficients.

(3) Control Variables

In examining the impact of digital finance on investment, this study fully considers the multidimensional factors that may affect investment decisions. Based on the theoretical foundation and practical experience of the existing literature, we selected the following control variables to control for potential other effects: 1) the degree of government intervention (measured by the general budget expenditure of the local government); 2) the characteristics of the industrial structure (the share of the value added of the secondary industry in the GDP); 3) the level of infrastructure (per capita ownership of the road area and the mileage of railroad business); 4) the level of economic development (per capita gross domestic GDP per capita); 5) population size (total population); 6) degree of openness to the outside world (total import and export of goods). The selection of these control variables not only covers key dimensions such as macroeconomic environment and regional development characteristics, but is also consistent with the selection of variables in existing studies, which helps to identify the effect of digital finance on investment more accurately.

(4) Moderating Variables

This study selects the intensity of financial regulation and the level of financial marketization as moderating variables, aiming to reveal how government and market forces shape the mechanism of digital finance's impact on investment. Adoption of appropriate financial regulation by local governments can reduce information asymmetry and systemic risk and enhance investor confidence[37]. Therefore, this paper draws on the recent research results of Zhang et al.[38], and adopts the proportion of financial regulatory expenditure in the fiscal expenditure of each province as a proxy for "financial regulatory intensity", which is an indicator that can objectively reflect the actual investment of the local government in the field of financial regulation.

The degree of marketization determines the efficiency of financial resource allocation. As pointed out by established studies, the degree of marketization affects the allocation efficiency of financial resources. A higher level of financial marketization can promote the efficiency of resource allocation by strengthening the competition mechanism[44], which in turn amplifies the positive impact of digital finance on investment activities. For this reason, this paper adopts

the financial marketization index as a moderating variable, which comprehensively takes into account the degree of marketization of credit fund allocation, the level of interest rate marketization and other dimensions, and can comprehensively reflect the degree of development of the regional financial market. Table 1 gives the statistical results of each variable.

Table 1. Results of descriptive statistics

Variables	Observations	Mean	Standard Deviation	Min	Max
<i>Inv</i>	360	0.780	0.260	0.210	1.480
<i>Ind</i>	360	243.9	107.6	18.33	460.7
<i>Cov</i>	360	227.4	110.6	1.960	455.9
<i>Use</i>	360	236.5	107.4	6.760	510.7
<i>Dig</i>	360	312.1	118.3	7.580	467.2
<i>2nd_ind</i>	360	0.420	0.0900	0.160	0.590
<i>3rd_ind</i>	360	0.480	0.100	0.300	0.840
<i>Urban</i>	360	0.600	0.120	0.350	0.900
<i>Gdp/cap</i>	360	60797	30446	16413	190313
<i>Gov</i>	360	0.250	0.100	0.110	0.640
<i>Trade</i>	360	7553	13756	3.300	83774
<i>Road</i>	360	16.55	5.060	4.040	28
<i>Traffic</i>	360	0.990	0.530	0.0900	2.290
<i>Pop</i>	360	471	708.6	7.860	3951
<i>Fin_su1</i>	360	0.0028	0.0030	0	0.0190
<i>Fin_su2</i>	360	0.0109	0.0142	0	0.1116
<i>Fin_mar</i>	360	13.79	4.830	2.840	23.07
<i>Investpop</i>	360	4.320	1.690	1.200	9.550
<i>Internet</i>	360	2274.929	1866.128	62	9892.214

4. Analysis of Empirical Results

4.1. Benchmark Regression Analysis Results

Table 2 shows the estimation results of the baseline regression model, which, in column (1) of Table 2, includes only the estimation results of the total digital financial inclusion index. In columns (2), (3), and (4) of Table 2, the effects of the degree of government intervention, industrial structure characteristics, level of infrastructure, level of economic development, population size, and degree of foreign development on investment are controlled for stepwise. As can be seen in Table 2, the R² test results indicate that all four sets of regression equations are significant.

