

A STUDY OF THE IMPACT OF DIGITAL INCLUSIVE FINANCE ON THE REAL ECONOMY: EVIDENCE FROM CHINA

Dr. Zhanqin Guo

Zhengzhou University, Henan, China

E-mail: guozhanqin@zzu.edu.cn

Miss. Ying Wang

Zhengzhou University, Henan, China

Dr. Min Bai*

School of Accounting Finance and Economics, University of Waikato

*(Corresponding Author) E-mail: mbai@waikato.ac.nz

Received: 2024-01-23

Accepted: 2024-03-13

Published online: 2024-03-19

Abstract

With the rapid development of digital technology, digital inclusive finance has become an important force for promoting the development of the real economy. Based on an in-depth analysis of the relationship between digital inclusive finance and the development of the real economy, this paper takes Henan Province as an example. Based on the Digital Inclusive Finance Index and the Henan Statistical Yearbook, panel data on 17 prefectural-level cities in Henan Province for the period of 2012-2021 are used to carry out a basic regression analysis of various dimensions by using the fixed effect model, and the promotion effect of digital inclusive finance on the development of the real economy and different dimensions of digital inclusive finance on the promotion of real economic development are drawn. The paper finally used the quantile regression method to carry out a heterogeneity test and concluded that the promotion effect of digital inclusive finance is more significant in regions with lower levels of economic development. Therefore, to better promote the development of the real economy, Henan Province should strengthen the construction of a digital inclusive financial system, emphasize scientific and technological innovation, and use digital inclusive finance to guide rural migrants to return to their hometowns for development.

Keywords: Digital inclusive finance; Real economy; balanced panel data; fixed effects.

1. Introduction

The real economy is another aspect of economic development relative to the development of the virtual economy; it refers to the primary sector, secondary sector of industry and tertiary industry in addition to the financial industry, and other real industrial areas; it is the lifeblood of China's economic development and plays a vital role in economic development.^[1] The real economy is the lifeblood of China's economic development and plays a crucial role in economic development. The stable development and vitality of the real economy are crucial to realizing high-quality economic development. After the 18th CPC National Congress, General Secretary Xi Jinping

repeatedly mentioned at the Central Inspection Work Conference and the National Financial Conference that financial institutions must serve the development of the real economy and effectively meet people's needs, and the 14th Five-Year Plan for 2020 also emphasized the importance of building a financial system mechanism that supports the real economy, improving financial technology and enhancing financial inclusion.

At present, China has fully built a moderately prosperous society, and economic growth is shifting to a stage of high-quality development.^[2] To promote high-quality economic development at this stage, the development of inclusive finance is an important path. Inclusive finance is the provision of accessible financial services at affordable costs to all levels of society, especially small and micro enterprises and low-income people, based on the principle of commercial sustainability. Increasing efforts to develop inclusive finance is an intrinsic requirement for the construction and development of socialism with Chinese characteristics, and it is highly important for supporting the development of the real economy, developing strategies for revitalizing the countryside, and ultimately realizing the goal of common prosperity.

Under the joint efforts of the state and society at all levels, China's economy has made great progress, but at the same time, we should also see that along with economic development, there are also some problems that have gradually appeared, such as social capital continuing to increase investment in the virtual economy and neglecting the development of the real economy, the mismatch of financial resources, and the imbalance between the development of the financial economy and the real economy. In particular, the sudden outbreak of the new coronavirus epidemic has had a major impact on the whole Chinese real economy, resulting in the simultaneous inhibition of the development of the real economy, the flow of funds to the virtual economy, and the development of the virtual economy for the real economy, resulting in a series of risks and impacts. In the context of such a global economic weakness, only by promoting the development of the real economy, increasing the promotion of the development of the real economy has become the key to overcoming this problem.

Henan Province has more advantages. First, it has a favorable geographical location. It is located in the central region of China, carrying the east to the west and connecting the south to the north; second, the food supply is close to 10% of the country, and the wheat production is more than 25% of the country, which is a real agricultural province; third, it has a large population, with a resident population of nearly 100 million, accounting for as much as 7.04% of the national proportion, which is ranked third in the country; and last, Henan Province plays an important role in the national strategy, which is part of the new development pattern and the first of the six provinces in the plan for the rise of central China. Finally, Henan Province plays an important role in the national strategy, both as part of the new development pattern and as the first of the six provinces in the Rise of the Central Region program. However, despite these many advantages, Henan's per capita disposable income

remains relatively low. By the end of 2022, Henan's per capita disposable income was 28,200 yuan, ranking only 23rd among all provinces in the country and indicating that the development of the real economy in the province still has great potential to be tapped¹.

In recent years, Henan Province has made remarkable achievements in digital inclusive finance. According to the digital inclusive finance index made public by the Digital Finance Research Center of Peking University, in 2012, Henan Province ranked 26th in the country, with a digital inclusive finance index of 83.68, while in 2021, Henan's digital inclusive finance index was 374.37, which had already jumped to 12th place² and achieved leapfrog improvement, which is sufficient to illustrate that Henan Province has made remarkable developments in digital inclusive finance. This is sufficient to show that Henan Province has achieved remarkable development in digital inclusive finance. In addition, as of 2021, the inclusive financial service stations in Henan Province have covered 99.1% of the administrative villages^[3], all of which reflect the progress of Henan Province in the field of digital inclusive finance and provide strong support for the realization of high-quality real economic development. With the implementation of the Fourteenth Five-Year Plan, the strategy for The Rise of Central China and the construction of a new pattern of development, Henan Province has an important opportunity for economic development. In this context, the development of digital inclusive finance is an important way to enhance the real economy of Henan Province.

Based on the above analysis, this paper chooses Henan Province as the research object to study the impact of digital inclusive finance on the real economy, examines the role of digital inclusive finance in the development of the real economy of Henan Province through multiple dimensions, explores the effect of different dimensions on the development of the real economy, and studies the extent to which digital inclusive finance promotes different economic development areas. At the same time, relevant suggestions are proposed in light of the actual situation to further promote the development of digital inclusive finance and the enhancement of the real economy in Henan Province. This regional-level study not only helps to deepen the understanding of the role of digital inclusive finance in the real economy but also provides a reference for other regions to promote the sustainable development of China's real economy.

