



# Digital financial inclusion for economic growth

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**Abstract.** The digital and inclusive advantages of digital inclusive finance, an emerging business, have contributed to high-quality economic growth, and energy transition has led a vital role in this process, but few articles have examined the association among digital financial inclusion, energy transition and the development of economy. This research utilizes panel statistics of 30 provinces in China from 2011 to 2019, and adopts panel regression methods to build regression models to analyze the role of digital inclusive finance on economic growth and the moderating role played by energy transition in it. The study illustrates that digital inclusive finance has significantly enhanced economy by promoting innovation and entrepreneurship and narrowing the income gap, while energy transition strengthens the salutary effect of digital inclusive finance on the growth of economy. Based on this, it is recommended that the government should harness the strength of digital inclusive finance in driving economic growth, and use digital inclusive finance to actively enhance the financing of energy transition, and leverage the financial credit by "digital dividend", so as to promote the high-quality economic growth.

**Keywords:** digital inclusive finance; economic growth; energy transition; high-quality growth

## 1 Introduction

Digital financial inclusion, as a new business, is formed during the spread of inclusive finance being accelerated by digital technology. Conceptually, the G20 Global Partnership for Financial Inclusion (GPFI) and the Bank for International Settlements (BIS) jointly defined digital financial inclusion in October 2014 as "a broad term for all actions that promote financial inclusion through the use of digital financial services. It includes the use of digital technologies to provide a range of formal financial services to groups who do not have access to financial services or who lack access to financial services, where the financial services offered meet their needs and are provided in a responsible and affordable manner, and are sustainable for the service provider".

Digital financial inclusion overcomes some of the drawbacks of traditional finance and has significant advantages over traditional finance. Li Jizun (2015) [1] argues that digital finance, driven by advances in e-commerce and communications technology, circumvents the disadvantages of traditional finance which relies on physical branches.

With greater geographic penetration and cheaper costs, digital finance promotes financial inclusion.

The Chinese government attaches great importance to the development of digital financial inclusion, which will lead to high-quality development. The 24th meeting of the Central Committee for Comprehensively Deepening Reform in 2022 gave important instructions on digital financial inclusion, emphasizing "orderly promotion of the development of digital inclusive financial services" and considering and adopting the "Implementation Opinions on Promoting the High-Quality Development of Inclusive Finance" (Xinhua News Agency, 2022). The "14th Five-Year Plan for National Informatization" also proposes to prioritize the implementation of digital inclusive financial service initiatives, and seeks to build a digital inclusive financial service system that is security-oriented, people-centered, and demand-driven (Central Committee for Cybersecurity and Informatization, Dec. 27, 2021). Studying the effect of digital financial inclusion can benefit China's economy.

This paper makes contributions to the relationship between digital financial inclusion and economic growth. In the context of advocating "carbon neutrality", little research has been done on the mechanism by which digital financial inclusion promotes economic growth through its impact on China's energy use structure in China's energy decarbonization transition process. This paper will explore the moderating role of digital inclusive finance in this mechanism.

## 2 Literature Review

Digital inclusive finance can be regarded as a product formed by the combination of financial digitization and financial inclusion in co-development. Financial digitization can promote financial inclusion. Digitization is a way of processing information, i.e., with the help of developed information technology, all kinds of information collected are turned into digital signals for analysis and dissemination. The concept of inclusive finance, which originated from the United Nations' Blue Book on Financial Inclusion at the turn of the century, refers to the provision of appropriate and effective financial services at an affordable cost to all segments and groups of society that have a need for financial services. Its driving effect on economic growth has become one of the main focuses of the Chinese government's financial policy.

### 2.1 Research on Digital Financial Inclusion

An increasing number of academic research has been done on financial inclusion. Scholarly research on financial inclusion in China began in 2006, with Du (2006) [2] describing the requirements of the financial inclusion system framework at different levels, from micro to macro. Jiao Jinpu et al. [3] on the other hand, pointed out that digital currencies have increased the coverage of financial services and reduced the cost of services (Jiao et al., 2015). Large-scale research on financial inclusion by scholars in other countries began in 2017, with Corrado (2017a) and Corrado (2017b) [4]

analyzing the role of inclusive finance on inclusive economic growth, and Ozili (2018) [5] studying the role of digital finance in improving financial inclusion.

In the digital technology era, inclusive finance has been able to gradually develop in the direction of digitalization. The earliest research studies on digital financial inclusion in China by scholars can be roughly traced back to Jiao et al. (2015) [3], who summarized for part of the role of digital money on financial inclusion. In recent years, Guo et al. (2020) [6] compiled the "Peking University Digital Inclusive Finance Index", which measured the indexing and spatial characteristics of digital financial inclusion, and showed the development trend of this sector across China. Yi and Zhou (2018) [7] found that digital financial inclusion can augment consumption through theoretical discussion and empirical testing, and Zhang et al. (2019) [8] evaluated the role of the development of digital finance in promoting inclusive growth by combining the China Digital Inclusive Finance Index and the data from the China Family Tracking Survey (CFPS). Qian et al. (2020) [9] found that China's digital financial development promoted China's economic growth with the help of panel data. The systematic research on digital inclusive finance by scholars in other countries began in 2018. In the field of agriculture, some researchers investigated the beneficial effects digital financial inclusion on agricultural credit (Agyekumhene et al., 2018) [10], the economic resilience of rural residents (Yang et al., 2022) [11] and rural revitalization (Wang, 2023) [12]. In the field of energy conservation, scholars have investigated the positive impact of digital financial inclusion on energy and environmental performance (Cao et al., 2021; Lee and Wang, 2022; Wang and Guo, 2022) [13-15]. Chen and Zhang (2021) [16] find that digital financial inclusion helps China's manufacturing industry to transform into a service-oriented industry based on data from listed firms. Du et al. (2023) [17] utilize China's 285 cities panel data, found that the development of digital financial inclusion helps enhance economic resilience through empirical tests and heterogeneity analysis.