The results from column (1) to column (4) of Table 2 show that the coefficients of the total digital financial inclusion index are 0.328, 0.342, 0.329, and 0.405, respectively, and all of them are significant at the 1% level. In particular, the change from column (3) to column (4) shows that the effect of the digital financial inclusion index on investment is strengthened after the addition of the control variables. This suggests that the control variables play a role and influence investment to some extent. Taking column (4) as an example, for every unit increase in the digital financial inclusion index, investment will rise by 0.405 units. This indicates that digital inclusive finance has a promoting effect on investment, supporting research hypothesis 1. The reason may be that digital finance improves the convenience of financial services and reduces financing constraints through mobile payment, digital wealth management, Internet

credit, etc.; at the same time, digital finance reduces the asymmetry of information through digital platforms and improves the efficiency of capital allocation; on the other hand, the development of digital inclusive finance, such as mobile payment, etc. Improve the consumption ability of residents, all of which can stimulate enterprises to expand production and investment. In the process of analyzing the control variables, it is found that some of the control variables present statistically significant results. The coefficient of government intervention in column (4) is 0.802 and is significant at the 1% level, which indicates that the government may directly stimulate investment through fiscal subsidies, industrial policies or infrastructure development. The coefficient of GDP per capita is 0.804 and significant at 1% level, which suggests that higher level of economic development contributes to investment. The reason for this may be that regions with higher levels of economic development have more opportunities for investment and a higher rate of return on investment, which can attract more investment. The coefficient of the degree of openness to the outside world is 0.127 and is significant at the 1% level, which indicates that the increase in the degree of openness to the outside world promotes the growth of investment. This could be due to the fact that the growth in foreign trade leads to more inflows of foreign capital or that domestic firms expand their investments due to the increased demand for exports.

Table 2. Benchmark Regression Results

	<i>Inv</i> (1)	<i>Inv</i> (2)	<i>Inv</i> (3)	<i>Inv</i> (4)
<i>Ind</i>	0.328*** (3.52)	0.342*** (3.63)	0.329*** (3.32)	0.405*** (3.98)
<i>Gov</i>		0.140 (1.43)	0.810*** (4.04)	0.802*** (3.91)
<i>2nd_ind</i>		-0.040 (-0.17)	-0.496** (-2.20)	-0.646*** (-2.68)
<i>Traffic</i>			-0.179 (-1.07)	-0.304* (-1.87)
<i>Gdp/cap</i>			0.973*** (3.90)	0.804*** (3.11)
<i>Pop</i>				0.827* (1.96)
<i>Trade</i>				0.127*** (3.48)
<i>Time Fixed Effect</i>	<i>Control</i>	<i>Control</i>	<i>Control</i>	<i>Control</i>
<i>Province Fixed Effect</i>	<i>Control</i>	<i>Control</i>	<i>Control</i>	<i>Control</i>
<i>R2</i>	0.837	0.838	0.857	0.863
<i>Observations</i>	360	360	360	360

Note: t statistics in parentheses; *p < 0.10, **p < 0.05, and ***p < 0.01

4.2. Heterogeneity Analysis

Table 3 shows the impact of different dimensions of digital financial inclusion (breadth of coverage, depth of use, and degree of digitization) on investment. In column (1), the coefficient of breadth of digital financial coverage is 0.142 and is significant at the 1% level, which suggests that the expansion of the scope of digital financial services is effective in boosting investment growth. The possible reason is that expanding the scope of digital financial services, such as increasing the number of mobile payment access points and expanding the network of banking services, lowers the financing thresholds of enterprises and individuals and improves the availability of funds. In column (3), the coefficient of the depth of use of digital financial inclusion is 0.167 and significant at the 1% level, indicating that deeper use of digital financial services, such as wealth management and credit services, has a more pronounced role in promoting investment than simple payment functions. This may be due to the fact that the deeper use of digital finance can optimize the allocation of resources and improve the efficiency of investment. In column (2), on the other hand, the digitization of digital finance does not have a significant impact on investment, a result that shows that simply enhanced technological

levels, such as the adoption of blockchain and artificial intelligence, are difficult to directly drive investment growth if they cannot be translated into actual use.

