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How does digital inclusive finance promote the journey of common prosperity in China?

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Abstract: In contrast to previous studies by using provincial data, this paper employs city-level data from 260 prefecture-level cities in China between 2011 and 2020 to explore the underlying mechanism of how digital inclusive finance promotes the realisation of common prosperity in China. In addition, this paper incorporates financial deepening theory, financial exclusion theory, long tail theory, digital divide theory and technology driven theory to examine the proposed research questions. Through the use of system-GMM and IV estimation, the robust estimation results show that common prosperity is composed of development, sharing and sustainability. The high level of the weight of the first-level indicators for development and sharing reflects the importance of “prosperity” and “sharing” in common prosperity. Digital inclusive finance plays a significant role in promoting the development of urban common prosperity, with a more pronounced effect in the Eastern cities when compared to the Central and Western cities. In addition, digital inclusive finance is found to facilitate regional entrepreneurial vitality and, consequently promote urban common prosperity by overcoming the digital divide and by improving the activity of urban innovation and entrepreneurship. Furthermore, the degree of marketisation is suggested to exert a positive role in regulating the impact of digital inclusive finance on common prosperity. Thus, the level of the development of digital inclusive finance is identified as an important path to promote the journey of common prosperity.

Key words: Digital inclusive finance, common prosperity, digital divide, urban innovation and entrepreneurship, IV estimation.

1. Introduction

Common prosperity is the essential requirement of socialism and the common expectation of a better life among people. Through the mitigation of financial and energy poverty, common prosperity bolsters social equality and economic equality, facilitating well-being among people (Xu and Li, 2023). Discussions on how to effectively and substantially promote common prosperity have become the most cutting-edge major theoretical and practical agenda worldwide. Sustainability involves a range of socio-economic aspects, playing a critical role in addressing concerns of poverty, waste generation, and natural resource depletion. However, most countries merely focus on promoting sustainable development, although this is one of the components of common prosperity (Liu et al., 2023). Bella et al. (2016) mention that sustainable development improves societal health and living conditions. Bansal et al. (2022) state that the increasing use of digitalisation and technological advancement affirms the beneficial impacts of natural resources on sustainability. However, the impact of artificial intelligence (AI) on carbon emissions varies across countries, and its carbon reduction effect is mainly reflected in high-carbon emission and high-income countries (Zhong et al., 2023). Recent major shifts in China's development paradigm, emphasising self-reliance through domestic production to meet domestic demand and supported by internal financing, have resulted in a diminished presence of the Chinese economy in international indicators (Stanojević and Zakić, 2023). The primary cause of fluctuations in China's financial market is the uncertainty originating from within the internal market itself (Li and Zhong, 2020). In the report of the 20th National Congress of the Communist Party of China (CPC), it was proposed to promote common prosperity in a pragmatic and realistic way. In recent years, with the wide application of technologies such as AI and blockchain in the financial sector, digital inclusive finance (DIF), which is based on the Internet and financial technology, has gradually integrated into people's everyday life. Through the close integration of digital technology and financial services, digital inclusive finance constantly delivers innovative financial products and services into the market. These products and services effectively reduce transaction costs, improving the management of financial risk in both quality and efficiency, and expanding the scope and depth of financial services provided. Relevant studies reveal that digital finance plays a significant role in promoting economic growth (Kapoor, 2014), reducing the income gap (Chen, 2021; Xiong et al., 2022), eliminating poverty (Wang and Fu, 2022; Lee et al., 2023), improving the level of social security (Wang et al., 2020) and stimulating residents' consumption (Li et al., 2022). However, limited attention are paid to investigate the association between digital inclusive finance and common prosperity in developing countries. Although some scholars in China are paying attention to the relationship between digital inclusive finance and common prosperity (Zhang et al., 2024), their research are largely limited due to data accessibility. The majority of the research only stays at the stage of

exploring provincial-level data, and the underlying mechanisms between digital inclusive finance and common prosperity still need to be further explored. To bridge this research gap, this paper uses city-level data from 260 prefecture-level cities in China between 2011 and 2020 to explore the association between digital inclusive finance and common prosperity.

Our research makes the following novelties. First, using the prefecture-level city data, the entropy method and principal component analysis method were used to construct the common prosperity indicators, including 3 first-level indicators, 7 second-level indicators and 19 specific indicators. This represents an innovative approach to constructing common prosperity indicators using data from prefecture-level cities, providing a valuable reference for other research. The results show that common prosperity is composed of three dimensions (development, sharing and sustainability). The weight of the first-level indicators of development and sharing is high, reflecting the importance of “prosperity” and “sharing” in common prosperity. The level of urban common prosperity in China has shown a strong increase year by year, with the exception of a slowdown in growth in 2020 due to the pandemic. Beijing and Shanghai and Zhejiang are at the forefront of achieving common prosperity among all cities, with cities in Hebei experiencing the most rapid progress, followed by cities in Hunan, Tianjin and Zhejiang.

Second, we used the two-step system-GMM and IV estimations to resolve the endogeneity problem between digital inclusive finance and common prosperity, this is an innovative application of econometric modelling, making a significant contribution to methodological design. Research findings evidence that digital inclusive finance and its three sub-dimensions have significantly promoted the development of urban common prosperity. Among them, the coverage and depth of use play a greater role, while the degree of digitalisation needs to be improved. Digital inclusive finance is found to significantly promote the development of common prosperity in different regions, with the effect in Eastern China being greater than in the Central and Western regions.

Third, we incorporated financial deepening theory, financial exclusion theory, long tail theory, digital divide theory and financial innovation theory to verify the proposed underlying mechanisms. For instance, factors such as the digital divide, innovation and entrepreneurship activity have been employed to investigate the pathway of digital inclusive finance to enhance common prosperity. It differs from the previous studies that the construction of theoretical frameworks and investigation of underlying mechanisms such as financing constraints are normally neglected. We found that digital inclusive finance can stimulate regional entrepreneurial vitality by overcoming the digital gap and improving the activity of urban innovation and entrepreneurship, thus promoting urban common prosperity. This is an innovation in theory and mechanism.

Finally, we also explored some regulatory effects in our model. The degree of marketisation is found to play a positive role in regulating the impact of digital inclusive finance on common prosperity. This research provides a valuable extension in digital inclusive finance duties, offering actionable insights and suggestions, for related government departments. Furthermore, it directs a

path for other countries pursuing a higher level of common prosperity, beyond merely achieving sustainable development.

The rest of this paper is structured as follows. Section 2 provides a review of the literature. Section 3 establishes the theoretical framework and proposes the research hypothesis. Section 4 details the data and methodology. Section 5 reports the empirical results, section 6 offers in-depth discussions and the last section concludes the paper.

2. Literature Review

2.1 Overview of digital inclusive finance and common prosperity's concept

The concept of digital inclusive finance originated in the United States. During that period, the financial model of providing financial services and financial markets using electronic communication technology and computing technology was collectively referred to as electronic finance (e-finance). Ozili (2018) defines digital inclusive finance as a series of financial services provided through mobile terminals, personal computers, the Internet and other forms of digital technologies. Huang and Huang (2018) point out that digital inclusive finance represents an innovative financial business model for traditional financial institutions and Internet enterprises, utilising digital technology to achieve investment, financing, payment, lending and other emerging forms of financial business. This innovation specifically emphasises the dual attributes of technology and finance. To sum up, digital inclusive finance is an emerging financial service that integrates digital technologies such as mobile Internet, big data, artificial intelligence, cloud computing, blockchain and other digital technologies with traditional financial service models.

Common prosperity is the fundamental requirement of socialism, acting as a concentrated expression of the superiority of the socialist system. It emphasizes not just achieving economic growth but also ensuring that people can benefit from the achievements of sustainable development (Liu et al., 2023). There are varied views on the measurement of common prosperity indicators. Liu et al. (2021a) highlight that common prosperity entails shared prosperity through collective efforts, necessitating the collective participation of the people. Chen et al. (2021) take development, sharing and sustainability as the three evaluation dimensions within the common prosperity index model. Zhang et al. (2022) develop a micro-level indicator system based on three dimensions: material prosperity, spiritual prosperity and social sharing.

2.2 Determinants of common prosperity

The realisation of common prosperity depends on the collaboration of multiple factors. The rise in GDP and financial markets correlates with a deterioration in common prosperity across Chinese provinces (Xu and Li, 2023). In contrast to the widely held perception that large cities are growth-inducing, for most countries, relatively small cities with a population of up to 3 million are more conducive to economic growth (Frick and Rodríguez-Pose, 2018). In addition, government initiatives can stabilise the economy and stimulate business activities (Lam, 2000). Adjustment in the industry structure is also seen as an important vehicle to bolster the development of the economy

and environment (Zhu and Zhang, 2021). Different forms of economic openness deliver distinct effects on economic growth (Gräbner et al., 2021). Eradicating energy poverty has a notable positive impact on common prosperity in China, generating an indirect effect on common prosperity through the improvement of labour productivity (Dong et al., 2023). Liu et al. (2023) find that the low-carbon energy transition significantly promotes common prosperity, which also imposes an indirect impact on common prosperity through gross fixed capital, labour productivity, and industrial structure.