¹ Data Source: [China Statistical Yearbook-2022 \(stats.gov.cn\)](https://stats.gov.cn)

² Data Source: Peking University Digital Finance Research Center (pku.edu.cn)

³ Data Source: Financial Operation Report of Henan Province (2022) (pbc.gov.cn)

2. Literature Review

2.1 Research Related to the Development, Advantages and Innovative Models of Digital Inclusive Finance

The concept of financial inclusion was first introduced by the United Nations in 2005, advocating equal access to modern financial services for all. In China, Jiao Jinpu first used the concept of an "inclusive financial system" in 2005.^[3] In China, Jiao Jinpu first used the concept of an "inclusive financial system" in 2005. In the field of digital inclusive finance, current research focuses on its advantages over traditional inclusive finance and the innovation of the model. Among the studies on the advantages of digital inclusive finance, Ren Biyun et al. (2019) take residents in rural areas as the object of study, use micro data to explore the influence mechanism, and point out that the digital lending and digital payment services of digital inclusive finance have a significant and direct promotion effect on rural inclusive growth.^[4] Using provincial panel data, Liu Jinyi et al. (2020) concluded that digitally inclusive finance can alleviate rural poverty directly or indirectly. The direct pathway is reflected in the ability to increase financial accessibility and reduce the cost of using funds. The indirect path is reflected in the ability to create more employment opportunities for rural residents and enhance farmers' income.^[5] Indirectly, it can create more employment opportunities for rural residents and increase farmers' incomes. In the related research on digital inclusive financial model innovation, Zheng Meihua et al. (2019) proposed three models for the development of digital inclusive finance from the perspective that the main body of the supply of financial services is the rural area: agricultural supply chain financial service providers, financial institutions, and financial technology enterprises.^[6] Xie Lin (2020) also proposed three innovative models of rural digital inclusive finance based on the supply chain of e-commerce platforms, the agricultural industry chain, and three agricultural network financial platforms.^[7] He Ying (2022), starting from the performance of the Internet consumption behavior of residents in the western region, proposed improving the coverage of digital inclusive financial services and the effectiveness and precision of service automation and promoting the batch development of agricultural loan services.^[8]

2.2. Studies related to the economic impact of digital inclusive finance

To address the impact of digital inclusive finance on the economy, current scholars have conducted relevant studies at the micro and macro levels. At the micro level, the impact of digital inclusive finance on enterprises has been studied. Lee-Chien-Chiang (2023) noted that digital inclusive finance has an impact on the Chinese economy, which is now undergoing enterprise transformation.^[9] Sheng Mingquan et al. (2022) noted that digital inclusive finance has a certain inhibitory effect on the "derealization" of real enterprises.^[10] At the macro level, the impact of digital inclusive finance on the real economy has mostly been studied at the provincial or national level. Pan-Yu (2022)

suggested that the innovation effect and the market effect are the main channels through which digital inclusive finance promotes a city's export upgrading and thus economic development.^[11] Li et al. (2020), from the perspectives of financial inclusion and economic growth as well as the urban-rural income gap, found that the economic effect of financial inclusion varies across regions.^[12] After empirical analysis of a dynamic stochastic equilibrium general model, Ma Shaogang et al. (2021) examined the relationship between financial inclusion and the real economy and concluded that financial inclusion has a positive impact on promoting economic growth.^[13] Li Linhan et al. (2022) argued that residential consumption, regional entrepreneurship and technological innovation play a mediating role in the effect of digitally inclusive finance on the real economy.^[14] LvJianglin et al. (2021) found some spatial heterogeneity in the synergistic development of digital inclusive finance and the real economy by using analytical tools such as the Dagum Gini coefficient.^[15]

Comprehensive research by current scholars shows that, relative to traditional inclusive finance, digital inclusive finance has certain advantages and innovations in terms of digital payments and lending. Based on the results of research at the national level, scholars have proven that there are regional effects and intermediary effects on the impact of digital inclusive finance on the real economy, and there are also certain differences in the impact channels and other aspects. These findings provide a certain theoretical basis for the research of this paper. However, through a literature review, we find that very few studies on the impact of digital inclusive finance on the real economy are based on a province at the prefecture-level city level, especially for relevant research in Henan Province. Therefore, this paper takes the data of 17 prefecture-level cities in Henan Province as the basis for studying the impact of digital inclusive finance on the real economy of Henan Province.

3. Rationale and Research Hypotheses

3.1 Digital Inclusive Finance Can Help Real Economy Development

Compared with traditional inclusive finance, digital inclusive finance has made great breakthroughs in all aspects, providing many practical conveniences for the development of the real economy. First, under the traditional inclusive financial system, the provision of financial services mainly relies on human resources, with a relatively large dependence on outlets, and the process of carrying out financial services requires the consumption of a large amount of human and material resources and financial resources, resulting in limited service coverage. Second, the business purpose of financial institutions is also the pursuit of profitability, and when it is considered that the costs paid and the risks borne in the process do not match the profits to be made in the future, it will definitely give up the provision of financial services for low-income or disadvantaged groups and choose to provide services for high-income groups instead.

Therefore, under traditional conditions, the development of inclusive finance faces many difficulties, and it is difficult to break through.

The development of digital inclusive finance has brought breakthrough convenience to the real economy. First, with the help of big data, artificial intelligence and other technologies, digital inclusive finance is easier to popularize in all regions, and along with the popularization of digital inclusive finance, the breadth of financial inclusion coverage in the originally underdeveloped areas will increase, which can provide inclusive services for the local community and improve the accessibility of services. Second, the popularization of inclusive finance improves data analysis capabilities, which is conducive to credit establishment and risk monitoring and promotes the continuous improvement of digital inclusive systems. In addition, increased digitization breaks down geographic and network constraints, improves service efficiency, and prompts financial institutions to provide higher-quality financial products, effectively contributing to the development of the real economy.