Table 3. Digital Financial Inclusive Finance Sub-dimension Regression Results

	<i>Inv</i> (1)	<i>Inv</i> (2)	<i>Inv</i> (3)
<i>Cov</i>	0.142*** (3.85)		
<i>Dig</i>		-0.089 (-1.63)	
<i>Use</i>			0.167*** (2.61)
<i>Gov</i>	0.765*** (3.72)		0.764*** (3.60)
<i>2nd_ind</i>	-0.616** (-2.55)		
<i>Traffic</i>	-0.250 (-1.55)	-0.094 (-0.55)	
<i>Gdp/cap</i>	0.776*** (2.95)	0.274 (1.45)	0.771*** (2.75)
<i>Pop</i>	0.644 (1.59)	-0.191 (-0.54)	0.053 (0.16)
<i>Trade</i>	0.129*** (3.46)	0.108** (2.58)	0.105* (2.50)
<i>Road</i>		-0.194* (-1.86)	-0.178* (-1.76)
<i>Time Fixed Effect</i>	<i>Control</i>	<i>Control</i>	<i>Control</i>
<i>Province Fixed Effect</i>	<i>Control</i>	<i>Control</i>	<i>Control</i>
<i>R2</i>	0.862	0.843	0.854
<i>Observations</i>	360	360	360

Note: t statistics in parentheses; *p < 0.10, **p < 0.05, and ***p < 0.01

This study examines the differential investment impact of the development of digital financial inclusion on the eastern, central and western regions of China through group regression. Table 4 shows significant regional heterogeneity in the impact of digital finance on investment. From columns (1) to (3), it can be seen that the impact of digital finance on investment in the eastern, central and western regions shows a decreasing state. The coefficient of digital financial inclusion in the eastern region is 1.233, which is significant at 1%, indicating that digital financial inclusion has the most significant impact on the eastern region. This result highlights the dominant position of the eastern region as a pioneer in the development of the digital economy. The reason for this may be that the eastern region has the most complete digital infrastructure and a high level of enterprise digitization, and the eastern region is highly active in financial innovation, with financial centers such as Beijing, Shenzhen, and Shanghai breeding a rich system of digital financial products. Column (2) shows the significant but weaker impact of digital finance in the central region than in the east, and this gradient difference reflects the stage-by-stage characteristics of digital economy development in the central region. The reason for this may be that the digital divide in the central region is more obvious, and the digital financial penetration rate in rural areas has a significant gap compared with that in cities. Secondly, the central region is in the transition period of industrial structure, and the digital transformation rate of manufacturing industry is not high. The central region's talent short board problem is also more prominent, the density of digital talent is not high compared with the east. But the central region also has a certain development potential, in the policy dividend support, Wuhan, Zhengzhou and other cities in the rapid development of digital finance. In Column (3), the coefficient of the digital finance index in the western region is 0.365, and its absolute value is only about 30% of that in the east, which indicates that the actual impact of digital finance on investment in the western region is weak. The reasons for this may be: first, there are obvious shortcomings in infrastructure, with insufficient network coverage constraining the popularization of services; second, the lack of digital skills among the population leads to low usage of tools; and finally, the sparse distribution of service outlets

creates a fragmented market. These structural barriers together limit the depth of penetration and role of digital finance in the western region. This confirms the development dilemma of digital finance in the western region.

