

Digital Economy Empowers Common Prosperity: Theoretical Basis, Mechanism and Space-Time Evolution

Lingxi Li

International Education College, Henan University, Kaifeng, China.

1924260070@vip.henu.edu.cn

Abstract. Based on the provincial panel data of China from 2011 to 2020, we first fit the common prosperity index by using entropy weight method, then establishes a benchmark regression to explore the relationship between digital inclusive finance and common prosperity, and conducts a spatial expansion. The research results show that digital inclusive finance can help promote common prosperity, among which the dimension of coverage breadth is still the main driving force. However, at current stage, the development of digital inclusive finance in other provinces can only manage to improve the level of common prosperity in their own provinces, and cannot yet produce positive spillover effects on other provinces. Therefore, in order to achieve coordinated regional development and bridge the "digital divide", the development of digital inclusive finance should be transformed from the breadth of coverage to the depth of use as soon as possible, and while the western region is vigorously building digital infrastructure, the digitalization of the eastern region should be enhanced.

Keywords: basic freshman, digital economy, theory.

1. Introduction

After China has achieved the overall prosperity, the focus of high-quality development has shifted to narrowing the urban-rural income gap and coordinating inter-regional development, and this critical historical stage coincides with the booming development of digital economy. How to make digital economy become a powerful driving force to realize common prosperity has become an important research interests.

As an important part of the digital economy, digital inclusive finance has become popular with the original purpose of narrowing the gap between urban and rural areas and supporting the development of poor areas. Although the degree of development is still limited by the level of development of digital technology in different regions, it has great advantages in widen accessibility of financial services compared with traditional financial services. [1] Can the "development" and "sharing" characteristics of the digital economy alleviate the problem of uneven development of common prosperity? Which dimension of digital financial inclusion is the main factor affecting the common prosperity? Is there a spatial effect of digital inclusive finance in promoting common prosperity? Here, we try to explore this issue based on the measurement of common prosperity.

2. Literature Review

Common prosperity, as a concept with Chinese characteristics, has not been studied in foreign countries, and the research themes are mainly related to "development", "sharing" and "balancing equity and efficiency". Basu (2000) suggests that in addition to overall development, the assessment of social development should also examine whether the living standards of the poorest 20% of the population have improved, thus conveying the idea of "development" and "equity and efficiency". In addition, Klugman et al. (2011) argue that human development is much more than economic growth, so they use income inequality to modify the Human Development Index (HDI) while considering education, income, and health dimensions, which clarifies that "development" is a multidimensional growth of material and spiritual prosperity. As we can see, the concept of common prosperity is a dynamic concept that is constantly being extended in both breadth and depth. However, there is still much room for subdivision of "development" and "sharing", and China has expanded it based on these two dimensions. Shi Li(2021) argues that in order to accurately understand the common

prosperity in the new era, it is necessary to grasp the two key words of affluence and sharing, where affluence covers both spiritual and material affluence, and sharing is differentiated sharing.

The gradual clarification of the connotation of common affluence has laid a solid foundation for the establishment of measurement index system. Jinchang Li and Wei Yu (2022) believe that common affluence in the new era should be "people-centered", "shared" and "sustainable", then construct an index system covering ecological, economic, and public service dimensions. The common affluence process evaluation index system covering ecological, economic and public service dimensions and the common affluence result evaluation index system consisting of three dimensions of sharing, affluence and sustainability were constructed, and finally the degree of common affluence in Zhejiang Province was measured by using this system.

With the growing maturity of the common prosperity measurement system, empirical studies on the relationship between key areas and common prosperity have also become rapidly prevalent. Based on the level of development of digital economy and the level of common prosperity, Qian Lu et al. (2022) investigated the effects and mechanisms of the digital economy to empower common prosperity. All these have laid a solid theoretical foundation for promoting the cause of common prosperity in a sustainable and steady manner. However, due to the rapid development of digital economy, the spatial effects of digital economy on common prosperity have not been sufficiently studied. Therefore, the essay explores the spatial and temporal evolution of the effects of digital inclusive finance on common prosperity, taking the connotation of common prosperity as the starting point, based on the reality of China.

3. Construction of Common Prosperity Indicators

3.1 Indicator connotations

In terms of statistical significance, this paper considers that common prosperity has three dimensions: developmental, shared, and sustainable. Based on three dimensions and combined with the research achievement of Chen, Lijun et al. (2021), the following indicator system was established.