## 2.2 Related Research on Economic Growth

Regarding economic growth, various definitions have been given by academics. According to Kuznets, economic growth can be defined as "a long-term increase in the ability to provide the population with an increasingly wide variety of economic products, and this growing ability is based on advanced technology and the corresponding adjustment of the required institutions and ideology". Samuelson developed Kuznets' theory of economic growth, suggesting in Economics that economic growth represents an increase in a country's potential national output. Lewis, on the other hand, defined economic growth as an increase in per capita output. North, on the other hand, sees economic growth as the long-term increase in per capita income when total social income grows faster than population growth.

Economic growth has been measured mainly in terms of gross domestic product per capita. Zhao et al. (2020) [18] used GDP per capita as a tertiary indicator under the dimension of the living standard of the population, and studied the degree of improvement in the standard of resident's living under the system of high-quality economic development. Pan (2012) [19] studied the spatial spillover effects of regional economic development in China by using Chinese provinces and regions' GDP per capita as a

measure for the period of 1988-2009, while Moghaddam et al. (2023) [20] analyzed the impact of changes in oil prices on economic growth by using the data of Canadian provinces and GDP per capita as an indicator.

Economic growth is heterogeneous across time and regions. Different regions have different resource endowments, industrial policies and infrastructure levels, and the same region's economic level constantly fluctuates during different economic cycles, thus the growth rate of GNP is significantly heterogeneous. Using a dataset of 153 countries for the period 1980 to 2019, Gngangnon (2023) [21] finds that countries or regions with a long duration of GATT/WTO membership have more significant economic growth volatility is more pronounced. Badeeb et al. (2017) [22] find that countries or regions rich in natural resources grow their economies at a lower rate than those with fewer natural resources. Cieřlik and Goczek (2018) [23], using the GMM methodology and economic data from 1994 to 2014 for 142 countries, find that the economic growth rates of countries with high levels of governmental corruption are higher compared to others lower. Clercq et al. (2023) [24], using economic development data from 2011 to 2018 for each of the 1348 regions of the EU member states, find that regions with a high degree of broadband infrastructure coverage have faster economic growth rates compared to other regions.

Economic growth can be realized in a variety of ways. For example, Ben-Salha et al. (2021) [25] argue that natural resource-rich regions can leverage increased investment in physical capital to promote economic growth. Tahir and Burki (2023) [26] argue that entrepreneurship and trade openness policies can help to achieve economic growth. Murdipi et al. (2023) [27] argue that a democratic political environment can help to reduce the pressures faced in economic development and accelerate economic expansion. Haldar et al. (2023) [28] argue that the use of the internet and technological innovations improve the effectiveness of financial development while promoting sustainable growth of economy. Wang et al. (2023) [29] argue that the marketization of the financial structure is conducive to the achievement of long-term economic growth.

## **2.3 Mechanism analysis**

### **2.3.1 Impact of digital financial inclusion on economic growth.**

At the micro level, digital inclusive finance has a facilitating effect on innovation and entrepreneurship. Zhang et al. (2019) [30] study the impact of the development of digital finance driven by the Internet revolution on inclusive growth, concluding that digital inclusive finance brings about equalization of entrepreneurial opportunities. Tian et al. (2023) [31] combine the China Digital Inclusive Finance Index with China Family Tracking Survey (CFPS) data under the premise of high quality development of entrepreneurship, and find that digital finance promotes individual entrepreneurship as well as the ascension of entrepreneurship, and this verdict is still valid after considering endogeneity issues. Based on statistics about Shanghai and Shenzhen A-share listed companies from 2011 to 2017, Tang et al. (2020) [32] found that there is indeed a "structural" driving effect of digital finance development on corporate technological innovation. Xie et al. (2018) [33] find that digital financial development has a significant effect on entrepreneurship by matching provincial-level data from Peking

University's Digital Financial Inclusion Index with new business registration information used to measure regional entrepreneurial activity. Using Anderson's "long tail theory", Wang (2015) [34] finds that Internet finance helps alleviate the problem of financing difficulties for micro and small enterprises. Wu (2023a) and Wu (2023b) [35] select three years of China Household Finance Survey (CHFS) data, and through mediation effect modeling, reach the conclusion that digital financial inclusion can improve household entrepreneurship and enhance entrepreneurial performance. It can be seen that by promoting innovation and entrepreneurship, digital inclusive finance adds more new jobs and consumer goods to the economy and society, improves labor productivity, drives private investment, and facilitates the transformation of industries to high value-added, which in turn promotes economic growth.