Table 4. Subregional Heterogeneity Regression Results

	<i>East Inv(1)</i>	<i>Middle Inv(2)</i>	<i>West Inv(3)</i>
<i>Ind</i>	1.233*** (3.87)	0.944** (2.49)	0.365** (2.55)
<i>Gov</i>	1.075*** (3.35)	2.033*** (3.94)	0.046 (0.21)
<i>2nd_ind</i>	0.624 (1.39)	-1.331*** (-3.89)	-0.897*** (-4.03)
<i>Traffic</i>	-2.745*** (-3.24)	1.001*** (3.31)	0.093 (0.43)
<i>Gdp/cap</i>	0.629* (1.79)	0.825* (1.72)	0.585*** (3.16)
<i>Pop</i>	2.861*** (2.73)	-0.030 (-0.03)	0.903 (1.64)
<i>Trade</i>	0.072 (0.39)	0.532*** (4.57)	0.129*** (3.27)
<i>Time Fixed Effect</i>	<i>Control</i>	<i>Control</i>	<i>Control</i>
<i>Province Fixed Effect</i>	<i>Control</i>	<i>Control</i>	<i>Control</i>
<i>R2</i>	0.903	0.731	0.770
<i>Observation</i>	120	96	132

Note: t statistics in parentheses; *p < 0.10, **p < 0.05, and ***p < 0.01

4.3. Analysis of Moderating Effects

Table 5. Moderated Effects Regression Results

	<i>Inv(1)</i>	<i>Inv(2)</i>	<i>Inv(3)</i>	<i>Inv(4)</i>
<i>Ind</i>	0.334*** (3.48)	0.394*** (3.94)	0.385*** (3.72)	0.448*** (4.18)
<i>Indfin_su1</i>	-2.893** (-2.39)	-3.425*** (-3.24)		
<i>Fin_su1</i>	0.028 (1.47)	0.020 (1.10)		
<i>Fin_mar</i>			-0.808*** (-3.77)	-0.723*** (-2.61)
<i>Indfin_mar</i>			0.135*** (3.00)	0.121** (2.07)
<i>Gov</i>		0.840*** (4.21)		0.784*** (3.80)
<i>2nd_ind</i>		-0.644*** (-2.92)		-0.723*** (-2.87)
<i>Traffic</i>		-0.226 (-1.41)		-0.337** (-2.12)
<i>Gdp/cap</i>		0.739*** (2.94)		0.840*** (3.26)
<i>Pop</i>		0.808** (2.10)		0.715* (1.67)
<i>Trade</i>		0.176*** (4.31)		0.095** (2.33)
<i>Time Fixed Effect</i>	<i>Control</i>	<i>Control</i>	<i>Control</i>	<i>Control</i>
<i>Province Fixed Effect</i>	<i>Control</i>	<i>Control</i>	<i>Control</i>	<i>Control</i>
<i>R2</i>	0.842	0.871	0.844	0.868
<i>Observation</i>	360	360	360	360

Note: t statistics in parentheses; *p < 0.10, **p < 0.05, and ***p < 0.01

The regression results in Table 5 reveal the differential moderation of the digital finance-investment relationship by financial regulation and financial marketization. The two moderating effects show contrasting characteristics: financial regulation mainly plays an inhibitory role, while financial marketization plays a facilitating role. The formation of this dual effect reflects both the intrinsic law of digital finance development and the key influence of the institutional environment. As can be seen from Column (2), the coefficient of the interaction term between the digital finance index and financial regulation is -3.425 and significant at 1%, which indicates that strict financial regulation significantly weakens the promotion effect of

digital finance on investment. This may be due to the fact that strict financial regulation increases the operating costs of digital financial institutions, limits the room for innovation in digital finance and raises the threshold for market entry, thus inhibiting investment. As for financial marketization, the coefficient of the interaction term between digital finance index and financial marketization is 0.121 and significant at 5% from column (3), which indicates that financial marketization can significantly enhance the investment promotion effect of digital finance. This positive moderating effect may be realized by improving the price signaling mechanism, strengthening market competition and promoting the efficiency of resource allocation, so that funds flow more effectively to high-return areas. The higher the degree of marketization, the more significant the role of digital finance in promoting investment in innovation.

4.4. Robustness Analysis

Based on column (4) of Table 2, this study conducted a robustness test of the benchmark regression results by three different methods, and all the results in Table 6 confirm the reliability of the investment promotion effect of digital finance.