Table 1. Common prosperity index model index system

Dimension	Implication	Indicator
Development	Economic growth	GDP per capita
	Level of modernization	Urban area
Sharing	Medical treatment	Number of Practicing (assistant) physician
	Education	Student-teacher ratio in higher education
	Employment	Number of registered urban unemployed
	Social insurance	Number of people with minimum living security in each region
	Infrastructure construction	Number of broadband access ports
Sustainability	Ecological environment	Number of nature reserves
		Total investment in industrial pollution control

3.2 Index Construction

The entropy weight method was chosen to build common prosperity index, and the specific calculation has three steps.

1. Normalize the data: among all the selected indicators, GDP per capita, urban area, number of practicing (assistant) physicians, number of broadband access ports, number of nature reserves, and total investment in industrial pollution control in each region are positive indicators; the student-teacher ratio in higher education, the number of registered urban unemployed, and the number of people with minimum living security in each region are negative indicators.

For positive indicators:

$$x'_{ij} = \frac{x_{ij} - \min(x_{1j}, \dots, x_{nj})}{\max(x_{1j}, \dots, x_{nj}) - \min(x_{1j}, \dots, x_{nj})} \quad (1)$$

For negative indicators:

$$x'_{ij} = \frac{\max(x_{1j}, \dots, x_{nj}) - x_{ij}}{\max(x_{1j}, \dots, x_{nj}) - \min(x_{1j}, \dots, x_{nj})} \quad (2)$$

2. Calculate the entropy value and redundancy value of each indicator:

$$p_{ij} = \frac{x'_{ij}}{\sum_{i=1}^n x'_{ij}}, i = 1, \dots, n, j = 1, \dots, m \quad (3)$$

$$e_{ij} = -k \sum_{i=1}^n p_{ij} \ln(p_{ij}) \quad (4)$$

$$k = \frac{1}{\ln(n)} \quad (5)$$

$$d_j = 1 - e_j \quad (6)$$

3. Calculate the weight of each indicator

$$w_j = \frac{d_j}{\sum_{j=1}^m d_j} \quad (7)$$

3.3 Index Performance

Taking 2020 common prosperity index as an example, the following conclusions are summarized: the index is higher in the southeast coastal region and lower in the northeast and northwest regions.

Table 2. Average Common prosperity Index for the seven regions in 2020

Region	Average Common prosperity Index
Northern China	0.35
Northeast China	0.26
Northwest China	0.21
Eastern China	0.44
Central China	0.27
Southern China	0.31
Southwest China	0.25

Note: Taiwan Province is not included

4. Empirical Results and Evaluation

4.1 Basic Model

This paper uses panel economic data for 31 Chinese provinces and cities from 2011-2020 to explore whether digital inclusive finance has a facilitating effect on common prosperity. The econometric model is designed as a double fixed effects model.

$$score_{it} = \delta_0 + \beta_1 combined_index_{it} + \beta_x X_{it} + v_t + \mu_i + \varepsilon_{it} \quad (8)$$

score_{it} denotes the common index of province i in t year; combined_index_{it} denotes total digital inclusive finance index of province i in t year; β₁ measuring the impact of the comprehensive development of digital inclusive finance in each province and city on the common prosperity of the region, X_{it} is the set of control variables, δ₀ is the intercept term that does not vary with the individual,

β_x is the estimated coefficient of each control variable, ν_t is time fixed effects, μ_i is individual fixed effects, ϵ_{it} is the random error term.

4.2 The overall effect of digital inclusive finance on common prosperity

According to model (8), the overall effect of digital inclusive finance development on common prosperity is shown in Table 3, using robust standard errors.

The results show that for the common prosperity index, the regression coefficient of the total digital inclusive finance index is positive at the 5% significant level. Each unit increase in the total digital inclusive finance index, the common prosperity index of that province can increase by nearly 0.1%, which indicates that digital inclusive finance has a positive effect on promoting the achievement of common prosperity. In addition, among the control variables, the turnover of commodity exchange market over 100 million yuan, which represents the degree of economic activity, and the number of special schools, which represents social security services, are also significant.

Table 3. The Overall Effect of Digital Inclusive Finance on Common prosperity

Variables	Score
Combined_index	0.0075** (0.0003)
Pub_librarybooks_per_capita	0.2851 (0.0262622)
Value_commotramkt_overbillion	6.10e-09** (2.37e-09)
Num_special_edu	0.0010*** (0.0004)
Dome_garbage_harmlesstreat_rate	-0.0002 (0.0002)
Region-Year	Control
N	310
Adj R-squared	0.9468

Note: ***, ** and * denote 1%, 5%, and 10% significant levels, respectively, with robust standard errors in parentheses and the same table below.