Based on this analysis, this paper proposes hypothesis 1: digital inclusive finance can help real economic development in Henan Province.

3.2 Differences in the Extent to Which the Dimensions of Digital Inclusive Finance Indicators Contribute to the Real Economy

The digital inclusive finance indicator system includes three first-level dimensions: breadth of coverage, depth of use and degree of digitization. The breadth of coverage has a weight of 54.0%, the depth of use has a weight of 29.7%, and the degree of digitization has a weight of 16.3%. Among them, the breadth of coverage is different from that of traditional financial institutions in that the coverage of users is represented by the number of outlets and the number of staff members, and the breadth of coverage of digital financial services is reflected by the number of e-accounts, with the following specific indexes: the number of Alipay accounts per 10,000 people, the ratio of Alipay users' bound cards, and the number of bank cards bound to each Alipay account on average. Account tied to a bank card; depth of use is measured mainly by actually using digital financial services, including services such as payments, money funds, credit, insurance, investment and credit; and degree of digitization is dominated by mobility, affordability, convenience and credit. The increased convenience, lower cost, and increased creditworthiness of digital financial services will make the value of digitally inclusive finance more significant.^[16]

In summary, the depth of use, breadth of coverage and degree of digitization dimensions of digital inclusive finance represent the development of digital inclusive finance at different levels. Depth of use focuses on people who are already using digital financial services, breadth of coverage measures the popularity of digital financial services, and the degree of digitization relates to the technological level of financial

institutions. Thus, these dimensions will have an impact on the development of the real economy to varying degrees.

Based on this analysis, this paper proposes Hypothesis 2: The dimensions of digital inclusive finance indicators promote the real economy to different degrees.

3.3 Digital Inclusive Finance is more Supportive in Areas with Low Levels of the Real Economy

Digital inclusive finance has injected new impetus into traditional financial products and services through technological means, significantly expanding the coverage and depth of financial products and services and filling the gaps in traditional financial supply, especially in less developed regions.

If inclusive finance is to be popularized in economically underdeveloped areas, the first issue that needs to be overcome is the problems of high construction costs, high risk and a low cognitive level of financial awareness. However, with the development of digital technology, the application of cloud computing, artificial intelligence and other high-tech methods in digital inclusive finance, when combined with traditional financial services, can break traditional service boundaries, shorten the traditional cost of manpower and the cost of time, improve the efficiency of financial services, and provide convenient conditions for the development of financial services in poor areas. Therefore, with the help of digital technology, it is possible to broaden the coverage area of financial inclusion in economically underdeveloped areas so that more poor people can enjoy the convenience of inclusion.

Second, the application of big data technology will be more convenient and effective in addressing issues such as risk identification and tracking. Through digital technology, digital inclusive finance dynamically monitors the flow of money for each loan, thus establishing a database of credit risk in impoverished areas and making it easier for banks and other inclusive financial institutions to provide inclusive financial services to the inclusive population in the region.

In addition, digital inclusive finance is more flexible in terms of matching usage scenarios and other aspects. It can optimize the provision of inclusive financial products and services according to the current situation. Moreover, in terms of capital supply, economically underdeveloped regions also have new sources of access to capital, which in turn better promotes the development of the local real economy.

Based on this analysis, this paper proposes Hypothesis 3: Digital inclusive finance has a more pronounced effect on the promotion of cities lagging behind in economic development.

4. Research Design

4.1 Selection of Variables

4.1.1 Dependent Variable

Real Economy. Most scholars, such as Hu Qianwen (2022), measure the development level of the real economy by taking the GDP of each prefecture-level city in Henan Province minus the GDP of the financial and real estate industries.^[17] However, the central bank issued a statement in April 2022 that real estate is the real economy, so this paper measures the development level of the real economy by taking the GDP of prefecture-level cities in Henan Province minus the value added of the financial sector (unit: billion yuan) to ensure that the data are located on the same order of magnitude, reduce the difference between the data, and avoid the impact of a few extreme values. This paper takes the natural logarithm of the real economy.

4.1.2 Core Explanatory Variables

This paper first chooses the digital inclusive finance index compiled by Peking University as the core explanatory variable. Moreover, to study the impact of each dimension of digital inclusive finance on the real economy of Henan Province, in this paper, with reference to Chen Jie (2022),^[18] the three dimensions of digital inclusive finance, breadth of coverage (cover), depth of use (use), and degree of digitization (dig), were chosen as explanatory variables for the study. Again, this was treated by taking the natural logarithm.

4.1.3 Control Variables

Considering the development of the real economy in Henan Province, in addition to the impact of digitally inclusive finance, there may also be interference from other internal and external factors, which may impact the accuracy of the results. Therefore, other factors affecting the development of the real economy in Henan Province need to be controlled here. The control variables selected in this paper are as follows:

Level of urbanization. Urbanization is usually accompanied by a concentration of population and an increase in the size of cities, which creates larger markets and helps to attract more businesses and investment, leading to more business opportunities and job creation. As the level of urbanization increases, the industrial structure changes, and the incomes of residents increase, which in turn stimulates and expands consumer demand. In addition, population mobility stimulates demand for housing, employment and education, which can also promote the development of related industries. This is measured by the proportion of the urban population to the total population.

Level of basic transportation. The development of transport infrastructure is related to the development of economic transactions in the transportation sector and has a

significant impact on the ease of economic activity. A good transportation infrastructure improves the efficiency of logistics and supply chains and reduces the time and cost of transporting goods, which helps firms reduce production costs, increases competitiveness and promotes the development of industries. Moreover, regions with good basic transportation are usually more likely to attract investment, which creates more jobs and increases the convenience of economic activities, which in turn affects the development of the real economy. The total number of kilometer journeys (kilometers) in each region of Henan Province is used here, and the natural logarithm of this number is also taken for the same reason.