At the macro level, digital financial inclusion has reduced the income differential and drives balanced economic growth. Zhou et al. (2020) [36], based on China's digital inclusive finance development index and China Labor Force Tracking Survey (CLDS) matched data, found that digital financial inclusion has a salutary effect on reducing the income inequality between urban and rural areas by constructing an urban and rural household credit threshold model with the use of MM decomposition based on quantile regression, and that the marginal effect is larger at the lower quartile. Zhou et al. (2021) [37] find that digital financial inclusion helps to reduce the income gap from a micro perspective, and the poverty reduction effect of digital financial inclusion is more significant for households with lower income, less social capital, and poorer health, as well as for households with higher human capital, and the same is true for households with higher human capital. Song et al. (2022) [38] organize county-level panel data from 2014-2019 based on text mining methods and find that digital finance inclusion can significantly lessen the urban-rural income inequality, and it is more significant in the east-central region. Based on Chinese inter-provincial panel data from 2011 to 2015, Huang et al. (2019) [39] find that poorer groups are more able to benefit from the development of digital inclusive finance compared to richer groups, and that the development of digital inclusive finance improves the inequality of income within the population. Zhu et al. (2023) [40], by analyzing the data of small and medium-sized enterprises (SMEs) in China from 2011-2021, find that digital financial inclusion has a notable effect on the western region's enterprises' labor income share is significantly higher than that of developed regions. By narrowing the income gap, digital inclusive finance enhances the consumption capacity of low-income groups and middle-income groups, mitigates the outflow of talent and capital from less developed regions, and helps to stabilize the economy of less developed regions, creating new growth while balancing development.

Hypothesis 1: Digital financial inclusion positively affects economic growth.

### **2.3.2 The impact of digital financial inclusion and energy transition on economic growth.**

Digital financial inclusion and energy transition have a driving effect on high-quality economic development. First, some articles have proved that digital inclusive finance prefers to invest in new energy industries. The high binding between traditional finance and traditional energy industry has naturally set up a high entry threshold for digital

inclusive finance. As an emerging industry, the investment risk of clean energy industry is higher than traditional energy, and traditional finance has relatively low willingness to invest in it, so the clean energy industry is relatively less tied to traditional finance, which provides a large amount of investment space for digital inclusive financial investment, and attracts the investment focus of digital inclusive finance to shift to clean energy and its supporting industries. Secondly, digital inclusive finance has more advantages compared to traditional finance. Clean energy investment has high upfront costs and long payback period, the traditional financial transaction process is complex and less inclusive, is not conducive to timely solution of the lack of investment in the start-up period of clean energy enterprises. Digital inclusive finance can simplify the transaction process with the help of digital technology, provide timely and sufficient financing for clean energy enterprises in the early stage, implement precise support for clean energy enterprises, improve the financial performance of clean energy enterprises, and promote the development and growth of clean production (Wu and Huang, 2022) [41].

With the energy transition process, the scale and price effects brought about by capital and the environmental benefits brought about by technological upgrading have led to a continuous increase in the proportion of clean energy in the total energy consumption, gradually replacing non-clean energy and other factors of production, increasing the carbon factor productivity and the proportion of clean energy consumption in the total energy consumption, and realizing the high-quality growth of the economy (Li et al., 2023) [42]. The transformation of energy structure can make a huge dent in carbon emissions, expand the scope of energy utilization, clean and diversify the means of energy acquisition, increase related supporting employment, create more energy income while enhancing the overall energy utilizing efficiency, and drive the development of upstream and downstream supporting industries, which will in turn stimulate economic growth. Moreover, under the background of "carbon neutrality", the regional energy consumption structure's low-carbon transformation will also increase the competitive advantages of regional products or services, and drive the growth of exports and investment in regional products or services, thus promoting the growth of the overall economy.

Hypothesis 2: There is a "digital dividend" of digital inclusive finance at the level of cleaner energy transformation, i.e. the energy consumption structure's transformation enhances the promotion of economic growth.

### **3 Data and Modeling**

#### **3.1 Data description**

Due to the collectability, continuity and relative consistency of statistical caliber of the data, this paper uses the panel data of 30 provincial units (municipalities or autonomous regions) in China (excluding Macao Special Administrative Region, Hong Kong Special Administrative Region, Tibet Autonomous Region and Taiwan Province) for the period from 2011 to 2019. Unless otherwise specified, the data are obtained from China Statistical Yearbook, China Science and Technology Statistical Yearbook,

Compendium of Science and Technology Statistics, China Urban Statistical Yearbook, and China's main S&T indicator database. Table 1 shows the statistical descriptions of the main variables:

**Table 1.** the statistical descriptions of the main variables

Variable	Obs	Mean	Std. Dev.	Min	Max
Economic development (ED)	270	5.174	2.572	1.591	16.185
Peking University Digital Inclusive Finance Development Index (DIFI)	270	203.358	91.568	18.33	410.282
Government intervention (GOV)	270	.264	.115	.12	.758
Innovation level (INV)	270	5.214	7.607	.05	52.739
Urban greening forest coverage (UGC)	270	34.457	18.107	4.2	66.8
Industrial structure (IS)	270	43.878	8.626	16.2	59

### 3.1.1 Explanatory variables.

Digital Inclusive Finance:

Digital inclusive finance refers to any actions that can improve financial inclusion by using digital financial services. This paper utilizes the "Peking University Digital Inclusive Finance Development Index" (Guo Feng et al., 2020) [6], which constructs a digital financial inclusion index system from three aspects: the depth of digital financial use, the breadth of digital financial coverage, and the degree of digitalization of inclusive finance, as a measurement method. The index is processed by dimensionless processing, coefficient of variation method and hierarchical analysis method, which combines the new situation and characteristics of digital financial services with the availability and reliability of data, reflecting the current situation and evolutionary trend of China's digital inclusive financial development.