However, there are limited studies on the relationship between digital inclusive finance and common prosperity. Few scholars have employed empirical investigations to explore the relationship between digital inclusive finance and common prosperity. For example, Liu et al. (2021b) explore the effect and path of digital inclusive finance on common prosperity based on China's provincial panel data from 2013 to 2020. Their empirical findings indicate that digital inclusive finance can significantly promote common prosperity through the mechanism of alleviating financing constraint and stimulating economic growth. Moreover, they also observe that digital inclusive finance has evident effects on common prosperity by increasing income and reducing inequality. Zhang et al. (2024) also capture the positive relationship between digital inclusive finance and common prosperity by using China's provincial panel data. Three channels are identified to evidence the impact of digital inclusive finance on common prosperity: by promoting individual entrepreneurship, stimulating employment and facilitating Internet finance. In a study using the panel data of 31 provinces in China, it was found that the level of regional innovation also plays a partial mediating role in promoting common prosperity through digital inclusive finance (Zhao and Jiao, 2024).

2.3 The economic and welfare effects of digital inclusive finance

Current studies mainly explore the economic and welfare effects of digital inclusive finance at the macro, corporate, and individual levels. At the macro level, studies have found that digital inclusive finance can promote economic growth, reduce income inequality, alleviate poverty, drive rural revitalisation, improve the level of social security and foster regional green innovation. For example, Kapoor (2014) finds that digital inclusive finance can promote economic growth in India, the findings have also been verified by a study conducted in China (Zhang and Yu, 2021). In addition, the development of digital inclusive finance can help to narrow the income inequalities between urban and rural areas (Xiong et al., 2022), thereby making a substantial contribution to poverty reduction. It is suggested to have a more pronounced impact on poverty reduction than traditional inclusive finance (Lee et al., 2023). From the perspective of social security, an analysis of China's urban panel data by Wang et al. (2020) reveals that digital inclusive finance significantly improves the level of social security, primarily through fostering income generation and employment. Besides, digital inclusive finance is identified as having a substantial impact in improving the level of regional green innovation. The improvement in the level of regional green financial services delivers the main mechanism, however, the intermediary role of industrial

structure optimisation and upgrading fails to pass the test (Meng and Zhang, 2022). A higher level of financialisation is believed to be an efficient allocation mechanism for green development and innovation (Yahya and Lee, 2023; Lee and Nie, 2023).

From the point of view of firm performance, digital inclusive finance also retains some notable impacts. For instance, beyond the positive impact of corporate social responsibility on corporate reputation and financial performance (Jing et al., 2023), digital finance contributes to firm performance through the resource effect and governance effect. It reduces corporate financial risk by alleviating corporate financing constraints and reducing inefficient investment (Dai and Zhang, 2023), thus enhancing corporate financing efficiency (Chang et al., 2021). Inevitably, digital finance is tied up with more concentrated debt structures within firms. When evaluating the sub-indices of digital finance, it is evident that the broad coverage and wide usage of digital finance result in a higher concentration of debt among firms, while the degree of digitisation is not a central concern for these firms. The link between digital finance and debt concentration intensifies for companies facing high levels of information asymmetry and elevated default risk (Chen and Li, 2023). Xiong et al. (2023) believe that digital inclusive finance enhances a company's R&D innovation, and also indirectly contributes to economic growth and innovative development by boosting residents' disposable income, increasing fiscal expenditure and encouraging educational achievements (Wang et al., 2023).

When looking at the impact of digital inclusive finance on individual's consumption, Li et al. (2020) evidence that digital inclusive finance boosts residents' consumption by approaches such as expanding investment channels, increasing disposable income, and enhancing security. This positive effect on residents' consumption has been confirmed by subsequent research (Li et al., 2022).

2.4 Summary

To sum up, existing studies have adopted different approaches to measuring digital inclusive finance and common prosperity, as a result, a consensus measurement standard has not been established. Currently, studies on the relationship between digital inclusive finance and common prosperity predominately remain at the theoretical level, and only a few studies use empirical analysis to investigate the dynamic mechanism of how digital inclusive finance promotes common prosperity. Moreover, the majority of these studies are limited to using provincial-level data in China, potentially rising estimation issues as a result of small samples. Consequently, this study uses prefecture-level city data to bridge the literature and methodological gap. It examines the impact of digital inclusive finance on common prosperity through the employment of the system-GMM and IV estimation, further exploring the underlying mechanism between digital inclusive finance and common prosperity.

3 Theoretical framework and research hypothesis

Our theoretical framework is presented in Figure 1, illustrating the relationship between digital inclusive finance and common prosperity.

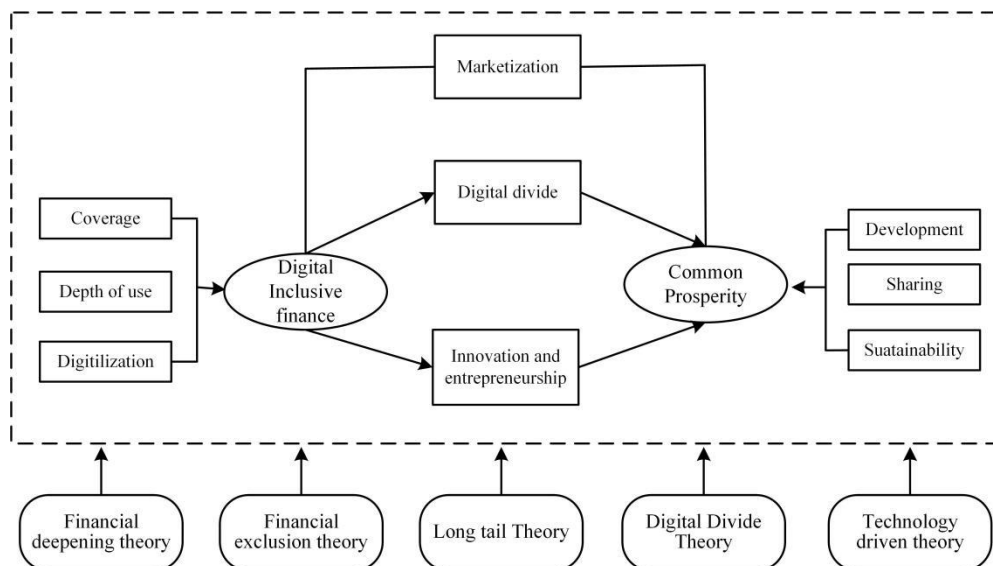


Figure 1 The theoretical framework (source: Author's illustration)

Financial deepening theory suggests that financial development is a very important tool for promoting economic growth. Digital inclusive finance is the result of the continuous integration between advanced technology and traditional inclusive finance, serving as a tangible indication of financial deepening. The service model of traditional finance has been subsequently improved and innovated, enabling individuals previously excluded from financial services now to participate in benefiting from the outcomes of financial development. This shift delivers a positive impact on common prosperity.

Financial exclusion refers to the existence where certain groups in the economy and society who are excluded from the financial system due to a lack of normal access or methods to access financial services. The majority of individuals in these groups are low-income or disadvantaged households. Financial exclusion leads to their inability to allocate financial resources effectively, thereby widening the gap between the rich and the poor. This further creates a detrimental cycle that exaggerates societal polarisation, contracting the fundamental principle of common prosperity. With the application of big data, blockchain and other technologies, digital inclusive finance has reduced the service threshold, improved the capabilities and quality of financial service, and better addressed the financial requirements of residents. In addition, the application of digital technology enables digital inclusive finance to transcend geographical barriers and fosters the sustained development of inclusive finance. The approach has significantly alleviated the issues of financial exclusion, meeting the financing requirements of low-income and other disadvantaged groups. Consequently, it helps to narrow the income gap among residents, paving the journey to common prosperity.

The development of digital inclusive finance incorporates the principles of the long tail theory into two aspects: Firstly, it strategically targets the tail-end customers in the market, integrating those traditionally underserved, reflecting the inclusiveness of digital inclusive finance. This progress has also considerably diminished the cost associated with information search and processing, enabling a growing number of groups to access digital inclusive financial services at a

reduced cost. Secondly, digital inclusive finance prioritises the financial demands of long-tail customers, offering innovative, diversified and distinctive digital financial products and services, motivating these populations towards common prosperity.