Scale of government expenditures. The scale of government expenditures plays a key role in macroeconomic policy. It shapes the economic direction of a country or region in a number of ways, such as stimulating growth, providing public services, balancing regional development and stabilizing economic cycles. Among other things, government expenditures are used to provide public services such as education, health care and social welfare, to improve quality of life, to develop human capital and to promote long-term economic growth. In addition, the direction and scale of government expenditures affect economic activities in various fields and play a certain role in guiding the development of the real economy.^[19] In this paper, we use the share of general government budget expenditures in GDP as a measure. Table 1 provides a summary of the specific variables.

Table 1
Summary of Variables

variables	specified variable	calculation method
Dependent Variable	real economy	Ln(GDP of each prefecture-level city in Henan Province - value added of financial industry of each prefecture-level city)
core explanatory variables	Digital Inclusive Finance Index Breadth of coverage (cover) Depth of use (use) Degree of digitization (dig)	Ln (Digital Inclusive Finance index) Ln (breadth of coverage) Ln (depth of use) Ln (Degree of digitization)
control variables	Level of urbanization Level of basic transportation Scale of government expenditure	Urban population/Total population Ln (total road mileage by prefecture) General government budget expenditure/GDP

4.2 Data Sources

The core explanatory variables and their three dimensions include the digital inclusive finance index, breadth of coverage (cover), depth of use (use), and digitization (dig), which are derived from the digital inclusive finance index published by Peking University's Center for Digital Finance Research, and the years are selected from 2012 to 2021.

The data required for the explanatory and control variables come from the Henan Statistical Yearbook, selected from 17 prefecture-level cities in Henan Province for a total of 10 years from 2012 to 2021, including the GDP of each prefecture-level city, the value added of the financial industry, the urban population, the total population, the total number of highway mileage, and the government's general budgetary expenditures.

4.3 Descriptive Statistics

Table 2 presents the results of descriptive statistics for all the above variables:

Table 2
Results of the Descriptive Statistics

variables	variable symbol	Sample size	average value	standard deviation	minimum value	maximum value
Real Economy	real	170	7.624	0.54	6.285	9.334
Digital Inclusive Finance Index	index	170	5.204	0.385	4.155	5.801
breadth of coverage	cover	170	5.15	0.427	3.846	5.874
Depth of use	use	170	5.148	0.385	4.283	5.665
Degree of digitization	dig	170	5.424	0.345	4.392	5.781
Level of urbanization	urban	170	0.494	0.0943	0.322	0.791
Level of basic transportation	traffic	170	9.447	0.575	8.403	10.6
Scale of government expenditure	government	170	0.161	0.0333	0.0891	0.231

As seen from the analysis in Table 2, the standard deviation of the real economy of the explanatory variables is 0.54, which indicates that the standard deviation is large and that the difference between the maximum and minimum values is large, indicating that the level of the real economy of the different prefectures and cities in Henan Province varies significantly and is not at the same level. The standard deviations of the core explanatory variable digital inclusive finance index and its three dimensions are 0.385, 0.427, 0.385, and 0.345, respectively, indicating that the degree of digital inclusive finance development in various prefectures varies. The maximum standard deviation of the breadth of coverage indicates that the popularity of digital financial services is seriously unevenly distributed, and the differences among prefectures are significant. The standard deviation of the control variable basic transportation

construction is large, which indicates that the transportation situation in each place is mixed and that the gap is more obvious.

4.4 Model Selection

This paper uses balanced panel data from 17 prefecture-level cities in Henan Province. On this basis, first, the F test is used to determine whether the model should be mixed or fixed effect. The regression result is $\text{Prob}>F=0.0000$, and the result is less than 0.05; therefore, the original hypothesis is strongly rejected, and it is better to use a fixed effect model. Next, through the LM test to compare the random effect model and the mixed effect model, the result is a p value of 0, which is less than 0.05. Therefore, the original hypothesis is strongly rejected, and the result of using the random effect model is better. Finally, the Hausmann test is used to compare the random effect model and fixed effect model, and the result is $\text{Prob}>\chi^2=0.0265$, the p value is less than 0.05, and it is better to use the fixed effect model. Based on the above analysis, the fixed effect model is finally adopted, and the specific model constructed in this paper is as follows: $\ln \hat{\partial}_{it} = \beta_0 + \beta_1 * \ln difi_{it} + \beta_2 * control_{it} + \theta_t$ Model1

In Model 1, $\ln \hat{\partial}$ is the real economy, i is each prefecture-level city, t denotes the year, β_0 is the constant intercept term, $\ln difi$ is the core explanatory variable, is the control variable, $control$ is the control variable, and θ_t is the randomized disturbance term.

5. Empirical Analysis

5.1 Baseline Regression Analysis

The regression results used to study the impact of digital inclusive finance on the real economy of Henan Province are shown in Table. Column (1) in Table 3 shows the regression results without adding control variables, and column (2) shows the regression results after adding control variables.

Table 3

Benchmark Regression

variables	real	
	(1)	(2)
index	0.5211*** (29.3381)	0.1953*** (5.0557)
urban		3.0094*** (8.7803)
traffic		0.2685*** (3.4729)
government		-2.4040*** (-7.1294)
Constant	4.9117*** (52.9960)	2.9704*** (4.1795)
N	170	170
adj. R ²	0.833	0.921

Note: ***, **, and * indicate 1%, 5% and 10% significance levels, respectively.

As seen from the columns where columns (1) and (2) of Table 3 are located, the regression coefficients are 0.5211, both are larger than 0, and both are significant at the 1% level. This indicates that the development of digital inclusive finance will promote real economic development in Henan Province regardless of whether control variables are added. The regression coefficients after adding control variables show that for every unit increase in the level of digital inclusive finance, the level of the real economy increases by 0.1953 units. Therefore, hypothesis 1, "Digital inclusive finance can contribute to the development of the real economy in Henan Province", is confirmed.