### 3.1.2 Explained Variables.

Economic growth:

Economic growth refers to the growth of potential national output in a region. The degree of economic growth of a region, as an important component of regional development, has multiple measures. GDP per capita has significant advantages as a measure. Firstly, GDP per capita is a direct and significant indicator of the level of growth of a region's economy. Secondly, GDP per capita, as a quantifiable indicator, is easy to measure and analyze. Therefore, this paper chooses GDP per capita as an indicator to measure economic growth.

### 3.1.3 Control variables.

Government Intervention:

Government intervention (GOV) refers to government intervention in the economy through administrative means. In countries like China with a low degree of marketization, the market's role in determining resource allocation and economic performance is relatively weak, and the government is able to strongly intervene in market trends

through administrative or legal means to improve its own performance, which in turn affects the operation of the economy. The link between digital financial inclusion and government intervention is mainly reflected in the fact that the government, as one of the biggest promoter of digital financial inclusion, is able to use administrative or legal means to force digital inclusive finance to tilt funds to some specific industries and prohibit some industries from financing with the help of digital inclusive finance. This article utilizes the ratio of the government's general budget expenditures to the region's GDP, i.e.,  $\frac{\text{general budget expenditures}}{\text{gross domestic product (GDP) of the region}}$ , to measure the extent of the government's intervention in the economy. A larger ratio indicates a greater degree of government intervention in the economy.

#### Technological Progress:

Technological progress is the process of creating and utilizing new technologies to replace old ones. In China, technological progress optimizes the use of resources through the invention of new processes and products, as well as improved management to increase production efficiency and develop productivity, promote the emergence of new economic growth points. The relationship between digital financial inclusion and technological progress is mainly reflected in the fact that digital inclusive finance can target and support the innovative activities of enterprises and reduce the financial barriers to technological progress. In this paper, we use the innovation level (INV), i.e. the number of active patents in a region, to measure technological progress. A higher number of effective patents indicates more pronounced technological progress.

#### Greening rate:

The greening rate refers to the degree of environmental impact of production and life in a certain region. In China, economically developed regions make enterprises and consumers actively choose energy-saving and less environmentally polluting products or services through market means to increase the greening rate and promote the development of environmental protection industry, which in turn promotes the development of the economy. The connections between digital financial inclusion and the greening rate is mainly reflected in the fact that digital financial inclusion promotes the development of industries such as renewable energy and energy-saving products, which can reduce energy consumption and environmental pollution and increase the greening rate. In this paper, we use urban greening forest coverage (UGC), which is  $\frac{\text{the urban woodland area}}{\text{total urban area}}$ , to measure the greening rate. A larger urban greening forest coverage rate indicates a higher greening rate.

#### Industrial Structure:

Industrial structure (IS) refers to the five-dimensional spatial relationship between production factors within an industry, between industries, in time, space, and hierarchy. In China, the transformation and upgrading of industrial structure can not only enhance the status of enterprises in global value chain, but it can also create added value to products, liberate and develop productive forces, optimize the regional economic structure, and promote economy. Digital inclusive finance can accurately support emerging industries with the help of digital technology, provide sufficient financial support for the burgeoning emerging industries, promote the replacement of old and new industries and the enhancement of product value-added within the region, and realize the

transformation and upgrading of industrial structure. This paper uses the proportion of the secondary industry, i.e.  $\frac{\text{the value of the gross domestic product of the secondary industry in the region}}{\text{the gross domestic product of the region to measure the industrial structure}}$  to measure the industrial structure.

### 3.1.4 Mechanism Variables.

Energy Transformation:

Energy transition refers to the process of energy production and consumption transitioning from traditional energy with high pollution and high carbon emissions to clean energy. Digital inclusive finance uses the "digital dividend" to simplify the financing process and enhance the universality of financing, and in this way support the development of clean energy production and consumption to increase its proportion of total energy consumption, promote energy transition and gradually obtain a flourishing and steady economy. This paper uses the proportion of clean energy natural gas in the energy consumption structure, i.e.  $\frac{\text{total natural gas consumption (billion cubic meters)}}{\text{total energy consumption (tons)}}$  to measure energy transition. A higher proportion indicates a more significant degree of energy transition.