Digital inclusive finance and common prosperity are inherently interconnected, each reinforcing the other's objectives. Digital inclusive finance delivers the principle of "widespread accessibility", aiming to extend its coverage and provide efficient, convenient and cost-efficient financial support to underserved groups while effectively reducing credit risks (Wu et al., 2021). This approach is in line with the fundamental concept of "common" in common prosperity. Secondly, the "benefit" of digital inclusive finance means benefiting the people. Digital inclusive finance not only uses digital technology to alleviate information asymmetry, but also expands the boundaries of financial services. The "trickle-down effect" enables low-income groups to participate in benefiting the growth dividend, realising the concept of "equality and enhancing societal welfare", which aligns perfectly with "prosperity". By utilising digital tools, digital inclusive finance accelerates the development of inclusive business, facilitates access to financing for households, increases residents' educational opportunities and satisfies their consumption needs (Khaki and Sangmi, 2017). This approach promotes social equality, enabling a large group of people to benefit from economic and social development, improving the living standards, and accelerating progress towards achieving common prosperity.

Given the emergent phase of digital inclusive finance in China, it presents substantial prospects for further growth. Meanwhile, affected by social, economic and other factors, the extent of development varies across different dimensions. For instance, certain analyses may focus on the "horizontal" scale of financial services or products, highlighting the significance of inclusivity in digital finance. Conversely, the depth of service usage is more prominently reflected in the "vertical" dimension, reflecting residents' actual utilisation of financial services. The degree of digitalisation is to measure the convenience and efficiency of the financial services provided by digital inclusive finance. Variations in coverage, depth of utilisation and levels of digitalisation ultimately contribute a profound impact on the economy and society. Based on the above analysis, we propose the following hypothesis for further examination.

H1: Digital inclusive finance contribute to common prosperity, with varying impacts on common prosperity deriving from its distinct dimensions.

The term "digital divide" refers to the discrepancy in the capacity of individuals from different countries, regions, or societies to make use of information technology, this disparity originates from the rapid development of information and communication technology. Meanwhile, variances in comprehension and accessibility to digital technology, will result in an information gap or wealth gap (Van Dijk, 2006). With the composite attributes encompassing technology, economy, knowledge, society, and the digital divide can exacerbate income and consumption disparities among residents, further accelerating the polarisation between the rich and the poor. This is considered to be harmful for economic development, and substantially hindering the process of

common prosperity. Factors such as economic imbalances, disparities in information infrastructure and gaps in information literacy education are crucially important in generating the digital divide (van Deursen and van Dijk, 2019).

The interconnection between the digital divide and digital inclusive finance is significant. First, the existence of the digital divide may hinder the effectiveness of digital inclusive finance, potentially leading to financial exclusion, and thereby undermining the development of digital inclusive finance. Digital inclusive finance offers accessibility and opportunities to those who are at the margins of the digital divide, offering resources to disadvantaged groups, thus impeding poverty risks (He et al., 2020). Furthermore, the development of digital inclusive finance helps to alleviate the negative effects of the digital divide and curbs its further expansion, enhancing the income distribution among residents, and boosting consumer consumption, which in turn contributes to the realisation of common prosperity. Therefore, eliminating the digital divide improves the effectiveness of digital inclusive finance and expands its coverage to underserved populations. Conversely, the development of digital inclusive finance can limit the expansion of the digital divide and its negative impact, creating a positive cycle that supports to development of digital inclusive finance. This cycle plays a significant role in promoting the realisation of the goal of common prosperity. On this basis, we propose the hypothesis 2.

H2: Digital inclusive finance can promote common prosperity by curbing the digital divide.

The technology-driven theory believes that technological change and progress are the main driving forces for social development. Innovation is the source of wealth creation and plays an important strategic role in fostering common prosperity in China. Entrepreneurial activities among residents directly influence the development of the private sector and play an important role in advancing high-quality economic development. Achieving economic modernisation requires a concentrated effort to boost the real economy through continuous innovation and entrepreneurship. This approach not only empowers the development of the real economy, but also optimises the economic structure, facilitates efficient distribution of resources, and supports the development towards common prosperity.

The purpose of financial development is to create a supportive business environment for the real economy. Financial development facilitates innovative activities by relaxing credit constraints on the capital flow of the most productive projects (Chowdhury and Maung, 2012; Amore et al., 2013; Hsu et al., 2014). An insufficient supply of financial products or services will obstruct residents' innovation and entrepreneurial activities, impeding the development of the real economy. In the early stage of financial development, disadvantaged groups such as residents in underdeveloped areas or low-income groups may face financial exclusion, struggling to obtain the necessary funding to maintain innovation and entrepreneurship. This situation weakens economic dynamics and exacerbates income gaps. Digital inclusive finance, characterised by its efficiency and equity, can drive the development of traditional inclusive finance. Additionally, it can intensify

banking competition (Yin et al., 2019), which further enhances corporate innovation through resource reallocation (Moll, 2014). By broadening the scope of financial services and enhancing their accessibility, digital inclusive finance also reduces financing costs, establishes an equitable opportunity for development and creates a platform for innovative and entrepreneurial activities among residents (Li and Li, 2022). Digital inclusive finance promote entrepreneurship through three mechanisms: increasing government infrastructure investment, stimulating consumer consumption and motivating enterprise innovation (Gao et al., 2022). On the one hand, financial innovation continuously generates inclusive financial products or services, expanding the breadth and depth of financial inclusion, thus bringing a growing number of groups to meet their needs. In this process, underdeveloped regions and disadvantaged groups can benefit from the outcome of the financial innovation, stimulating their entrepreneurial spirits. This approach not only narrows regional and group income disparities, but also improves the overall prosperity of residents, thereby empowering common prosperity. Furthermore, innovation produces a growing number of high-income employment opportunities, expanding the market participant base. Theoretically, the growing trend of involvement in innovation indicates an improvement in the overall income level of the population. This contributes to the overall prosperity of the people, boosting social wealth, and thus promoting common prosperity. Therefore, we propose hypothesis 3.

H3: Digital inclusive finance can promote the development of common prosperity by promoting the innovation and entrepreneurship in various regions.

The disparity and insufficiency in China's economy and social development have seriously posed obstacles to the journey of common prosperity. Developed regions located in the Eastern, benefiting from its advantages for economic development, a well-established financial system, and a comprehensive digital infrastructure. They develop a relatively advanced level of digital inclusive finance, providing wide accessibility of financial products or services for the majority of the people. However, compared with the Eastern region, developments in the Central and Western regions relatively lag behind, with economies still heavily relying on resource extraction and heavy industry. This reliance seriously hinders the principles of low-carbon, environmental protection and sustainability, impeding economic progression. Additionally, these regions are suffering from the underdevelopment of digital infrastructure and the challenge of attracting skills professional, resulting in sluggish development in digital inclusive finance, and limited availability of financial products or services for local communities.

It can be seen that China's digital inclusive finance has significant regional heterogeneity and has different effects across different regions. Therefore, it is necessary to explore whether there is regional heterogeneity in digital inclusive finance for promoting the development of common prosperity. This investigation aims to provide insights into the proposal of regional differentiation policies. Accordingly, we propose the following hypothesis.

H4: The impact of digital inclusive finance on common prosperity varies across different regions, indicating regional heterogeneity.

Factors such as the external institutional environment of finance influence the efficiency of capital allocation. As a form of financial innovation, digital inclusive finance essentially is the financing for funds, and its role will inevitably be affected by these factors. The degree of marketisation is an important indicator to measure the external financial system environment and other factors, encompassing elements such as government and market interaction, the non-state-owned economy, product and factor market, market intermediary organisations and the legal framework (Bridgman et al., 2018). A higher degree of marketisation in the region typically enhances the economic effect of digital inclusive financial services (Liu et al., 2021b). Through the reform of marketisation, it not only improves the market environment and the allocation efficiency of funds, but also contributes to the development of the regional real economy, positively stimulating local residents' income growth. China's development experience also shows that the market-oriented reform has liberated and advanced the productive forces, not only improving the material prosperity of the Chinese people, but also improving the well-being of residents. Based on this understanding, we propose hypothesis 5.

H5: The degree of marketisation can play a positive role in the relationship between digital inclusive finance and common prosperity.

4 Data and methodology

4.1 Data and variables

We employ prefecture-level city data from 260 cities in China. Data on urban characteristics and common prosperity is mainly obtained from the China Urban Statistical Yearbook, the Provincial and Municipal Statistical Yearbooks and the official websites of National Statistical Bureaus. Due to data availability, the following provincial administrative regions are excluded from our data sample: Taiwan, Jilin, Tibet Autonomous Region, Xinjiang Uygur Autonomous Region and Hong Kong and Macao Special Administrative Regions. Additionally, the following prefecture-level cities are not included in our research: Heilongjiang Province, Guangdong Province, Hainan Province, Guizhou Province, Qinghai Province and Guangxi Zhuang Autonomous Region. The digital inclusive financial index are collected from the Digital Finance Research Centre of Peking University. After matching various data and clearing missing values, a total sample of 2600 datasets are constructed spanning the period between 2011 and 2020.

Common prosperity. With the emergence of the concept of common prosperity, many scholars have started to pay attention to measuring and quantifying its level of development. Grounded in a thorough comprehension of the theoretical underpinnings of common prosperity, they have developed a various system of evaluation index. Aligning with the methods proposed by Chen et al. (2021), and integrating with the theoretical framework of common prosperity and the methodological approach of constructing the indicators, we propose a comprehensive evaluation indicator system of common prosperity indicators. Our approach covers 3 first-level indicators

(development, sharing and sustainability), 7 second-level indicators and 19 specific indicators (see Table 1).