Observing the coefficients of each control variable in the regression results after adding control variables in the columns of Table 3 (2), we find that the regression coefficients of the level of urbanization and the level of basic transportation are 3.0094 and 0.2685, respectively, both of which are larger than 0 and significant at the 1% level, which indicates that the improvement of these two variables has a different degree of promotion for the development of the real economy, and the promotion of the level of urbanization has a higher coefficient, indicating that the promotion effect is more obvious. A higher coefficient indicates that the promotion effect is more obvious. The regression coefficient of the indicator government expenditure scale is -2.4040, which is significant and negative at the 1% level, which indicates that an increase in the scale of government expenditure strongly inhibits the development of the real economy. This may indicate that excessive government intervention dampens the development of the real economy in the region, as it may interfere with the effective allocation of market resources and economic order. On the other hand, with the development of the financial system and the improvement of the institutional environment, excessive government intervention may lead to financial market imbalance and the "government failure" phenomenon; thus, it is necessary to rely more on the market to improve the efficiency of the financial system.^[20] (b) The financial system must rely more on the market to improve its efficiency.

5.2 Analysis of Digital Inclusive Finance Indicators by Dimension

Digital inclusive finance has diverse characteristics. This article discusses digital inclusive finance and its impact on the real economy of Henan and studies the different levels of digital inclusive finance and its impact on the real economy of Henan. Next, the article will explore the three levels of digital inclusive financial services in terms of breadth of coverage, depth of use and degree of digitization and analyze the impact on the operation of the real economy of society at different levels one by one.

The empirical regression results are shown in Table 4. The columns where (1) and (2) are located, where (3) and (4) are located, and where (5) and (6) are located are the regression results for breadth of coverage, depth of use, and digitization,

respectively, in Table 4. No control variables were added to columns (1), (3), or (5), and control variables were added to columns (2), (4), or (6).

Table 4

Regression Results for Each Dimension of Digital Inclusive Finance

variables	real					
	(1)	(2)	(3)	(4)	(5)	(6)
cover	0.4791*** (29.6701)	0.1814*** (5.4200)				
use			0.5059*** (25.1757)	0.1062*** (3.0060)		
dig					0.5326*** (20.2116)	0.1278*** (4.0042)
urban		2.9661*** (8.9925)		3.8236*** (12.9099)		3.6801*** (13.7086)
traffic		0.2882*** (3.7415)		0.1671** (2.0720)		0.3130*** (3.7589)
government		-2.2543*** (-6.7862)		-2.4129*** (-6.7567)		-2.4862*** (-7.0953)
Constant	5.1564*** (61.8148)	2.8632*** (4.0580)	5.0192*** (48.3876)	3.9973*** (5.4929)	4.7352*** (33.0683)	2.5550*** (3.2857)
N	170	170	170	170	170	170
adj. R^2	0.836	0.923	0.785	0.913	0.698	0.917

Note: ***, **, and * indicate 1%, 5% and 10% significance levels, respectively.

First, whether the inclusion of control variables affects the regression results is verified. As seen from the results in Table 4, regardless of whether control variables are added or not, the regression coefficients of the breadth of coverage, depth of use, and degree of digitization are all larger than 0, and all of them are highly significant at the 1% level, which indicates that the breadth of coverage, depth of use, and degree of digitization of digital inclusive finance have a facilitating effect on the development of the real economy in Henan Province and the size of the regression coefficients, which indicates that the various dimensions of digital inclusive finance have a facilitating effect on the real economy.

Next, we examine the regression results for the three dimensions after adding the control variables.

First, a regression analysis of the breadth of coverage was performed. As seen from the column where (2) is located in Table 4, the regression coefficient of breadth of coverage is 0.1814, and it is highly significant at the 1% confidence level, which indicates that improving the breadth of coverage has a positive effect on the real economy.

This result is consistent with our economic intuition. The breadth of coverage is mainly measured by the number of Alipay accounts per 10,000 people, the proportion of cards tied to Alipay, and the average number of bank cards tied to each Alipay

account. An increase in the breadth of coverage indicates that more users prefer the fast, secure and low-cost payment and transfer services provided by these platforms, which to some extent accelerates economic activities, improves the liquidity of funds and the efficiency of transactions, and is conducive to facilitating the resolution of financial service problems in impoverished areas, which in turn promotes the growth of the real economy. In addition, the regression coefficient of this indicator is the largest among the three-dimensional indicators of the DIFI, indicating that an increase in the breadth of coverage has the most obvious effect on Henan Province, which is a province with a large population.

Next, the regression analysis of depth of use was performed. As seen from the column where (4) is located in Table 4, the regression coefficient of the depth of use is 0.1062, and it is highly significant at the 1% confidence level. This reflects that an increase in the depth of use has a facilitating effect on the development of the real economy. This result is also consistent with our common sense in economics. The depth of use index is measured based on the actual use of financial services. The application of Internet financial services can, to a certain extent, promote the digitalization and automated processing of services such as payment, credit, insurance, investment and credit collection, which reduces red tape and waiting time, improves the efficiency of financial services, provides faster and more convenient services for individuals and enterprises, and provides greater help to the financing problems of small and microenterprises, thus promoting the development of the real economy.

Finally, for the regression analysis of the degree of digitization, from the columns in (6) in Table 4, the regression coefficient of the degree of digitization is 0.1278, and the regression result is highly significant at the 1% confidence level. This indicates that an increase in the degree of digitization significantly contributes to the development of the real economy. A possible explanation for this result is that the degree of digitization is mainly reflected in the aspects of mobility, affordability, creditworthiness and convenience, which are the main factors affecting users' use of digital financial services. The digitalization of finance effectively reflects the low-cost and low-threshold advantages of financial services, improves the efficiency of all aspects of financial inclusion, and promotes the sustainability of financial inclusion.^[21] The poor in Henan Province are densely distributed and large in number compared with those in other provinces, and increasing the degree of financial digitization for financial inclusion has obvious effects from a general point of view.