4.3 Heterogeneity Analysis

The results show that the regression coefficient of the breadth of digital inclusive financial coverage is positive at the 1% significant level, and each unit increase in the breadth of digital inclusive financial coverage can increase the common prosperity index of the province by 0.15%, which indicates that the breadth of coverage has a significant contribution to the realization of common prosperity; the regression coefficient of the depth of digital inclusive financial use is not significant; the regression coefficient of the degree of digital inclusive finance digitization is positive at 10% significant level, and each unit increase in the degree of digital inclusive finance digitization can only increase the common affluence index of that province and city by 0.016%, which indicates that although the degree of digitization has a facilitating effect on common prosperity, the coefficient is too small and the facilitating effect is weak.

From the information embedded in the model, we can draw the following three regular facts: First, digital inclusive finance has contributed to common prosperity, and the breadth of coverage is still the dominant element. Second, the depth of use is not significant, which may be due to the breadth of coverage is still in the period of development ascent, resulting in the depth of use not being able to fully release the positive effect. Third, the degree of digitization is also a essential influence factor. However, its regression coefficient is too small, which may also be due to the insufficient development of breadth of coverage, resulting in the innovation of digital technology is not yet able to achieve the scale economy. Therefore the current development stage for digital innovation should be cautious and take into full consideration of the cost. These regular facts reveal that we should focus

on improving the breadth of coverage, pay continuous attention to the degree of digitalization, and realize the transition from the breadth of coverage to the depth of use as early as possible.

Table 4. Three-dimensional heterogeneity test of digital inclusive finance

Variables	score		
	(1)coverage	(2)depth	(3)digitization
coverage/depth/digitization	0.0016*** (0.0003337)	0.0001 (0.0001)	0.0002* (0.0000)
Pub_librarybooks_per_capita	0.0562** (0.0264)	0.0445* (0.0264)	0.0335 (0.0259)
Value_commotramkt_overbillion	4.57e-09** (2.06e-09)	5.38e-09** (2.56e-09)	4.66e-09** (2.23e-09)
Num_special_edu	0.0007** (0.0003)	0.0010*** (0.0003)	0.0010*** (0.0003)
Dome_garbage_harmlesstreat_rate	-0.0002 (0.0002)	-0.0003 (0.0002)	-0.0003 (0.0002)
Region-Year	Control	Control	Control
N	310	310	310
Adj R-squared	0.9492	0.9452	0.9458

4.4 Endogenous Test

Endogeneity refers to the fact that one or more explanatory variables in the model are correlated with random disturbance terms that can undermine the consistency of parameter estimates. In empirical studies, the absence of endogeneity is a necessary condition for the model to be meaningful. There may be a two-way causality problem between common prosperity and digital inclusion finance. To exclude this causal factor, the essay introduces the one-period lagged digital inclusion financial index as an instrumental variable into the equation to test endogeneity.

Table 5. Comparison of two-stage least squares method with least squares method

Variables	score	
	Two-stage least squares method	Least squares method
Combined_index	0.0014*** (0.0005)	0.0075** (0.0003)
Control variables	Control	Control

The results show that the core variable, combined index, is significant when comparing the two methods, so it can be considered that no serious endogeneity problem occurs.

4.5 Robustness Test

In order to exclude interference in selected years, the essay adopts the method of replacing the samples here by excluding the data of 2011 and 2020 respectively, and build two regression models with the data of the remaining nine years. Then comparing the results of three regressions in which the samples are not identical to achieve the robustness test of the benchmark model.

Table 6. Three regression results with different years span

Variables	Score		
	Score(1)	Score(2)	Score(3)
Year	2011-2020	2012-2020	2011-2019
Combined_index	0.0075** (0.0003)	0.0006* (0.0003)	0.0007** (0.0003)
Pub_librarybooks_per_capita	0.2851 (0.0263)	0.0255 (0.0241)	0.0226 (0.0282)
Value_commotramkt_overbillion	6.10e-09** (2.37e-09)	1.12e-08** (5.09e-09)	4.81e-09** (2.36e-09)
Num_special_edu	0.0010*** (0.0003)	0.0007** (0.0003)	0.0014*** (0.0004)
Dome_garbage_harmlesstreat_rate	-0.0002 (0.0002)	0.0007** (0.0003)	-0.0003 (0.0002)
Region-Year	Control	Control	Control

By comparison, the regression coefficients of the core variable, digital inclusive financial index, in three regressions are all significant, which means the benchmark model passes the robustness test.