We derive the corresponding index by performing entropy weight dimensionality reduction to the data, after the inversion and standardisation processing. The processing is as follows:

① Data standardisation processing: For positive indicator

$$y_{ijt} = \frac{x_{ijt} - x_{\min}}{x_{\max} - x_{\min}} \quad (1)$$

For negative indicator

$$y_{ijt} = \frac{x_{\max} - x_{ijt}}{x_{\max} - x_{\min}} \quad (2)$$

Among them, x_{ijt} represents the indicator value of the j -th variable in the i -th region in the t -th year, x_{\max} represents the maximum value of the j -th variable, x_{\min} represents the minimum value of the j -th variable, and y_{ijt} represents the standardized value. In addition, if $x_{ijt} = 0$, it requires conversion to 0.0001 to ensure its non-negativity, and after standardisation, the decision matrix $Y = (y_{ij})_{m \times k}$ can be obtained.

② Calculate the proportion of the j -th indicator value in the i -th year

$$P_{ijt} = x_{ijt} / \sum_i \sum_t x'_{ijt} \quad (0 \leq P_{i,j,t} \leq 1) \quad (3)$$

③ Calculate the information entropy of the j -th indicator

$$e_j = -k \sum_i \sum_t P_{ijt} \ln P_{ijt} \quad (4)$$

k is a constant, $k = 1/\ln n$.

④ Calculate the information entropy redundancy of the j -th indicator

$$d_j = 1 - e_j \quad (5)$$

⑤ Calculate the weight of the j -th indicator

$$w_j = d_j / \sum_j d_j \quad (6)$$

⑥ Conduct a comprehensive evaluation to obtain a comprehensive score

$$Cp_{it} = \sum_j w_j * P_{ijt} \quad (7)$$

Among them, Cp_{it} is the level of common prosperity and development in various regions.

Table 1 Index evaluation system of common prosperity

Level 1 indicators	Level 2 indicators	Special indicators	Indicator attribute	Weight

Development 37.64%	Material prosperity 20.98%	Residents' income level	Per capita disposable income of urban residents (yuan)	4.18%
			Per capita disposable income of rural residents (yuan)	4.18%
		Residents' consumption level	Per capita consumption expenditure of urban residents (yuan)	4.17%
			Per capita consumption expenditure of rural residents (yuan)	4.17%
		Consumption structure	Engel's coefficient	4.27%
	Spiritual prosperity 8.23%	Cultural and entertainment industry development	Proportion of employed people in cultural and entertainment industry (%)	4.22%
		Cultural resources	Public library collection per capita (volume)	4.01%
	Wealth growth 8.44%	Economic growth	GDP growth rate (%)	4.28%
		Output efficiency	Total factor productivity	4.16%
	Sharing 0.34	Coordination and balance 12.80%	Urban-rural income gap	Ratio of urban and rural per capita disposable income
Urban-rural consumption gap			Ratio of urban and rural per capita consumption expenditure	4.28%
Urbanisation level			Urbanisation rate of permanent population (%)	4.24%
Basic guarantee 0.21		Education	Education expenditure intensity (%)	4.19%
		Medical care	Number of professional (assistant) physicians per 10000 persons (persons)	4.21%
		Social security	Number of basic endowment insurance participants per 100 persons (persons)	4.11%
		Housing	Ratio of housing price to employee salary	4.29%
		Transportation	Highway mileage per unit area (km)	4.19%
		Sustainability 28.57%	Sustained development 20.24%	Innovation driven
Green patent applications per 10000 people (piece)	3.71%			
Number of ordinary college students and above per 10000 people (person)	3.93%			
Energy conservation and environmental protection	Energy consumption per unit GDP (ton of standard coal/10000 yuan)			4.29%
	Environmental pollution index			4.28%
Continuous sharing 8.33%	Social stability		Registered urban unemployment rate (%)	4.28%
	Financial stability		Per capita financial income (10000 yuan)	4.04%

Digital inclusive finance. We select the 2011-2020 digital inclusive finance index released by Peking University to measure the development level of digital inclusive finance in various regions. The index encompasses three dimensions: coverage, depth of use and digitalisation, with a total of

33 specific indicators¹. To eliminate the influences of dimensions, this paper employs a method of subtracting 100 from the overall index and its three dimensions. This index examines the actual output of regional enterprises' innovation and entrepreneurship. The data covers the whole industry and full-scale enterprises in mainland China, particularly focusing on small, medium-sized and micro enterprises with high entrepreneurial activity, as well as start-up enterprises. It also integrates data from multiple areas, including technology, demographics and investment. The multi-dimensional data reflects different aspects of innovation and entrepreneurship.

Digital divide. Following the previous studies (Song and Liu, 2013; He et al., 2022), we select the number of broadband Internet access users per 100 people, the share of employment in the computer software and services industry, and the per capital volume of telecommunications business, and the number of mobile phone users per 100 people as sub-indicators, using the entropy method to calculate the degree of the digital divide in each region. The digital divide index is scaled between 0 and 1, functioning as an inverse indicator, necessitating a reverse adjustment of the index for analysis.

Innovation and entrepreneurship activity. Due to data constraints, this is restricted to accessing data on innovation and entrepreneurship activity from the years 2011 to 2019. Following Zhang (2019), we use China's regional innovation and entrepreneurship index (2011-2019) to construct this index. This entrepreneurship index is a set of indicators that objectively represent the levels of innovation and entrepreneurship activities at the urban level in China. This index is led by the Enterprise Big Data Research Centre of Peking University and jointly developed by the National Development Research Institute of Peking University and the Longxin Data Research Institute.

Marketisation. According to Bridgman et al. (2018), the market index is calculated by the weighting method, including five sub indicators: the relationship between the government and the market, the development of the non-state-owned economy, the development of the product market, the development of the factor market, the development of the market intermediary organisation and the legal framework environment.

Control variables. Drawing on the methodology of several studies (Liu et al., 2021b; Chen et al. 2021; Zhang et al., 2022) and considering the data availability, we have identified government intervention, industrial structure, openness, traditional financial development level and city size as control variables. Detailed explanation and the specific calculation for each variable are shown in Table 2.

Table 2 The Variables and their calculation method

Variable type	Variable	Symbol	Calculation method
Dependent variable	Common prosperity	Cp	Build an evaluation system and calculate it by entropy method
	Development	Develop	
	Sharing	Cp_share	

¹Due to space limitations, interested readers can request specific indicators from the author.

	Sustainability	Cp_sus	
Independent variable	Digital inclusive finance	Dif	Peking University Digital Inclusive Finance Index
	Coverage	Cover	
	Depth of use	Depth	
	Digital degree	Digital	
Control variable	Government intervention	Gov	Financial expenditure/regional GDP
	Industrial structure	Is	Ratio of added value of secondary and tertiary industries
	Openness	Open	Total regional imports and exports/regional GDP
	Traditional financial level	Fin	Total deposits and loans of financial institutions at the end of the year/regional GDP
	City size	Pop	The logarithm of permanent residents at the end of the year
Intermediary variable	Digital divide	Divide	Regional digital divide index
	Innovation and entrepreneurship	Entre	China's regional innovation and entrepreneurship index
Regulating variable	Marketisation degree	Market	Marketisation index

Table 3 shows the descriptive statistics of variables. The detailed presentation of the concept of common prosperity and the present of China's common prosperity level, these discussions are addressed in section 5.1 "The measurement and analysis of common prosperity in China".

Table 3 The descriptive statistics of variables

Variable type	Variable	Obs	Mean	SD	Min	Max
Dependent variable	Cp	2600	0.395	0.0533	0.277	0.625
Independent variable	Difi	2,600	1.755	0.685	0.170	3.345
	Cover	2,600	1.662	0.674	0.019	3.265
	Depth	2,600	1.731	0.701	0.043	3.497
	Digital	2,600	2.107	0.828	0.034	5.812
Control variable	Gov	2,600	0.200	0.101	0.059	0.915
	Is	2,600	1.003	0.556	0.204	5.348
	Open	2,600	0.177	0.277	0.000	2.491
	Pop	2,600	2.570	0.294	1.368	3.506
	Fin	2,600	2.475	1.169	0.732	12.506
Mechanism variable	Entre	2,304	53.902	27.336	1.365	99.659
	Divide	2600	0.074	0.0529	0.007	0.477
Regulating variable	Market	2600	11.94	2.305	4.960	19.69

4.2 Methodology

First, we build the linear regression model of the balanced panel as follows:

$$Cp_{it} = \alpha_0 + \beta_1 Difi_{it} + \sum_{j=2}^n \beta_j X_{it} + \varepsilon_{it} \quad (8)$$

Among them, i represents the prefecture level, t represents year, Cp_{it} represents common prosperity. $Difi_{it}$ is digital inclusive finance, including coverage ($Cover_{it}$), depth of use ($Depth_{it}$) and digital degree ($Digital_{it}$). X_{it} is the set of control variables, including the degree of government intervention (Gov_{it}), industrial structure (Is_{it}), the level of openness ($Open_{it}$), development level of traditional finance (Fin_{it}), city size (Pop_{it}). α_0 is a constant term, β_1 and β_j are the coefficients, ε_{it} is the random error term.