According to the findings above, among the three specific dimensions of digital inclusive finance, breadth of coverage has the most significant effect on the real economy, depth of use has the second most significant effect, and the degree of digitization has the least effect on the real economy. Therefore, Hypothesis 2, that the dimensions of digital inclusive finance indicators have different promotional effects on the real economy, is confirmed.

5.3 Endogeneity Test

Considering that there may be reverse causality between the explanatory variables and the dependent variable, to verify the possible endogeneity problem, this paper refers to the existing research methods to lag one period of both the core explanatory variables and the control variables to carry out the endogeneity test. When the levels of the core explanatory variables and control variables in the lag period are high, the levels of the core explanatory variables and control variables in the current period are also high, and the two variables are strongly correlated; moreover, the lagged terms of the core explanatory variables and control variables are not directly related to the explanatory variables in the current period, which satisfies the condition of exogeneity. The test results are shown in Table 5.

Table 5
Endogeneity Test Results

variables	(1) real	(2) real	(3) real	(4) real
L.index	0.1566*** (3.6501)			
L.cover		0.1312*** (3.4997)		
L.use			0.1116*** (2.9348)	
L.dig				0.0993*** (2.8065)
L.urban	3.3434*** (8.1816)	3.4798*** (8.9645)	3.7852*** (10.6228)	3.8886*** (11.5364)
L.Traffic	0.1755** (2.0919)	0.1844** (2.1716)	0.0834 (0.9908)	0.2060** (2.2894)
L.Government	-2.2031*** (-4.5370)	-2.1844*** (-4.4820)	-2.2045*** (-4.4657)	-2.2200*** (-4.4845)
Constant	3.9264*** (5.0892)	3.9117*** (5.0304)	4.8181*** (6.3454)	3.6474*** (4.3395)
N	153	153	153	153
adj. R ²	0.887	0.886	0.883	0.883

Note: ***, **, and * indicate 1%, 5% and 10% significance levels, respectively.

As seen from the results in Table 5, the regression coefficients of digital inclusive finance, breadth of coverage, depth of use, and degree of digitization are 0.205, 0.327, 0.235, and 0.170, respectively, which are all greater than 0, and all of them are significant at the 1% level, which is the same as the baseline regression results in terms of positivity, negativity, and significance. This indicates that there is no reverse causality between the explanatory and interpreted variables.

5.4 Robustness Check

To test whether the above regression results are accurate and reliable, i.e., the robustness of the results, the robustness test of this paper is carried out by replacing the explanatory variables. Industry is the main carrier of the real economy and is more consistent with the trend of the real economy. To test the robustness of the model, the logarithm of the value added of industry in each province is used to replace the level of the real economy.^[22] The results of the regression are shown in Table 6. The regression results are shown in Table 6. In Table 6, (1) is the benchmark regression, and (2) indicates the regression results after replacing the real economy with industrial value added.

Table 6
Robustness Test Results

variables	(1)	(2)
	real	industrial
index	0.1953*** (5.0557)	0.4546*** (6.4008)
urban	3.0094*** (8.7803)	-2.2799*** (-3.6181)
traffic	0.2685*** (3.4729)	0.2933** (2.0640)
government	-2.4040*** (-7.1294)	-4.8121*** (-7.7623)
Constant	2.9704*** (4.1795)	3.5306*** (2.7020)
<i>N</i>	170	170
adj. <i>R</i> ²	0.921	0.684

Note: ***, **, and * indicate 1%, 5% and 10% significance levels, respectively.

In the regression results of replacing the explanatory variables, the regression coefficient of the core explanatory variable digital inclusive finance is 0.4546, and the coefficient is larger than 0 and significant at the 1% level, which is the same as that of the regression results before replacing in terms of positivity, negativity, and significance, which indicates that it passes the robustness test and that the regression results are accurate.

5.5 Heterogeneity Analysis

To examine whether there are differences in the impact of digital inclusive finance on the real economy of Henan Province in regions with different levels of development, this paper adopts the quantile regression analysis method. Table 7 shows the regression results of digital inclusive finance on the real economy of Henan Province under the quartiles of 0.1, 0.25, 0.5, 0.75, and 0.9.

Table 7*Quantile Regression Results*

variables	(1)	(2)	(3)	(4)	(5)
	q10	q25	q50	q75	q90
index	0.597*** (0.140)	0.551*** (0.114)	0.280** (0.138)	0.0561 (0.113)	0.0271 (0.0579)
urban	-0.775 (1.372)	-0.410 (0.905)	1.937* (1.047)	4.182*** (0.753)	4.119*** (0.141)
traffic	0.665*** (0.0765)	0.688*** (0.0585)	0.634*** (0.0713)	0.541*** (0.0879)	0.592*** (0.0390)
government	-5.296*** (1.628)	-6.798*** (1.118)	-3.828** (1.895)	-1.038* (1.274)	-1.155*** (0.399)
Constant	-0.842 (0.859)	-0.650 (0.482)	-0.172 (0.647)	0.540 (1.100)	-0.153 (0.420)
Observations	170	170	170	170	170

Note: ***, **, and * indicate 1%, 5% and 10% significance levels, respectively.

According to the results in Table 7, we can conclude that from left to right, as the quartile increases, the impact coefficient gradually decreases, and in the 0.1, 0.25 and 0.5 quartiles, digital inclusive finance has a very significant positive effect on the development of the real economy in Henan Province; however, in the 0.75 and 0.9 quartiles, this promotion effect is not significant. This suggests that there is heterogeneity in the impact of digital inclusive finance on the real economy in areas with different levels of development in Henan Province: in areas with a high level of real economic development, the promotion effect is not significant, i.e., the promotion effect is relatively weak; in areas with a low level of real economic development, the promotion effect is more significant, and the lower the level of economic development is, the more significant it is.

The reasons why the impact effect of digital inclusive finance is more significant in regions with lower levels of real economy, from an economic perspective, can be explained as follows:

First, the financial services gap should be filled. Gaps in financial services usually exist in areas with lower levels of economic development, and traditional banks and financial institutions may be unwilling or unsuitable to provide services in these areas. Through mobile payments, e-banking and other technologies, digital inclusive finance bridges the financial services gap in these areas, thus enabling more people to access financial services such as financing, savings and payments and thus promoting the development of the real economy.