(1) Replacement of Investment Metrics

After replacing the dependent variable from total investment to investment per capital in this study, the coefficient of the total digital finance index remains significantly positive in column (1), and the direction of the effects of the control variables, such as government intervention and level of economic development, is consistent with the benchmark regression. This result confirms that using a different index to measure investment does not change the empirical results, and that digital finance still has a positive contribution to investment, and the results are largely confirmed for the other control variables.

(2) Lagging the Aggregate Digital Finance Index by One Period

Considering that the impact of digital finance on investment needs time to be transmitted, for example, the popularization of digital payments needs to increase the ease of corporate finance to promote investment. Column (2) shows the results of the regression using a one-period lagged digital finance index, and Table 6 shows that the coefficient of the digital financial inclusion index is still significantly positive, indicating that digital financial inclusion has a positive impact on investment.

(3) Instrumental variable estimation

Considering that investment may also have an impact on digital finance, this two-way causality may raise endogeneity issues. In this paper, we choose to use Internet port data as an instrumental variable for the digital finance index. The reasons for this are: first, Internet port data is highly correlated with the development of digital finance, digital finance relies on Internet infrastructure, and the higher the port density, the greater the accessibility of digital financial services. Second, Internet port data should affect investment only indirectly by influencing digital finance and is uncorrelated with the error term. Port construction is mostly determined by early telecommunication planning and is not directly related to current investment. And ports, as physical infrastructure, theoretically do not affect firms' investment decisions. The Cragg-Donald Wald F-statistic in column (3) is well above the 10% bias level threshold, indicating instrumental variable validity. The results suggest that digital inclusion still has a significant positive impact on investment.

Table 6. Robustness Test Results

	<i>Replacement of Variables</i>	<i>Lagging Effect</i>	<i>iv-2sls</i>
	<i>Inv/pop(1)</i>	<i>Inv(2)</i>	<i>Inv(3)</i>
<i>Ind</i>	0.433*** (4.20)		1.196*** (3.41)
<i>L.ind</i>		0.323*** (3.39)	
<i>Gov</i>	0.717*** (3.59)	0.737*** (4.69)	0.849*** (4.24)
<i>2nd_ind</i>	-0.712*** (-2.96)	-0.758*** (-3.85)	-0.786*** (-3.33)
<i>Traffic</i>	-0.344** (-2.16)	-0.375** (-1.99)	-0.678*** (-2.82)
<i>Gdp/cap</i>	1.721*** (6.66)	0.775*** (4.67)	0.695*** (2.96)
<i>Pop</i>	0.985** (2.30)	0.791* (1.75)	1.904*** (2.80)
<i>Trade</i>	0.129*** (3.61)	0.126*** (2.89)	0.145*** (3.62)
<i>Time Fixed Effect</i>	<i>Control</i>	<i>Control</i>	<i>Control</i>
<i>Province Fixed Effect</i>	<i>Control</i>	<i>Control</i>	<i>Control</i>
<i>Cragg-Donald Wald F statistics</i>			42.784
<i>R2</i>	0.866	0.286	0.833
<i>Observations</i>	360	330	360

Note: t statistics in parentheses; *p < 0.10, **p < 0.05, and ***p < 0.01

5. Conclusion and Recommendations

5.1. Main Findings

Digital financial inclusion is important for promoting the growth of investment. This paper systematically analyzes the impact of digital inclusive finance on investment from the theoretical level and puts forward research hypotheses. This paper utilizes the provincial panel data of 30 provinces and the digital financial inclusion data from 2011 to 2022 to study the investment-driving effect of digital financial inclusion and its functioning mechanism, and draws the following main conclusions: first, digital financial inclusion has a significant promotion effect on investment, which indicates that the implementation of expanding digital finance can promote the improvement of investment efficiency. Second, the impact of digital finance on investment in the East, Central and West regions shows a decreasing state. It indicates that the impact of digital financial inclusion on investment shows regional differentiation. Third, financial regulation has a negative moderating effect on the investment-driving effect of digital inclusive finance, indicating that as the government strengthens financial regulation, the promotion of digital finance on investment will gradually weaken; financial marketization has a positive moderating effect on the investment-driving effect of digital finance, indicating that with the deepening of the degree of financial marketization, the promotion of digital finance on investment will gradually increase.