5. Extended Model: Spatial Durbin Model

5.1 Spatial Durbin Model

Spatial correlation test is the premise of constructing spatial econometric model. Moran's I index is often used to judge whether there is correlation among different regions of sectional data. The value range of Moran's index I is $-1 \leq \text{Moran's I} \leq 1$, and its absolute value reflects the strength of spatial correlation. When the index is less than 0, it is considered that there is spatial negative correlation. When the index is greater than 0, it indicates a spatial positive correlation. When the exponent is equal to 0, space is considered irrelevant;

$$\text{Moran's I} = \frac{\sum_{i=1}^n \sum_{j=1}^n w_{ij} (M_{it} - \bar{M})(M_{jt} - \bar{M})}{S^2 \sum_{i=1}^n \sum_{j=1}^n w_{ij}} \quad (9)$$

$$S^2 = \sum_{i=1}^n (M_{it} - \bar{M})^2 \quad \bar{M} = \frac{1}{n} \sum_{i=1}^n M_i$$

n denotes the number of provinces, M_{it} is common prosperity index or digital inclusive finance index of province i in year t. M_{jt} is common prosperity index or digital inclusive finance index of province j in year t. w_{ij} represents the element value of the spatial weight matrix.

Here, the distance between the locations is calculated by the latitude and longitude of the capital cities, and the distance is converted to form a spatial weight matrix of geographic distances w_{ij} .

the spatial Durbin model is as follows:

$$\text{score}_t = \alpha + \beta \text{combined_index}_t + \theta W \text{combined_index}_t + \lambda X_t + \eta WX_t + \varepsilon \quad (10)$$

score_t is the common prosperity index in year t, $\beta \text{combined_index}_t$ represents the direct impact of a province's digital financial inclusive index on its common prosperity index, $\theta W \text{combined_index}_t$ represents the weighted linear combination of digital financial inclusive index of other provinces, which shows the indirect impact of other provinces' digital financial development on the common prosperity index of certain provinces, λX_t , ηWX_t are direct and indirect effects of control variables, respectively. α is a constant term, ε is a random error term.

5.2 Spatial Correlation Test—Moran's I

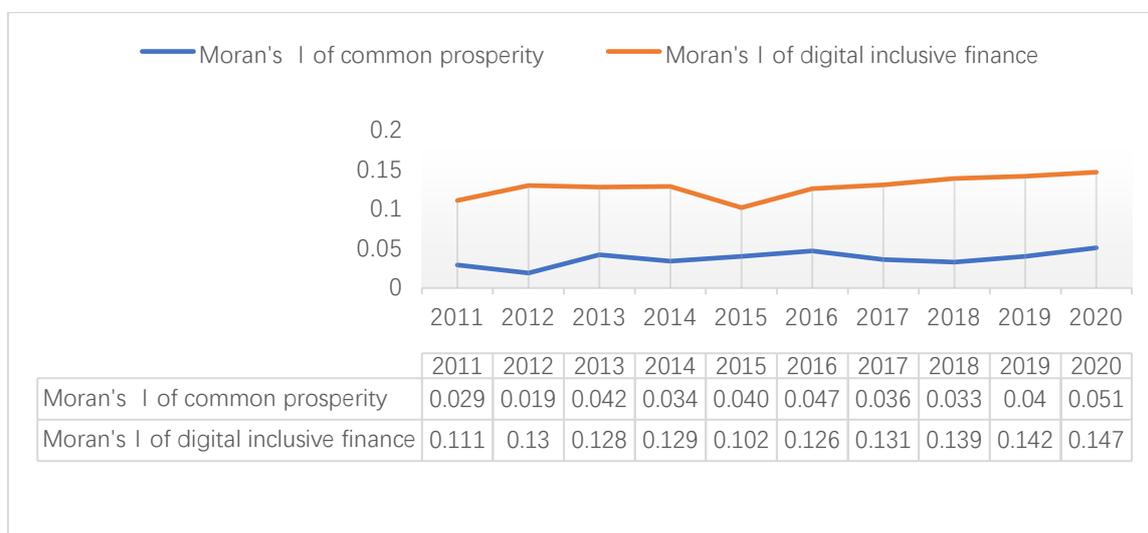


Figure 1. Spatial correlation analysis of the Common prosperity Index and the Digital Financial Inclusion Index

Moran's I test indicating that there is a strong spatial positive correlation between common prosperity and digital inclusive finance.