Second, reduce financial transaction costs. In areas with lower economic levels, people are usually more sensitive to the cost of financial transactions because of lower incomes. Digital inclusive finance technologies can reduce the cost of financial transactions. Through digital channels, traders can reduce the cost of financial

transactions, including payments, remittances and lending, which will lead to more people participating in economic activities and increased economic development.

Third, it increases financial inclusion. As populations in areas with lower economic levels may include a large number of people who are not included in the financial system by banks, the spread of digital inclusive finance can expand financial inclusion and enable those who do not have a traditional bank account to participate in the financial system so that more people can have access to financial services and thus promote the development of the real economy.

Fourth, increasing market participation. In regions with a low level of economic development, where the market is relatively small, digitally inclusive finance can promote the development and expansion of the market by increasing people's participation in the market so that more people will participate in economic activities.

In summary, there is heterogeneity in the effect of digital inclusive finance on regions with different real economic development situations, and the effect of digital inclusive finance on regions with lower levels of real economic development is more obvious. Hypothesis 3: The promotion effect of digital inclusive finance on cities lagging behind in economic development is more obvious.

6. Conclusion and Implications

6.1 Conclusion

This paper focuses on the impact of digital inclusive finance on the real economy based on panel data from 17 prefecture-level cities in Henan Province for a total of 10 years, from 2012 to 2021, using a fixed-effects model to carry out an empirical study and obtains the following conclusions: (1) Digital inclusive finance plays a role in promoting the development of the real economy in Henan Province; (2) the various dimensions of the digital inclusive finance indicators have different promotional effects on the real economy. (2) The dimensions of digital inclusive finance indicators have different effects on the real economy: the breadth of coverage has the most significant effect on the real economy, the depth of use has the second most significant effect, and the degree of digitization has the smallest effect on the real economy. (3) Based on the quantile regression method, this paper concludes that digital inclusive finance supports the real economy of the regions in Henan Province with a lower level of economic development and that it becomes increasingly significant as the level of economic development decreases. All of these findings pass the robustness test and do not have endogeneity problems.

This paper's study of the impact of digital inclusive finance on the real economy of Henan Province shows the important role of digital inclusive finance in supporting high-quality economic development and promoting balanced regional development. This

study provides a strong basis for policy makers in Henan Province and other regions. To promote the sustainable growth of the local real economy and improve the well-being of people's livelihoods, digital inclusive finance should be fully utilized to fuel the development of the local real economy.

6.2 Recommendations and Implications

First, strengthening the digitally inclusive financial system in Henan Province

Based on the conclusion that digital inclusive finance plays a facilitating role in the development of the real economy of Henan Province, this paper proposes strengthening the construction of a digital inclusive financial system in Henan Province. The specific steps are as follows:

First, it is necessary to strengthen the construction of a credit collection system. The government can encourage the establishment of a credit information-sharing mechanism among financial institutions to ensure that credit information on small and microenterprises and other customers can be widely transmitted and shared. It should support the construction of a unified credit information database that provides reliable credit rating and risk assessment data to help financial institutions better identify, assess and serve small and microenterprises and low-income people.

Second, it is necessary to strengthen the construction of risk regulation. The existing risk mechanism still exists in the development of digital inclusive finance without supporting the situation, so it is necessary to continue to develop and improve the construction of the risk supervision system. The construction process can achieve the construction of the complete link of risk identification, measurement, analysis and disposal, especially by combining the credit system with 5G, blockchain, cloud computing, artificial intelligence and other high-tech, and continuing to intelligently track the flow of each loan amount issued to realize the risk monitoring of the complete link of the inclusive people, especially small and microenterprises, before, during and after the loan. The government should also continue to improve the legal policy on digital inclusive finance to supplement the gaps in this area to effectively achieve a legal basis.

Finally, financial education should be strengthened. Financial literacy training can be provided to residents to help them better understand digital financial products and risks. Micro and small business owners should be educated on how to effectively use digital financial tools to manage their finances and expand their businesses.

Second, emphasize scientific and technological innovation

Science and technology innovation plays an important role in promoting digital inclusive finance to aid in the development of the real economy. In view of this paper's

conclusion that "among the multiple dimensions of digital inclusive finance, the degree of digitization has the lowest effect on the promotion of the real economy in Henan Province", this paper argues that, on the one hand, the government can provide financial support, tax incentives and innovation and entrepreneurship environment and other policy measures to encourage small and microenterprises to carry out innovative research and development in the fields of environmental protection technology, recyclable materials research and development. innovation and research and development. At the same time, the government can establish an industry-university-research cooperation mechanism to promote cooperation between small and microenterprises and research institutes and universities to strengthen technology transfer and the application of innovation results.

On the other hand, it has strengthened the cultivation and introduction of digital technology talent and promoted financial institutions and related enterprises to enhance their digital technology application capabilities. The research, development and application of cutting-edge technologies such as artificial intelligence, blockchain and big data should be strengthened to provide more efficient and intelligent services for financial inclusion. This can effectively alleviate problems such as information asymmetry between inclusive groups such as small and micro enterprises and low-income people and financial institutions, break the financial information gap, and better fulfill the original intent and concept of inclusive finance.

Third, guiding rural migrant workers to return to their hometowns for development

In light of the conclusion that digital inclusive finance has a more pronounced effect on promoting the real economy in areas with lower levels of development in Henan Province, this paper argues that the government can use digital inclusive finance to guide rural workers to return to their hometowns for development.

First, the use of inclusive finance to promote the development of talented people in the countryside to return to their hometowns and as an entry point for the development of inclusive finance and to build the construction of inclusive finance mainstays to return to their hometowns for employment modes from multiple dimensions is a way to promote poverty alleviation and rural revitalization strategy implementation. In addition, entrepreneurship and employment service platforms should be provided for people returning to their hometowns. The government can establish an entrepreneurship and employment service platform, integrate all kinds of resources and services, and provide entrepreneurial guidance, training and counseling and other support for people returning to their hometowns to help migrant workers return to their hometowns start their own businesses and employment and to improve their competitiveness and entrepreneurial ability in employment.