5.2. Policy Recommendations

(1) Comprehensively promote digital inclusive finance to enhance overall investment efficiency. As digital inclusive finance has a significant investment-driven effect, governments and enterprises should formulate policies to promote the development of digital finance. First, they should accelerate the construction of digital financial infrastructure and expand the coverage of services such as mobile payment and Internet credit, especially in favor of micro, small and medium-sized enterprises (MSMEs) and individual entrepreneurs. Second, enterprises should optimize the design of digital financial products, develop low-threshold investment tools suitable for different groups, and improve the efficiency of capital allocation. Third, the popularization of financial knowledge should be strengthened, and the ability of residents and

enterprises to use digital finance should be enhanced through community outreach and online training, so as to promote the conversion of savings into investment.

(2) Deepening the promotion of digital financial inclusion in the central and western regions and narrowing the regional investment gap. The study finds that the impact of digital financial inclusion on investment shows a clear “East-Middle-West” gradient, a phenomenon that reflects the significant imbalance that still exists in China’s regional financial development. In order to effectively realize the investment promotion role of digital inclusive finance, systematic measures should be taken to deepen its promotion and application in the central and western regions. First, focus should be placed on strengthening the construction of digital financial infrastructure in the central and western regions. Support the construction of new infrastructure such as 5G networks and data centers in the central and western regions to ensure the basic support of digital financial services such as mobile payment and Internet banking. Second, implement differentiated regional incentive policies. It is recommended to give preferential policies such as business tax reduction and exemption to institutions conducting digital financial services in the central and western regions, and appropriately increase the coverage of the targeted reduction policy for financial inclusion. Lastly, developed regions in the east are encouraged to establish digital finance collaboration mechanisms with central and western provinces to promote experience sharing through technology export and talent exchange.

(3) Optimize the financial regulatory framework to balance risk prevention and control with financial innovation. The study found that financial regulation has a negative moderating effect on the investment-driving effect of digital inclusive finance, which indicates that the current regulatory framework inhibits the release of digital financial innovation to a certain extent. In order to give full play to the investment promotion effect of digital inclusive finance, while effectively controlling systematic risks, it is recommended to optimize the financial regulatory framework in the following aspects: first, establish a differentiated regulatory system with hierarchical classification. For inclusive digital financial businesses serving small and micro enterprises and individual investors, the requirements for regulatory indicators such as capital adequacy ratio and provision coverage ratio should be appropriately relaxed; for large financial institutions and systemically important businesses, prudential regulatory standards should be maintained. Second, improve the regulatory coordination mechanism. Implement dynamically adjusted regulatory policies and establish a policy evaluation mechanism to regularly assess and optimize the effectiveness of regulatory policies.

(4) The implementation path of promoting financial marketization reform and strengthening the synergistic effect between digital finance and the real economy. Based on the positive moderating effect of financial marketization on the investment-driven effect of digital inclusive finance as shown in the study, it is recommended to deepen the financial marketization reform in the following dimensions to build a development pattern of a virtuous circle between digital finance and the real economy: first, reduce the market access threshold, allow more private enterprises to participate in digital banking, and focus on supporting demonstration enterprises in science and technology finance. The second is to improve the market-oriented competitive environment, break down data barriers, promote the market-oriented allocation of financial data elements, establish a fair and competitive market order, prevent monopoly and unfair competition, and improve the market-oriented exit mechanism to realize the survival of the fittest. Third, improve the supporting support system, strengthen the protection of financial consumers' rights and interests, and cultivate a specialized financial talent team.

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