## 3.2 Model Setting

### 3.2.1 Basic regression.

$$ED_{it} = \alpha_0 + \alpha_1 DIF_{it} + \theta X_{it} + \mu_i + \tau_t + \varepsilon_{it}$$

$ED$  represents the level of economic development,  $DIF$  represents digital inclusive finance,  $\theta$  represents the coefficient of control variables,  $X$  represents the set of control variables, which in this paper refers to government intervention, technological progress, greening rate and industrial agglomeration.  $i$  represents the year,  $t$  represents the period,  $\mu$  represents the individual fixed effect,  $\tau$  represents the time fixed effect, and  $\varepsilon$  represents the random error term.  $\alpha_0$  stands for the constant term, and  $\alpha_1$  stands for the marginal effect of digital inclusive finance. financial inclusion marginal effect,  $\alpha_1 > 0$  represents the marginal effect of digital inclusion on economic development is positive, while  $\alpha_1 < 0$  represents the marginal effect of digital financial inclusion on economic development is negative.

### 3.2.2 Moderating effect.

$$ED_{it} = \alpha_0 + \alpha_1 DIF_{it} + \alpha_2 M_{it} + \alpha_3 (DIF \times M)_{it} + \theta X_{it} + \mu_i + \tau_t + \varepsilon_{it}$$

$M$  represents the moderating variable, which refers to energy transition in this paper.  $\alpha_3$  represents the moderating effect, and  $\alpha_2$  is the primary term coefficient of the moderating effect. If both  $\alpha_3$  and  $\alpha_2$  are positive (negative), it represents that the moderating effect strengthens the impact of digital inclusive finance on economic

growth, and if  $\alpha_3$  and  $\alpha_2$  have opposite signs, it represents that the moderating effect weakens the impact of digital inclusive finance on economic growth.

## 4 Results and Discussion

### 4.1 Main effects

**Table 2.** the main effect between digital financial inclusion and economic development

	(1)	(2)	(3)	(4)	(5)	(6)
		Pool ols		time fixed ef- fect	individual fixed effect	time and individual fixed effect
DIFI	0.012*** (0.000)	0.010*** (0.001)	0.010*** (0.001)	0.064*** (0.004)	0.012*** (0.001)	0.045*** (0.005)
GOV		- 7.204*** (1.211)	- 7.204*** (1.211)	-2.514** (1.022)	-6.552*** (1.536)	-2.948** (1.340)
INV		0.077*** (0.013)	0.077*** (0.013)	0.017 (0.011)	0.066*** (0.012)	0.023** (0.011)
UGC		- 0.030*** (0.009)	- 0.030*** (0.009)	- 0.026*** (0.008)	0.027 (0.030)	0.056* (0.029)
IS		-0.018 (0.013)	-0.018 (0.013)	0.006 (0.011)	0.025* (0.013)	0.037*** (0.013)
Time fixed	N	N	N	Y	N	Y
Individual fixed	N	N	N	N	Y	Y
constant term	2.736*** (0.218)	6.390*** (0.917)	6.390*** (0.917)	2.162*** (0.748)	2.115* (1.213)	-1.162 (1.112)
N	270	270	270	270	270	270

Note: \*\*\*, \*\* and \* denote 1%, 5% and 10% significance levels, respectively. Numbers in parentheses are standard deviations of regression coefficients. The following tables have the same settings.

Table 2 demonstrates the main effect between digital financial inclusion and economic development. The results show that digital financial inclusion contributes to economic development. The possible explanation is that digital financial inclusion promotes innovation and entrepreneurship, reduces income disparity, leads to technological advancement and balanced regional development, enhances consumption and employment, and thus economic growth. Regarding the control variables, government intervention plays a significant negative role in economic development, probably because local government fiscal decentralization and local protectionism hinder high-quality economic development (Hou et al., 2023) [43]. Technological progress plays a positive role in economic development, the greening rate of the city does not play a significant role in economic development, and the industrial structure plays an inconsistent role in economic development, mainly as a facilitating role, which is more consistent with the findings of You and Zhang (You and Zhang, 2022) [44].

### 4.2 Moderating effects

**Table 3.** the moderating effect between energy transition and economic growth

	(7)	(8)	(9)	(10)	(11)	(12)
	Pool ols			time fixed ef-	individual fixed ef-	time and individual
				fect	fect	fixed effect
DIFI	0.008*** (0.001)	0.008*** (0.001)	0.030*** (0.004)	0.049*** (0.004)	0.010*** (0.001)	0.008*** (0.001)
Total natural gas consumption(bil- lion cubic meters)	58.293** (24.825)	70.716*** (22.796)	83.690*** (18.138)	59.515*** (17.917)	83.450*** (21.710)	70.716*** (22.796)
DIFET	0.430*** (0.067)	0.401*** (0.063)	0.287*** (0.043)	0.262*** (0.048)	0.376*** (0.050)	0.401*** (0.063)
GOV		-7.676*** (1.028)	-3.067*** (1.100)	-3.895*** (0.912)	-5.453*** (1.243)	-7.676*** (1.028)
INV		0.059*** (0.011)	0.015* (0.009)	0.016* (0.009)	0.043*** (0.010)	0.059*** (0.011)
UGC		-0.033*** (0.008)	-0.059** (0.026)	-0.030*** (0.007)	-0.063** (0.026)	-0.033*** (0.008)
IS		0.011 (0.011)	0.059*** (0.011)	0.024** (0.010)	0.035*** (0.011)	0.011 (0.011)
_cons	2.664*** (0.224)	4.986*** (0.786)	1.784* (0.954)	2.039*** (0.665)	4.103*** (0.993)	4.986*** (0.786)
N	270	270	270	270	270	270