Given the model outlined in equation (8), we employ a balanced panel dataset with 2600 observations for conducting an ordinary panel regression. Subsequently, we conduct both the F-test and the Hausman test to evaluate the model specification and validity. Drawing on the methodology of existing research (Zhang et al., 2024) and considering the novelty of our dataset, we control both individual and time effects by employing a fixed effect model. Specifically, we implement a two-way fixed effect model to examine the impact of digital inclusive finance on urban common prosperity. The model is constructed as follows:

$$Cp_{it} = \alpha_0 + \beta_1 Difi_{it} + \sum_{j=2}^n \beta_j X_{it} + u_i + \tau_t + \varepsilon_{it} \quad (9)$$

u_i and τ_t are individual fixed effect and time fixed effect, the other variables remained the same as introduced in model (8).

However, considering the potential reverse causality between digital inclusive finance and common prosperity, as well as the possibility of omitted variables with the model, we further adopt system-GMM estimation model and IV estimation model to obtain the consistent results. The system-GMM method is particularly advantageous as it integrates the horizontal GMM with the differential GMM, thereby improving the estimation efficiency while addressing the limitations associated with the weak instrumental variable in the differential GMM. Consequently, this paper employs the two-step system-GMM estimation method, and the model specification is as follows:

$$Cp_{it} = \alpha_0 + \beta_1 Cp_{it-1} + \beta_2 Difi_{it} + \sum_{j=3}^n \beta_j X_{it} + u_i + \tau_t + \varepsilon_{it} \quad (10)$$

Among them, Cp_{it-1} represents the lag period of common prosperity. The other variables remaining consistent with those specified in model (9).

IV estimation model is designed as follows:

$$Difi_{it} = \mu_0 + \mu_1 IV + \sum_{j=2}^n \mu_j Control_{it} + \sigma_{it} \quad (11)$$

$$Cp_{it} = \alpha_0 + \beta_1 \widehat{Difi}_{it} + \sum_{j=3}^n \beta_j X_{it} + u_i + \tau_t + \varepsilon_{it} \quad (12)$$

Following previous studies (Nunn and Nancy, 2014; Zou and Deng, 2022), we introduce the interaction term between the spherical distance from each city to Hangzhou and the year is used as

an instrumental variable for digital inclusive finance. Given Hangzhou is the first city introducing the digital economy in China, its influence on the development level of digital inclusive finance can be measured by its spherical distance from it (Zhang et al., 2020). However, it needs to be noticed that the distance should not impact common prosperity. In addition, the introduction of an interaction term allows the instrumental variable to vary over time. Therefore, this instrumental variable meets the requirements and verifications.

According to the theoretical discussions, digital inclusive finance may affect the development level of common prosperity by enhancing regional innovation and entrepreneurship activity and reducing the digital divide. In order to test the validity of the transmission mechanisms, in line with the methodological approach proposed by Jiang (2022), we use the mechanism test model and choose innovation and entrepreneurship activity, and digital divide as the mechanism variables. Subsequently, we construct an interactive term model further to verify the moderating effect of the level of marketisation.

5 Empirical results and robustness check

5.1 The measurement and analysis of common prosperity in China

5.1.1 Analysis of the development level of common prosperity at the aggregate level

First of all, we analyse the trajectory of the composite index of common prosperity and its three sub-dimensions at the aggregate level over the years (see Figure 2). From the perspective of the total score of common prosperity, there has been a notable improvement in the level of common prosperity in China during the observation period, increasing from 0.34 in 2011 to 0.45 in 2020, making a growth rate of 31.45%. This progress prevails a year-on-year growth trend, with an average annual growth rate of about 3.09%. Among them, the level of common prosperity in 2020 experienced the smallest growth compared to previous years, with a year-on-year growth of about 2%. This slowdown may be attributed to the economic pressure induced by the epidemic situation, thus slowing the pace of common prosperity.

Based on the scores of the three sub-dimensions of common prosperity, the indicators of development, sharing and sustainability have all achieved higher scores from 2011 to 2020. Notably, the development indicators exhibited the most substantial growth rate, with an average annual growth rate of 5.08%. This progress shows a strong and clear upward trend, serving as the primary driving force of the total score of common prosperity. Conversely, the indicators of sharing and sustainability present relatively slower growth, with an average annual growth rate of only 1.34% and 1.46%, respectively.

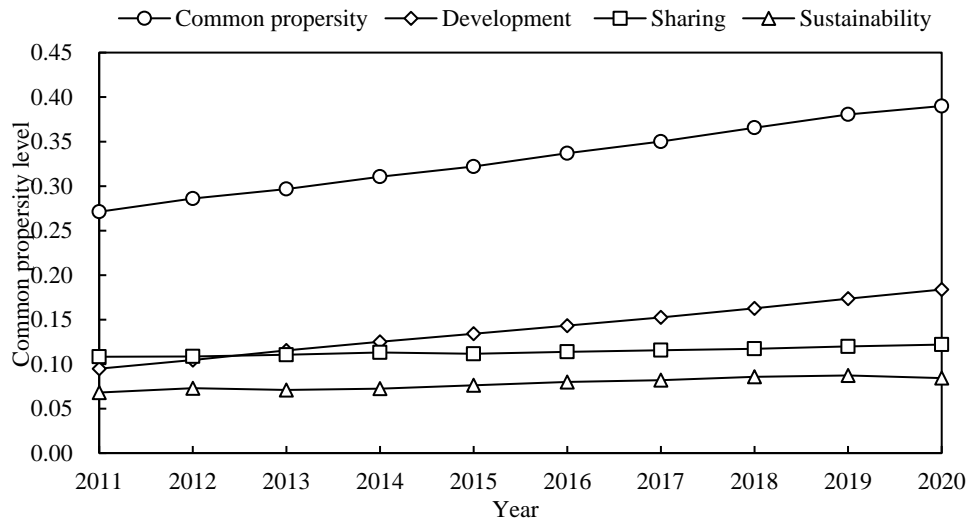


Figure 2 Historical trend of common prosperity in whole China

5.1.2 Analysis of the development level of common prosperity at the provincial level

Considering the changes in common prosperity level across provinces from 2011 to 2020, the sum of the scores of each city was used to calculate the development level of common prosperity at the provincial level, pertaining to 28 provinces, cities and autonomous regions (see in Figure 3). The results show that Beijing, Shanghai and Zhejiang generates notably higher development levels of common prosperity than other regions. Tianjin, Jiangsu and Guangdong have maintained a leading position in the development of common prosperity compared to the rest of the regions. From the perspective of the growth rate of the total score, Hebei Province demonstrates the most substantial growth, rising from the lowest score of 0.3063 in 2011 to 0.4317 in 2020, achieving a remarkable growth of 40.81%. This achievement presents an average annual growth rate of 3.88%, and a rapid upgrade from its previous bottom ranking. Hunan, Tianjin and Zhejiang also experienced significant growth rates of 39.37%, 39.3% and 37.41% growth respectively during the observation period, with the average annual growth rates of 3.76%, 3.75% and 3.59% respectively, leading to a massive change in their score rankings. In general, advanced municipalities and coastal developed provinces exhibit higher development levels of common prosperity, while the undeveloped Western provinces significantly fall behind. For example, Yunnan, Shaanxi, Gansu and other regions have lower scores and need further improvement. In addition, although Liaoning and Qinghai demonstrates relatively higher initial scores, their average annual growth rate remained below 2%, showing only 1.88% and 1.41%, respectively, making other provinces gradually overtake the ranking.