Second, inclusive financial services in rural areas should be strengthened, and targeted inclusive financial services such as low-interest loans, credit guarantees and financial counseling should be provided to returnee entrepreneurs. The government can encourage banks and financial institutions to establish specialized inclusive financial departments or windows to provide customized services for the financial needs of people returning to their hometowns.

Again, to promote digital agriculture, digital inclusive finance can be combined with digital agriculture to support the development of migrant workers returning to their hometowns. The government can promote the popularization of digital agriculture technology, encourage returning workers to use digital technology to improve agricultural productivity, and provide financing and investment support for digital agriculture.

Finally, the logistics system should be improved and the development of rural e-commerce promoted. The development of rural e-commerce can be supported by returning to their hometowns, promoting the large-scale cultivation of agricultural products in line with the characteristics of their hometowns through skills training in agricultural planting technology and e-commerce expertise, and promoting live streaming to bring goods for the online sale of agricultural products.

References

- [1] Dai Zhenmin. Empirical research on the efficiency of the development of Real Economy of inclusive financial services [J]. Times Finance, 2023, No. 828(02): 26~30+33.
- [2] XianJinkun, Wang Wei, Lan Yuan. Has population aging aggravated economic "deconcentration"? Micro evidence from Chinese listed firms. J. Investment Research, 2022, 41(07): 20-45.
- [3] Yin Huijun, Kan Jingyang. Analysis of modern rural system construction based on the perspective of financial inclusion [J]. China Agronomy Bulletin, 2010, 26(17): 443-446.
- [4] Ren Biyun, Li Liuying. Whether Digital Inclusive Finance Promotes Inclusive Rural Growth - A Study Based on Survey Data of 2114 Rural Residents in Beijing, Tianjin and Hebei [J]. Modern Finance and Economics (Journal of Tianjin University of Finance and Economics), 2019, 39(04): 3-14.
- [5] Liu Jinyi, Liu Chunyang. The rural poverty reduction effect of Digital Inclusive Finance: effect and mechanism [J]. Finance and Economics, 2020(01): 43-53.
- [6] Zheng Meihua. Rural Digital Inclusive Finance: development model and typical cases [J]. Rural Economy, 2019(03): 96-104.
- [7] Xie Lin. Analysis of rural digital inclusive financial innovation model under digital agriculture and rural development [J]. Agricultural Economy, 2020, No. 403(11): 12-14.

-
- [8] He Ying. Analysis of innovation model of digital inclusive financial services [J]. National Circulation Economy, 2022, No. 2336(32): 110-113.
- [9] Lee Chien-Chiang, Tang Manting, Lee Chi-Chuan. Reaping digital dividends: Digital Inclusive Finance and high-quality development of enterprises in China [J]. Telecommunications Policy, 2023, 47(2).
- [10] Sheng Mingquan, Xiang Chunyan, Xie Rui. Whether Digital Inclusive Finance can inhibit the "derealization to virtualization" of real enterprises [J]. Journal of Capital University of Economics and Business, 2022, 24(01): 96-112.
- [11] Pan Yu, Ma Li, Wang Yanzhen. How and what kind of cities benefit from the development of Digital Inclusive Finance? Evidence from the upgrading of export in Chinese cities [J]. Economic Research-Ekonomska Istraživanja, 2022, 35(1).
- [12] LI Jianjun, PengYuchao, MaSichao. Financial inclusion and China's economic development: multidimensional connotation and empirical analysis [J]. Economic Research, 2020, 55(04): 37~52.
- [13] Ma Shaogang, Bai Dangwei, Wang Tiandu et al. Financial inclusion and the Real Economy: DSGE model and empirical test [J]. Shanghai Finance, 2021, No. 486(01): 44-51+65.
- [14] Li Linhan, Han Mingxi, Hou Yiwei. The impact of Digital Inclusive Finance on the Real Economy - an empirical analysis based on system GMM and panel threshold model [J]. East China Economic Management, 2022, 36(12): 14-25.
- [15] LvJianglin, Ye Jinsheng, Zhang Glimmerhorn. Research on regional differences and effects of synergistic development of Digital Inclusive Finance and Real Economy [J]. Contemporary Finance and Economics, 2021, No. 442(09): 53-65.
- [16] GUO Feng, Wang Jingyi, Wang Fang, Kong Tao, Zhang Xun, Cheng Zhiyun. Measuring the development of Digital Inclusive Finance in China: indexing and spatial characterization [J]. Economics (Quarterly), 2020, 19(04): 1401-1418.
- [17] Hu Qianwen, Li Zhan, Zhang Guangcai. Research on the effect and heterogeneity of Digital Inclusive Finance to support the development of Real Economy [J]. New Finance, 2022, No. 405(10): 18-24.
- [18] Chen Jie. Research on the Impact of Digital Inclusive Finance on the Development of Real Economy-Empirical Evidence Based on Provincial Panel Data [J]. Operation and Management, 2021, No. 444(06): 153-158.
- [19] Sheng Lei, She Jinghuai. Research on the optimization of financial structure to enhance the level of China's regional economic development--evidence from Beijing-Tianjin-Hebei region [J]. Credit, 2021, 39(03): 81-87.
- [20] Guo Beibei, LvChenglun. Internal Logic, Matching Mechanism and Reform Measures of Financial Support to Real Economy [J]. Hunan Social Science, 2022, (02): 52-59.
- [21] YiHanqing. Research on the impact of digital inclusive financial development on urban-rural income gap [J]. Times Finance, 2022, (06): 40-45.
- [22] Yao Qin. Research on the impact of Digital Inclusive Finance on the development of Real Economy [D]. Lanzhou University of Finance and Economics, 2023.