Table 3 shows the moderating effect between energy transition and economic growth. The results of model 7 ( $\alpha_3 = 0.008, p < 0.01, \alpha_3 = 0.430, p < 0.1$ ) show that the sign of  $\alpha_3$  and  $\alpha_2$  are both positive. The results illustrates that the positive role of digital inclusive finance in augmenting economic growth is strengthened under the moderation of energy cleaner transition, which further promotes high-quality economic growth. The possible explanations are that China's energy transition is in a high-speed development stage, which is the main channel for digital finance to exert economic benefits; China's cleaner production gradually becomes an important support and pillar for the role of digital economy in economic development. The promotion effect does not change and the conclusion remains robust before and after adding fixed effects and control variables,

## 5 Conclusions and Recommendations

### 5.1 Conclusion

In the study, we used the method of panel regression to empirically investigate the role of digital financial inclusion on economic growth, with the intention of indicating the pulling effect of digital finance, as a development trend of modern finance, on the high-quality development of the economy. In addition, we incorporate the moderating role

of energy transition into the analytical framework to examine the synergistic impact of digitalization and greening on economic development, which provides a new research perspective. The main conclusions of this paper are as follows:

Digital inclusive finance has a facilitating effect on economic growth. This is specifically manifested in the fact that digital finance may promote innovation and entrepreneurship and narrow the income gap. By promoting innovation and entrepreneurship, digital inclusive finance drives the growth of private investment, provides more jobs for the economy and society, creates new consumption hotspots, promotes the growth of consumption, improves labor productivity, facilitates industrial upgrading, improves the competitive position of enterprises in the international market, and enhances export efficiency. The above factors together drive economic growth. By narrowing the income gap, digital inclusive finance has raised the income of low-income groups and middle-income groups, strengthened the consumption capacity of low-income groups and middle-income groups, and helped weaken the status quo of "siphoning" of production factors such as talent and capital from less developed regions by developed regions, so that the less developed regions can make full use of these factors of production and realize balanced regional development and economic growth. It is also conducive to realizing balanced regional development and high-quality economic growth.

Digital inclusive finance has a "digital dividend" in the field of energy transition, and energy transition optimizes the positive impact of digital financial inclusion on the development of economy. Digital financial inclusion accurately supports clean energy and its supporting industries through its dual features of digitalization and universality, provides sufficient financial support for clean production and consumption, pushes forward the technological progress of related enterprises, promotes the development and growth of related industries, makes the proportion of clean energy consumption in the total energy consumption continue to rise, realizes the energy transition, and further stimulates the development of the upstream and downstream industries as a whole, and promotes the emergence of new jobs and points of economic growth. jobs and economic growth points, improve the overall energy use efficiency, achieve significant competitive advantages in the era of decarbonization, and ultimately achieve high-quality economic growth.

## 5.2 Recommendations

Based on the above findings, this paper puts forward two recommendations: first, the government should give full play to the effect of digital inclusive finance to drive economic growth. Make digital inclusive finance accurately identify credit subjects at the micro level, and provide financial data support for regulators at the macro level. Make digital inclusive finance play the role of promoting innovation and entrepreneurship, expanding employment and increasing labor productivity, while at the same time playing the role of digital financial inclusion in reducing the income inequality, making the development between different regions more balanced, enhancing the consumption capacity of low-income groups and middle-income groups, and promoting economic growth. Secondly, the Government should play an active role in the energy transition,

so that the "digital dividend" can play its role as a financial credit, thereby empowering emerging industries and small and medium-sized enterprises, and utilizing digital inclusive finance to actively promote financing for the energy transition and achieve high-quality economic development.