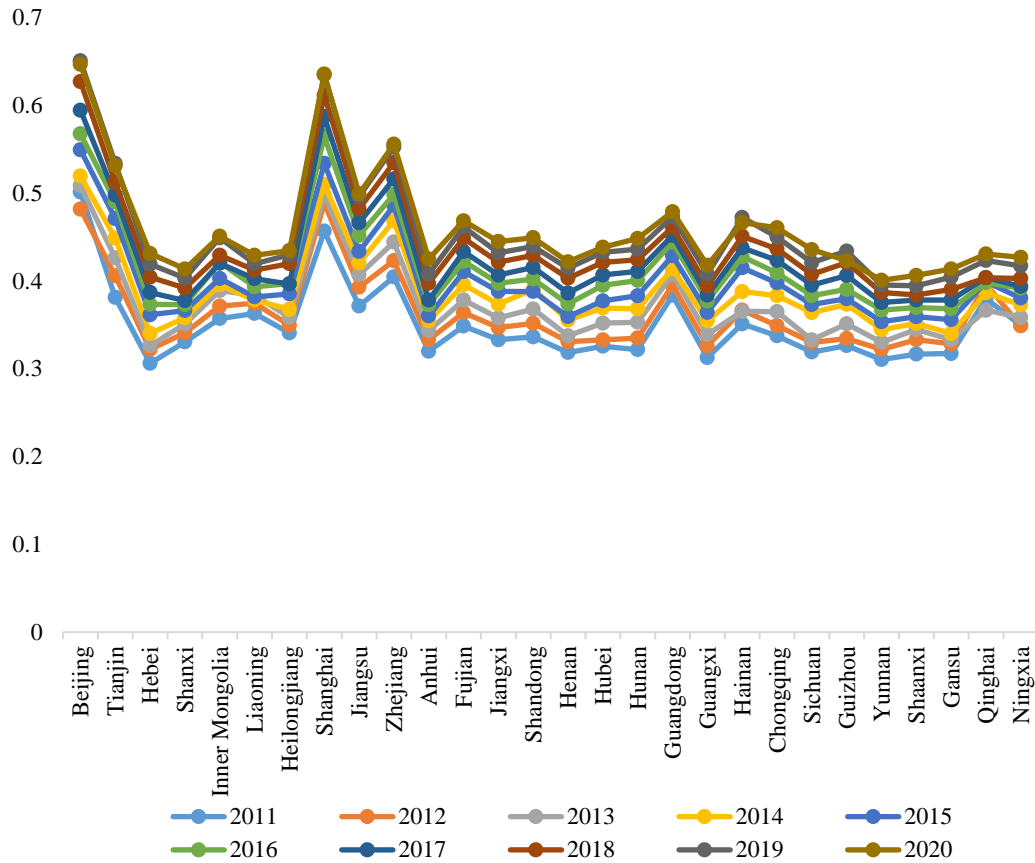


Figure 3 Evolution of provincial common prosperity over the years

5.1.3 Analysis of the development level of Common Prosperity at the regional level

In order to further explore the regional disparities in the development level of common prosperity, this study divides the total sample into three sub-regions: Eastern, Central and Western regions, based on the level of regional economic development. The result presented in Figure 4 shows a consistent upward trend in the average level of common prosperity across the Eastern, Central and Western regions. The Eastern region has always maintained the leading position in the development level of common prosperity, while the Central and Western regions have presented the same level in 2011, but the gap between the two has gradually widened over time. It can be seen from the previous analysis that the development indicators are the main driving force for the growth of comprehensive indicators at this stage, comprising the largest proportion of the overall weighting. Consequently, it is concluded that the regional disparities in common prosperity scores primarily originated from the differences in regional development. Given the Eastern region performs a higher economic development level than the Central and Western regions, and with the interconnection between the development indicators and the local economic level, the development of common prosperity will inevitably present an imbalanced and insufficient state across the Eastern, Central and Western regions.

Considering the growth rate of the total score, it is observed that the Central region is growing faster than the Eastern region, showing a rising trend. They are with an average annual growth rate of 3.22% and 3.04% respectively. The Central region is one of the main destinations for industrial

transfer from the more developed Eastern regions. In addition, with the demographic dividend yet to be fully released, it has a greater potential for future development. Conversely, the growth of the Western region is relatively slow, with an average annual growth rate of only 3.01%. Nevertheless, the national strategic initiatives for developing the Western region have been implemented. The priority for now lies in poverty alleviation, infrastructure enhancement, talent acquisition, and establishment of high-tech industries, to stimulate the economic growth in the Western region.

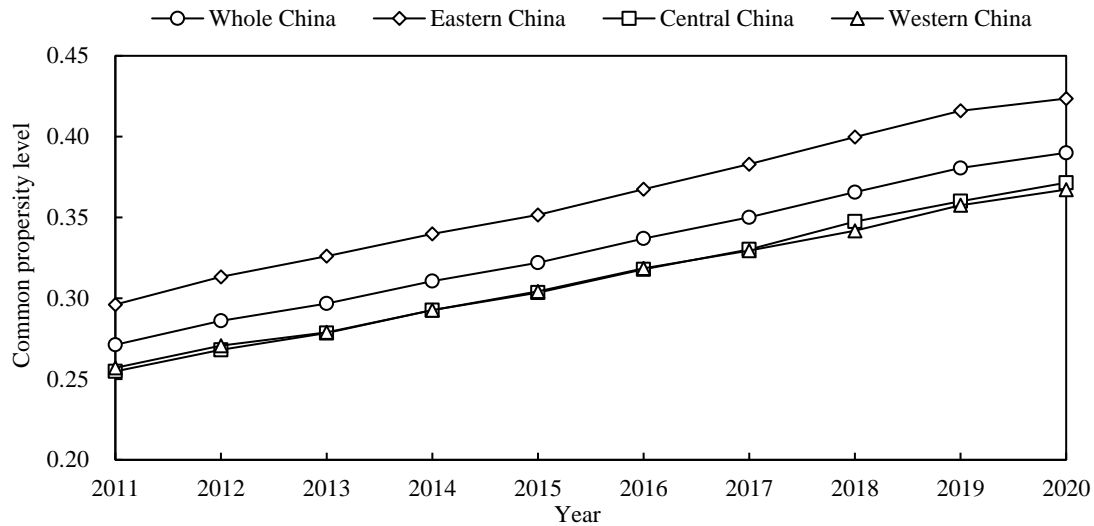


Figure 4 Historical trend of common prosperity in all regions of China

5.2 The total effect of digital inclusive finance on common prosperity

Firstly, a mixed regression analysis is conducted to obtain the estimation results. This approach involves integrating mixing panel data and cross-sectional data and performing ordinary least squares estimation based on the data. The mixed-regression results are shown in column (1) of Table 4, showing the coefficient of *Difi* is 0.041, with a P-value of 0.000. This suggests that digital inclusive finance significantly promotes common prosperity at the 1% level. The exploratory power of the mixed regression model is acceptable as indicated by the R^2 -value of 0.717. Meanwhile, the results of the fixed effects model are shown in columns (2) and (4) of Table 4. Specifically, column (2) presents the outcomes of the individual fixed effects model, and column (4) shows the results of the two-way fixed effects model. ρ represents the proportion of variance explained by individual relative to the total variance observed within the dataset. The ρ values in Table 4 are 0.8801 and 0.9354, respectively, indicating that individual term can well explain the variance changes of the composite disturbance term, and the two-way fixed effects model outperforms the individual fixed effects model. The estimated coefficients of *Difi* are 0.038 and 0.045, with a P-value of 0.000, indicating the substantial positive impact of digital inclusive finance on common prosperity. Furthermore, the random effects model analysis further evaluates whether individual effects exist in the form of random effects. The results are shown in column (3) of Table 4, showing that with the ρ value of 0.5756, which is notably lower than the ρ value of the fixed effects model (0.8801 and 0.9354), indicating a superior explanatory power of the fixed effects model.

Table 4 Comparison of model selection results

Variable	OLS	FE	RE	FE2
Difi	0.041*** (0.001)	0.038*** (0.001)	0.039*** (0.001)	0.045*** (0.005)
Gov	-0.160*** (0.006)	-0.011 (0.012)	-0.114*** (0.010)	-0.000 (0.009)
Is	0.008*** (0.001)	0.006*** (0.002)	0.007*** (0.002)	0.001 (0.001)
Open	0.055*** (0.002)	-0.026*** (0.004)	0.019*** (0.003)	-0.021*** (0.003)
Pop	-0.004** (0.002)	0.016 (0.015)	0.010** (0.004)	-0.012 (0.011)
Fin	0.010*** (0.001)	-0.001 (0.001)	0.004*** (0.001)	-0.002*** (0.001)
_cons	0.323*** (0.006)	0.291*** (0.038)	0.301*** (0.011)	0.377*** (0.028)
N	2600.000	2600.000	2600.000	2600.000
R ²	0.717	0.744		0.862
Rho		0.8801	0.5756	0.9354

Note: *, **, *** respectively represent the significance levels of 5%, 1%, and the standard errors corresponding to each variable are in brackets.

The Lagrange multiplier test is used to determine whether to use the mixed regression model or a random effects model. With the P-value of 0.000, the null hypothesis of no individual random effect is strongly rejected, indicating the appropriateness of the individual random effects model and the mixed regression is inappropriate to this study. In addition, the Hausman test was used to determine whether a fixed effects model or a random effects model is appropriate for this study, with the use of Difi as the variable. The coefficients of FE(b), RE(B), the Difference, and sqrt [diameter (V_b-V_B)] difference are 0.0380, 0.0390, -0.0010, 0.0002 respectively, with a P value of 0.0000, respectively. Consequently, the null hypothesis of the intercept term is not related to the explanatory variable is rejected, suggesting that a fixed effect model should be used.