5.3 Spatial Durbin Model Results and Analysis

The results show that at the 5% significance level, the development of digital inclusive finance in the province can improve its common prosperity level, while at the 10% significance level, the development of digital inclusive finance in the province will weaken other provinces' common prosperity level.

Table 7. Result of spatial Durbin model

Variables	Score
Combined_index	0.0007** (0.0003)
Pub_librarybooks_per_capita	0.0450** (0.0206)
Value_commotramkt_overbillion	4.80e-09 (4.22e-09)
Num_special_edu	0.0011*** (0.0003)
Dome_garbage_harmlesstreat_rate	-0.0001 (0.0002)
W×Combined_index	-0.0005* (0.0003)
W×Pub_librarybooks_per_capita	-0.0899 (0.0554)
W×Value_commotramkt_overbillion	-3.85e-09 (4.41e-08)
W×Num_special_edu	-0.0010 (0.0015)
W×Dome_garbage_harmlesstreat_rate	-0.0023* (0.0013)

According total decomposition effect, we know that the development of digital inclusive finance in each province can truly achieve the vision of promoting local development, which coincides with the intrinsic requirement of common prosperity. However, at this stage, we should also be alert to the fact that the development of digital inclusive finance in certain provinces can hardly contribute to the common prosperity of other provinces. The results in Tables 7 and 8 show that the development of digital inclusive finance even has a siphoning effect, which is obviously not conducive to the coordinated regional development and contrary to the concept of "sharing".

Table 8. spatial total effect decomposition based on the spatial Durbin model

Variables	Direct effect	Indirect effect	Total effect
Combined_index	0.0007** (0.0003)	-0.0003 (0.0004)	0.0004 (0.0003)
Pub_librarybooks_per_capita	0.0397** (0.0170)	-0.1466 (0.1063)	-0.1069 (0.1051)
Value_commotramkt_overbillion	4.85e-09 (5.34e-09)	-1.14e-08 (9.03e-08)	-6.55e-09 (9.34e-08)
Num_special_edu	0.0011*** (0.0003)	-0.0012 (0.0032)	-0.0002 (0.0033)
Dome_garbage_harmlesstreat_rate	-0.0002 (0.0003)	-0.0047* (0.0028)	-0.0049* (0.0028)

6. Conclusion

In summary, although the digital economy provides a new path to common prosperity in China, in order to truly bridge the development imbalance between regions, it still needs to accelerate the transformation of digital inclusive finance from coverage to depth. While building digital infrastructure in the central and western regions, the eastern regions should make good use of the existing good foundation to further achieve innovation and breakthroughs in digital technology, which implements the concept “the first rich drive the latter rich”.

References

- [1] He Zhang, Qinxian Bai. Has digital financial inclusion reduced the urban-rural income gap? -- A panel threshold regression analysis based on provincial data in China[J]. *Exploring Economic Issues*,2018(10):122-129.
- [2] Basu, K. , On the Goals of Development, in Gerald Meier and Joseph Stiglitz (eds.), *Frontiers of Development Economics: The Future in Perspective*. New York: Oxford University Press, 2000, pp.61-86.
- [3] Klugman J, Rodríguez F, Choi H J. The HDI 2010: new controversies, old critiques[J]. *The Journal of Economic Inequality*, 2011, 9(2): 249-288.
- [4] Shi Li. The goal of common prosperity and the choice of path to achieve it[J]. *Economic Research*, 2021, 56(11): 4-13.
- [5] Jinchang Li, Wei Yu. Exploration of statistical monitoring and evaluation of common prosperity [J/OL]. *Statistical Research*:1-15[2022-04-26].DOI:10.19343/j.cnki.11-1302/c.2022.02.001.
- [6] Yun Xiang, Qian Lu, Zhixuan Li. Digital economy development empowers common prosperity: impact effects and mechanism of action [J/OL]. *Securities Market Herald*:1-12[2022-04-26]. <http://kns.cnki.net/kcms/detail/44.1343.F.20220331.1352.004.html>
- [7] Lijun Chen, Jianxing Yu, Yina Xu. The construction of common prosperity index model[J]. *Governance Research*, 2021, 37(04): 5-16+2. DOI: 10.15944/j.cnki.33-1010/d.2021.04.001.