## References

1. Li Jizun, Reflections on Internet Finance, Management World, Issue 7, pp. 1-7+16, 2015, doi: 10.19744/j.cnki.11-1235/f.2015.07.002.
2. Du Xiaoshan, The Development of Microfinance and the Framework of Inclusive Financial System, China Rural Economy, Issue 8, pp. 70-73+78, 2006.
3. Jiao Jinpu, Sun Tianqi, Huang Tingting and Wang Tiandu, Digital Currency and the Development of Inclusive Finance-Theoretical Framework, International Practice and Regulatory System, Financial Regulation Research, Issue 7, pp. 19-35, 2015, doi: 10.13490/j.cnki.fir.2015.07.002.
4. G. Corrado and L. Corrado, Inclusive finance for inclusive growth and development, *Curr. Opin. Environ. Sustain.* vol. 24, pp. 19-23, February 2017, doi: 10.1016/j.cosust.2017.01.013.
5. P. K. Ozili, Impact of digital finance on financial inclusion and stability, *Borsa Istanbul. Rev.*, Vol. 18, Issue 4, pp. 329-340, December 2018, doi: 10.1016/j.bir.2017.12.003.
6. Feng Guo, Jingyi Wang, Fang Wang, Tao Kong, Xun Zhang and Zhiyun Cheng, "Measuring the development of digital inclusive finance in China: indexing and spatial characterization", *Economics (Quarterly)*, Volume 19, Issue 4, Pages 1401-1418, 2020, doi: 10.13821/j.cnki.ceq.2020.03.12.
7. Xingjian Yi and Li Zhou, "Does the development of digital inclusive finance significantly affect residents' consumption - Micro evidence from Chinese households", *Financial Studies*, Issue 11, pp. 47-67, 2018.
8. Xun Zhang, Guanghua Wan, Jiajia Zhang and Zongyue He, Digital Economy, Financial Inclusion and Inclusive Growth, *Economic Research*, vol. 54, no. 8, pp. 71-86, 2019.
9. Haizhang Qian, Yunqing Tao, Songwei Cao and Yuyang Cao, Theoretical and Empirical Evidence on the Development of Digital Finance and Economic Growth in China, *Research on Quantitative Economics and Technological Economics*, Volume 37, Issue 6, Pages 26-46, 2020, doi: 10.13653/j.cnki.jqte.2020.06.002.
10. C. Agyekumhene, J. R. de Vries, A. van Paassen, P. Macnaghten, M. Schut and A. Bregt, Digital platforms for smallholder credit access: the mediation of trust for cooperation in maize value chain financing', *NJAS - Wagening. j. Life Sci.* vol. 86-87, pp. 77-88, Nov. 2018, doi: 10.1016/j.njas.2018.06.001.
11. B. Yang, F. Ma, W. Deng and Y. Pi, "Digital inclusive finance and rural household subsistence consumption in China", *Econ. Anal. Policy*, vol. 76, pp. 627-642, Dec. 2022, doi: 10.1016/j.eap.2022.09.007. -642, December 2022, doi: 10.1016/j.eap.2022.09.007.
12. J. Wang, "Digital inclusive finance and rural revitalization", *Finance Res. Lett.*, vol. 57, p. 104157, November 2023, doi: 10.1016/j.frl.2023.104157.
13. S. Cao, L. Nie, H. Sun, W. Sun and F. Taghizadeh-Hesary, "Digital finance, green technological innovation and energy-environmental performance. Evidence from China's regional economies," *J. Clean. Prod.* vol. 327, pp. 129458, Dec. 2021, doi: 10.1016/j.jclepro.2021.129458.

14. C.-C. Lee and F. Wang, "How does digital inclusive finance affect carbon intensity?", *Econ. Anal. Policy*, vol. 75, pp. 174-190, September 2022, doi: 10.1016/j.eap.2022.05.010. 10.1016/j.eap.2022.05.010.
15. H. Wang and J. Guo, "Impacts of digital inclusive finance on CO2 emissions from a spatial perspective: Evidence from 272 cities in China", *J. Clean. Prod. ...*, vol. 355, pp. 131618, June 2022, doi: 10.1016/j.jclepro.2022.131618.
16. S. Chen and H. Zhang, "Does digital finance promote manufacturing servitization: Micro evidence from China", *Int. Rev. Econ. Finance*, vol. 76, pp. 856-869, Nov. 2021, doi: 10.1016/j.iref.2021.07.018. -869, November 2021, doi: 10.1016/j.iref.2021.07.018.
17. Y. Du, Q. Wang and J. Zhou, "How does digital inclusive finance affect economic resilience: evidence from 285 cities in China", *Int. Rev. Financ. Anal.* Vol. 88, pp. 102709, July 2023, doi: 10.1016/j.irfa.2023.102709.
18. Tao Zhao, Zhi Zhang and Shangkun Liang, "Digital economy, entrepreneurial activity and high-quality development - Empirical evidence from Chinese cities", *Management World*, Volume 36, Issue 10, Pages 65-76, 2020, doi: 10.19744/j.cnki.11-1235/f.2020.0154.
19. Pan Wenqing, "Regional linkages and spatial spillovers of economic growth in China", *Economic Research*, vol. 47, no. 1, pp. 54-65, 2012.
20. M. B. Moghaddam, "The relationship between oil price changes and economic growth in Canadian provinces: Evidence from a quantile-on-quantile approach", *Energy Econ.* vol. 125, pp. 106789, September 2023, doi: 10.1016/j.eneco.2023.106789.
21. J. Jerónimo, A. Azevedo, P. C. Neves and M. Thompson, Interactions between financial constraints and economic growth, *North Am. J. Econ. Finance*, vol. 67, pp. 101943, July 2023, doi: 10.1016/j.najef.2023.101943.
22. S. K. Ngangnon, "Effect of the duration of membership in the GATT/WTO on economic growth volatility", *Struct. Change Econ. Dyn.* vol. 65, pp. 448-467, June 2023, doi: 10.1016/j.strueco.2023.04.004. -467, June 2023, doi: 10.1016/j.strueco.2023.04.004.
23. R. A. Badeeb, H. H. Lean and J. Clark, The evolution of the natural resource curse thesis: a critical literature survey, *Resour. Policy*, vol. 51, pp. 123 -134, March 2017, doi: 10.1016/j.resourpol.2016.10.015.
24. A. Cieřlik and Ł. Goczek, Control of corruption, international investment, and economic growth - Evidence from panel data, *World Dev.*, vol. 103, pp. 323-335, March 2018, doi: 10.1016/j.worlddev.2017.10.028.
25. M. de Clercq, M. D'Haese and J. Buysse, Economic growth and broadband access: the European urban-rural digital divide, *Telecommun. Policy*, vol. 47, no. 6, pp. 102579, July 2023, doi: 10.1016/j.telpol.2023.102579.
26. O. Ben-Salha, H. Dachraoui and M. Sebri, Natural resource rents and economic growth in the top resource-abundant countries: a PMG estimation, *Resour. Policy*, vol. 74, pp. 101229, Dec. 2021, doi: 10.1016/j.resourpol.2018.07.005.
27. M. Tahir and U. Burki, "Entrepreneurship and economic growth: Evidence from the emerging BRICS economies", *J. Open Innov. Technol. Mark. Complex.*, Issue 2, Page 100088, June 2023, doi: 10.1016/j.joitmc.2023.100088.
28. R. Murdipi, A. Z. Baharumshah and S. H. Law, "Portfolio capital flows and economic growth: do institutional factors matter?", *Res. Int. Bus. Finance*, vol. 66, pp. 102019, October 2023, doi: 10.1016/j.ribaf.2023.102019.
29. A. Haldar, S. Sucharita, D. P. Dash, N. Sethi and P. Chandra Padhan, "The effects of ICT, electricity consumption, innovation and renewable power generation on economic growth: An income level analysis for the emerging economies," *J. Clean. Prod. jclepro.* 2022. 135607.