Considering the potential endogeneity issues in the model, this study uses dynamic panel regression to determine the estimation method of GMM and IV estimation. A two-step system-GMM estimation method is used to test the relationship between digital inclusive finance and common prosperity, and the results are compared with the regression results of the two-way fixed effects model. The test results are shown in Table 5. Models (1) and (2) show the regression results of static panel two-way fixed effects model and the dynamic panel system-GMM estimation model respectively. As the estimation result of system-GMM shows, the p-value of AR (1) is 0.000, which is smaller than 0.1. AR (2) is 0.250, higher than 0.1, indicating that there is no second-order sequence autocorrelation. The p-values of Hansen test is 0.214, which is greater than 0.1, indicating that there is no over identification problem in the instrumental variables. Therefore, this paper studies the impact of digital inclusive finance on common prosperity based on the system-GMM estimation method, and the results are unbiased and effective.

It can be seen that under the two-way fixed effect model, digital inclusive finance has a significant positive impact on common prosperity (Model 1, $\beta=0.045$, $p<0.01$). Under the system-GMM estimation model, the score of common prosperity in the current period is significantly positively correlated with its lag term in the first period at the level of 1%, suggesting that a higher score of common prosperity in the previous period corresponds to a higher value in the subsequent period. Meanwhile, the system-GMM model also draws the same conclusion as the two-way fixed effects model, indicating that the development of digital inclusive finance is positively correlated with common prosperity at a significant level of 1% (Model 2, $\beta=0.098$, $p<0.01$). This means that upon addressing the endogenous issues, the development of digital inclusive finance plays a significant role in promoting the process of regional common prosperity.

In addition, the IV estimation is also used to address the endogeneity problem, the results are shown in column (3) and (4) of Table 5. Following previous studies (Nunn and Nancy, 2014; Zou and Deng, 2022), the interaction term between the spherical distance from each city to Hangzhou and the year is used as an instrumental variable for digital inclusive finance. In the first regression, the interaction term between the spherical distance from each city to Hangzhou and the year is negatively and significantly associated with the digital inclusive finance. In the second stage regression, digital inclusive finance demonstrates a significant positive impact on common prosperity. The Kleibergen-Paap rk Wald F statistic (KPF) is greater than the critical value of the Stock Yogo weak identification test, indicating that there is no weak instrumental variable problem. Meanwhile, the Durbin Wu-Hausman (DWH) result notably shows that an endogenous relationship exists between the digital inclusive finance and common prosperity.

Table 5 The total effect of digital inclusive finance on common prosperity

Variable	(1)	(2)	(3)	(4)
	FE	SYS-GMM	Difi	Cp
L.Cp		0.312*** (0.113)		
Difi	0.045*** (0.011)	0.098*** (0.015)		0.1223*** (0.012)
IV			-0.00001*** (0.000)	
Control variables	Yes	Yes	Yes	Yes
Time fixed effect	Yes	Yes	Yes	Yes
Individual fixed effect	Yes	Yes	Yes	Yes
N	2600	2340	2600	2340
R ²	0.876			0.8612
AR(1)		0.000		
AR (2)		0.250		
Hansen		0.214		
KPF				436.926
DWH				55.741***

Note: * * * represents the significance level of 1%, and the standard errors corresponding to each variable are in brackets, AR (1) 、 AR (2) and Hansen are the p-values of their tests.

5.3 Robustness check

Firstly, by replacing the dependent variable, we use principal component analysis (PCA) to further obtain the indicator of common prosperity, and use the fixed effects model to estimate the results. Column (1) of Table 6 shows that digital inclusive finance has a significant impact on common prosperity. Secondly, considering that endogeneity issues cannot be effectively alleviated, we also use IV estimation for robustness check. Column (2) of Table 6 indicates the positive effect of digital inclusive finance on common prosperity. Thirdly, considering the regional disparities, especially in regions with strong economic development, we exclude data on municipalities including Beijing, Shanghai, Chongqing, Tianjin. The results are showed in the column (3) of Table 6, which similarly demonstrates that digital inclusive finance is positively associated with common prosperity. Therefore, the baseline regression result is robust.

Table 6 The robustness check

	FE	IV	IV(Exclude some cities)
Variable	Cp_pca	Cp_pca	Cp
Difi	0.149*** (0.013)	0.302*** (0.035)	0.119*** (0.012)
Control variables	Yes	Yes	Yes
Time fixed effect	Yes	Yes	Yes
Individual fixed effect	Yes	Yes	Yes
R ²	0.7493	0.7355	0.8620
N	2600	2600	2600
KPF		436.926	422.507
DWH		24.180***	52.438***

Note: * * * represents the significance level of 1%, and the standard errors corresponding to each variable are in brackets.

5.4 The impact of sub dimensions of digital inclusive finance on common prosperity

This paper further explores the impact of sub-dimensions of digital inclusive finance on common prosperity, the results are shown in Table 7. Models (1)-(3) show the regression results of coverage, depth of use, and digitalisation of digital inclusive finance on common prosperity. The regression outcomes show that the three sub dimensions of digital inclusive finance have a significant and positive impact on common prosperity, and the estimated coefficient values are all statistically significant at 1% level: coverage (model 1, $\beta = 0.314$, $p < 0.01$), depth of use (model 2, $\beta = 0.139$, $p < 0.01$) and degree of digitalisation (model 3, $\beta = 0.038$, $p < 0.01$). This shows that the three sub-dimensions of digital inclusive finance have significantly promoted the development of regional common prosperity, with coverage having the largest effect, followed by the depth of use, and the degree of digitalisation being the smallest. The economic rational behind this outcome lies

in the substantial expansion of digital inclusive finance, reaching more groups, especially low-income groups, and aiming to enhance user dependency and satisfy the diversified financial needs of users through inclusivity and availability. As a result, the promotion effects of coverage and depth of use have been enhanced. However, there is still much space for progress in building a digital financial system and promoting the digital transformation of financial institutions.

Table 7 The estimation of sub dimensions of digital inclusive finance on common prosperity

Variable	Cp	Cp	Cp
Cover	0.314*** (0.047)		
Depth		0.139*** (0.017)	
Digital			0.038*** (0.004)
Control variables	Yes	Yes	Yes
Time fixed effect	Yes	Yes	Yes
Individual fixed effect	Yes	Yes	Yes
R ²	0.6777	0.7816	0.8340
N	2600	2600	2600
KPF	60.326	127.675	275.132
DWH	94.657***	92.920***	86.075***

Note: * * * represents the significance level of 1%, and the standard errors corresponding to each variable are in brackets.

5.5 The underling mechanism of digital inclusive finance on common prosperity

Building upon the theoretical analysis assumptions discussed previously, this study identifies the internal mechanism between digital inclusive finance and common prosperity by investigating the digital divide and innovation and entrepreneurship activity. Firstly, it explores the intermediary role of the digital divide, as presented in Table 8. Models (1)-(2) demonstrate the results of the intermediary effect of the digital divide. Model (2) shows that digital inclusive finance has a significant negative impact on the digital divide ($\beta=-0.062$, $p<0.01$), indicating that the development of digital inclusive finance can alleviate the regional disparities in the digital divide. The widening digital divide has aggravated the income and consumption gap among residents, seriously posing a challenge to achieving common prosperity in China. However, given digital inclusive finance has the potential to assist low-income groups to bridging the digital divide, it positively contributes to the development of common prosperity.

Table 8 The underling mechanism of digital inclusive finance on common prosperity

Variables	(1) Cp	(2) Divide	(3) Cp	(4) Entre
Difi	0.1223*** (0.012)	-0.062*** (0.019)	0.147*** (0.016)	0.335*** (0.101)
Control variables	Yes	Yes	Yes	Yes
Time fixed	Yes	Yes	Yes	Yes

effect	Yes	Yes	Yes	Yes
Individual fixed effect				
R ²	0.8612	0.3921	0.8560	-0.0054
N	2600	2600	2048	2048
RPF	436.926	436.926	259.025	259.025
Dwh p-value	55.741*** (0.0000)	18.222*** (0.0000)	61.422*** (0.0000)	4.839** (0.0278)

Note: * * * represents the significance level of 1%, and the standard errors corresponding to each variable are in brackets.

Limited by the fact that data on innovation and entrepreneurship activity is only available from 2011 to 2019, and the municipalities have not been measured. We therefore rescreen and match the dataset, making a total of 2048 working samples in our study. By using the stepwise test regression method, we further examine whether the innovation and entrepreneurship activity is the transmission mechanism between digital inclusive finance and common prosperity. The empirical results, as detailed in Table 8, show that digital inclusive finance has a significant positive impact on innovation and entrepreneurship activity ($\beta = 0.335$, $p < 0.01$) (see model (4)), indicating that the development of digital inclusive finance fosters regional innovation and entrepreneurship. Consequently, digital inclusive finance has improved the regional innovation and entrepreneurship activity, bolstering regional entrepreneurial vitality, promoting employment through entrepreneurship, and encouraging labour migration to urban non-agricultural sectors. This approach further contributes to the income growth of rural residents, diminishing the urban-rural income gap. Ultimately contributing to the process of common prosperity and development.