30. M. Wang, H. Zhang and M. Zhang, "Industrial Structure Servitization, Financial Structure Marketization and Economic Growth - Based on PVAR Model", *Procedia Comput. Sci.* vol. 221, pp. 1432-1439, Jan. 2023, doi: 10.1016/j.procs.2023.08.135.
31. Tian Ge, Huang H. and Zhang X., Digital finance and entrepreneurial quality development: evidence from China, *Financial Studies*, Issue 3, pp. 74-92, 2023.
32. Song Tang, Xuchuan Wu, and Jia Zhu, "Digital Finance and Corporate Technological Innovation - Structural Characteristics, Mechanism Identification, and Differences in Effects under Financial Regulation," *Management World*, vol. 36, no. 5, pp. 52-66+9, 2020, doi: 10.19744/j.cnki.11-1235/f.2020.0069.
33. Gorgeous Xie, Yan Shen, Haoxing Zhang and Feng Guo, "Can digital finance promote entrepreneurship? --Evidence from China", *Economics (Quarterly)*, Volume 17, Issue 4, Pages 1557-1580, 2018, doi: 10.13821/j.cnki.ceq.2018.03.12.
34. X. Wang, "Study on the Financing Difficulties of Small and Micro Enterprises in the "Long Tail" by Internet Finance", *Financial Research*, Vol. 9, pp. 128-139, 2015.
35. J. Wu and L. Wu, "Impacts of digital inclusive finance on household entrepreneurship", *Finance Res. Lett.*, vol. 56, pp. 104114, September 2023, doi: 10.1016/j.frl.2023.104114.
36. Zhou Li, Feng Dawei and Yi Xingjian, "Digital inclusive finance and the urban-rural income gap: 'digital dividend' or 'digital divide'", *The Economist*, issue 5, pp. 99-108, 2020, doi: 10.16158/j.cnki.51-1312/f.2020.05.011.
37. Zhou Li, Jinglin Liao and Hao Zhang, Digital financial inclusion, credit availability and residential poverty alleviation - Micro evidence from a Chinese household survey, *Economic Science*, Issue 1, pp. 145-157, 2021.
38. K. Song, J. Liu and Z. A. Li, "Can Digital Inclusive Finance Reduce the Income Gap between Urban and Rural Counties? --Analyzing the synergistic effect between digital inclusive finance and traditional finance", *China Soft Science*, Issue 6, pp. 133-145, 2022.
39. Qian Huang, Zheng Li, and Deping Xiong, "The poverty reduction effect of digital inclusive finance and its transmission mechanism", *Reform*, Vol. 11, pp. 90-101, 2019.
40. W. Zhu, "Digital financial inclusion and the share of labor income: Firm-level evidence", *Finance Res. Lett.*, vol. 56, pp. 104160, September 2023, doi: 10.1016/j.frl.2023.104160.
41. Y. Wu and S. Huang, "The effects of digital finance and financial constraint on financial performance: firm-level evidence from China's new energy enterprises", *Energy Econ.* vol. 112, pp. 106158, August 2022, doi: 10.1016/j.eneco.2022.106158.
42. G. Li, H. Wu, J. Jiang and Q. Zong, "Digital finance and the low-carbon energy transition (LCET) from the perspective of capital-based technical progress", *Energy Econ.* vol. 120, pp. 106623, April 2023, doi: 10.1016/j.eneco.2023.106623.
43. S. Hou, K. Yu and R. Fei, "How does environmental regulation affect carbon productivity? The role of green technology progress and pollution transfer", *J. Environ. Manage.* vol. 345, pp. 118587, Nov. 2023, doi: 10.1016/j.jenvman.2023.118587.
44. J. You and W. Zhang, "How heterogeneous technological progress promotes industrial structure upgrading and industrial carbon efficiency? from China's industries", *Energy*, vol. 247, pp. 123386, May 2022, doi: 10.1016/j.energy.2022.123386.

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