5.6 Regional heterogeneity effect

Given the regional disparities in resource endowments, the improvement of digital infrastructure and financial system robustness in China, the impact of the development of digital inclusive finance on common prosperity also generates regional heterogeneity. In order to explore the regional heterogeneity, this study divides the total sample into two sub-samples: the Eastern and the Central and Western regions, examining whether regional disparities exist in the impact of digital inclusive finance on common prosperity. The estimated results are shown in Table 9.

Regression results show that digital inclusive finance delivers significant positive effects on common prosperity in both Eastern China (model 1, $\beta = 0.231$, $p < 0.01$) and Central and Western China (model 2, $\beta = 0.046$, $p < 0.01$). This shows that while regional disparities influence the relationship between China's digital inclusive finance development and common prosperity, the overarching trend remains consistent, promoting the development of common prosperity. When comparing the coefficients, it is evident that the promotion effect of digital inclusive finance on common prosperity in Eastern regions is greater than Central and Western. The economic rationale behind this is that most of the Eastern regions are developed coastal cities with geographical advantages and abundant resources. These regions have a strong propensity to embrace innovation,

making them more likely to seize digital development opportunities, fully benefiting from the dividends of digital inclusive finance, and propelling common prosperity (Zhang et al., 2024).

Table 9 Regional heterogeneity impact of digital inclusive finance on common prosperity

Variables	(1)	(2)
	Eastern China	Central & Western China
difi	0.231*** (0.021)	0.046*** (0.016)
Time fixed effect	Yes	Yes
Individual fixed effect	Yes	Yes
R ²	0.8393	0.8676
N	2600	2600
KPF	271.743	179.604
DWH	95.479***	3.355***
Chow p-value	0.0000	

Note: * * * represents the significance level of 1%, and the standard errors corresponding to each variable are in brackets.

5.7 The regulatory effect of marketisation

Finally, we use interaction term to analyse the moderating role of marketisation in the impact of digital inclusive finance on common prosperity. Table 10 indicates that the impact of digital inclusive finance on common prosperity is significantly positive (model 2, $\beta = 0.104$, $p < 0.01$), and its interaction with the marketisation level also has a significantly positive impact on common prosperity (model 2, $\beta = 0.001$, $p < 0.05$). This results suggests that the marketisation level of regulatory variables plays a significant role in promoting the development of regional common prosperity through digital inclusive finance, contributing to a positive regulatory role. With the improvement of regional marketisation, its business environment has also been optimised, thereby stimulating the activity of market players. Digital inclusive finance thus provides high-quality financial services to people trapped in financial constraints, enhancing efficiency of regional capital allocation, fostering regional entrepreneurship, generating more employment opportunities, and ultimately facilitating common prosperity and development.

Table 10 The regulatory effect of marketisation

Variables	(1)	(2)
	Cp	Cp
Difi	0.1223*** (0.012)	0.104*** (0.013)
Difi*Market		0.001** (0.000)
Market		-0.001 (0.000)
Time fixed effect	Yes	Yes
Individual fixed effect	Yes	Yes

R ²	0.8612	0.8698
N	2600	2600
KPF	436.926	378.620
DWH	34.791***	55.741***

Note: ***, ** represent the significance levels of 1% and 5%, and the standard errors corresponding to each variable are in brackets.

6 Discussion

Although there are a few studies in China that focus on the relationship between digital inclusive finance and common prosperity, most of them mainly use provincial-level data (Zhang et al., 2024; Zhao and Jiao, 2024). In this paper, we try to explore the association between digital inclusive finance and common prosperity by using the data of 260 prefecture-level cities from 2011 to 2020. Our research findings are consistent with previous studies, showing that digital inclusive finance has a positive effect on common prosperity. However, our approach differs as their study predominantly utilised the provincial-level data, which was constrained in scope. Meanwhile, there are also certain differences in our measurement methods and the composition of indicators for common prosperity. Furthermore, we try to construct a theoretical framework to explore the mechanisms by which digital inclusive finance promotes common prosperity, drawing on theories such as financial deepening theory, financial exclusion theory, long tail theory, digital divide theory and technology-driven theory. This is the theoretical innovation of our study.

Furthermore, considering the potential endogeneity issues between digital inclusive finance and common prosperity, we employ system-GMM and IV estimation techniques to address this problem. We find the underlying mechanism of digital inclusive finance to common prosperity is by overcoming the digital divide and improving the activity of urban innovation and entrepreneurship. The perspective aligns with the views of Zhang et al. (2024) and Zhao and Jiao (2024). For instance, Zhang et al. (2024) point out that this mechanism promotes individual entrepreneurship, stimulate employment and facilitate Internet finance. Similarly, Zhao and Jiao (2024) propose that the level of regional innovation has played a partial mediating role. Expanding on this perspective to a broader scale, our heterogeneity analysis echoes the conclusion from the previous studies (Zhang et al., 2024), confirming that digital inclusive finance positively contribute to promoting common prosperity in Eastern China. Thus, our research is an important supplement to existing research approaches in investigating the relationship between digital inclusive finance and common prosperity.

7 Conclusion

Common prosperity is the fundamental principle that distinguishes socialist modernisation from capitalist modernisation, stands as the primary pathway for developing countries to move towards modernisation. This paper employs data on 260 prefecture-level cities in China from 2011 to 2020, to explore the relationship between digital inclusive finance and common prosperity and

examine the associated underlying mechanism. The results show that common prosperity encompasses development, sharing and sustainability. The weight of the first-level indicators of development and sharing is high, reflecting the higher significance of “prosperity” and “sharing” in common prosperity. The level of urban common prosperity in China has shown continuous improvement year by year, albeit with occasional slowdowns caused by the pandemic in 2020. Notably, Beijing, Shanghai and Zhejiang have taken the lead in the level of common prosperity when compared with other areas. Hebei has the fastest pace of common prosperity, followed by Hunan, Tianjin and Zhejiang.

Further research findings indicate that digital inclusive finance and its three sub-dimensions have significantly promoted the development of urban common prosperity, with coverage and depth of use having a greater effect. However, there remains a need to enhance the degree of digitalisation. Digital inclusive finance notably stimulates the development of urban common prosperity, particularly exhibiting a more pronounced effect in Eastern China compared to Central and Western China. Digital inclusive finance can stimulate regional entrepreneurial vitality by overcoming the digital gap and improving the activity of urban innovation and entrepreneurship, therefore promoting urban common prosperity. In addition, the degree of marketisation also play a regulatory role in regulating the impact of digital inclusive finance on common prosperity, further amplifying its beneficial effects.

Therefore, some policy implications are put forward. First, it is important for all regions to tailor their approaches to local conditions and make full use of the development of digital inclusive finance to promote common prosperity. Regional disparities in digital inclusive finance and common prosperity persist, with the Eastern regions such as Zhejiang, benefiting from its regional advantages such as developed economy and well-established digital infrastructure. They should prioritise these advantages, focusing on innovation, actively exploring development strategies that advances both efficiency and equity. By doing so, these regions can progress a higher level of common prosperity, thus providing a model for other regions to achieve common prosperity. Conversely, the Central and Western regions should accelerate the development of digital infrastructure, attract high-tech industries, promote industrial upgrades, increase investment in sectors such as science and education, and health care. Enhancing the fundamental well-being of residents and improving the public services are vital in promoting the development of common prosperity.

Second, the government can effectively foster common prosperity by enhancing coverage, depth of use and digitalisation. For example, efforts should be directed towards improving the establishment of digital inclusive financial infrastructure in underdeveloped regions, prioritising attention to residents’ financial literacy and improving the financial availability of the underserved population. In addition, intensifying the integration between digital technology and financial services can pave the way for innovative financial services, ensuring the delivery of affordable and high-quality financial products and services. Additionally, increasing investment in scientific and

technological research and development, diversifying financing channels, enhancing independent innovation capabilities, and improving the development level of digital technology are all essential steps in this pursuit.

Third, in terms of underlying mechanism, there is a pressing need to actively create an entrepreneurial environment, offering certain entrepreneurial subsidies and preferences. There also is a need to provide comprehensive training and education to entrepreneurs, which serves to stimulate the activity of innovation and entrepreneurship, thereby promoting employment through entrepreneurship and cultivating new driving forces for economic development. In addition, accelerating the development of rural information infrastructure and enhancing information services, particularly in Central and Western China, is essential to bridging the digital divide and ensuring widespread access to information and resources. Additionally, strengthening the important regulatory role of market players and minimising government intervention are crucial steps towards advancing the trajectory of common prosperity development.

This paper acknowledges certain limitations. Due to the data constraints, we only use data at the prefecture-level and city-level. In addition, there are additional underlying mechanisms between digital inclusive finance and common prosperity need to be explored by employing the micro level data. This outlines our future research plan to explore how digital inclusive finance affects common prosperity with more detailed micro-level data.

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