



Digital economy, entrepreneurial activity, and common prosperity: Evidence from China

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ABSTRACT

Based on the provincial panel data of China from 2011 to 2019 for a total of 9 years, this paper uses the entropy method to construct a comprehensive measure of the digital economy and common prosperity. We theoretically analyzed the impact mechanism of the digital economy on common prosperity using the econometric model. The study found that the digital economy can significantly promote the realization of common prosperity. The digital economy has a significant impact on the development and sustainability of common prosperity. The results of the impact mechanism show that the digital economy promotes common prosperity by increasing entrepreneurial activity. Heterogeneity research shows that the role of digital economy in promoting common prosperity changes with different regions. Specifically, the digital economy in the central and western regions can significantly promote the realization of common prosperity, but this impact is not significant in the eastern region. From the regression results of the digital economy, we can see that industrial digitalization and digital infrastructure play a greater role in promoting common prosperity. Economic openness affects the promotion of digital economy to common prosperity. The conclusion of this work provides an important research reference for the development of digital economy and the realization of common prosperity.

KEYWORDS

digital economy; empirical study; entrepreneurial activity; common prosperity

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1. Introduction and literature review

The 19th Party Congress put forward the ambitious goal of "the basic realization of common prosperity for all the people" by the middle of this century. The Fifth Plenary Session of the 19th Central Committee of the Communist Party of China clarified the visionary goal of basically realizing socialist modernization by 2035, and proposed that "the comprehensive development of people and the common prosperity of all people will make more obvious and substantial progress". By 2050, the common prosperity of the whole people will be basically realized, and the people of the country will enjoy a happier and more comfortable life. The Sixth Plenary Session of the 19th Central Committee also emphasized that the government will comprehensively deepen reform and opening up, promote common prosperity, and adhere to safeguarding and improving people's livelihood. However, there are many obstacles to achieving common prosperity, such as excessive income gap, immature basic public services, healthy civilization and cultural development (Zhang and Li 2021). Common prosperity is the essential requirement of socialism. Its concept is that under the guarantee of the socialist system with Chinese characteristics, all the people rely on the developed and world-leading productivity level to share a happy and beautiful life (Liu et al., 2021). Based on the definition of the connotation of common prosperity, it is concluded that common prosperity has three basic characteristics of development, sharing, and sustainability (Chen et al., 2021). Then, what impact does the digital economy have on the realization of common prosperity?

At present, the research literature on digital economy and common prosperity mainly includes the following two categories. First, about the measurement of common prosperity. Liu and Zhang (2022) calculated the common prosperity index by constructing a spatial Markov chain. Liu Xinyi et al. Han et al. Zhang et al. Secondly, the impact of digital economy on common prosperity. Xia and Liu (2021) found that the digital economy can not only promote the general growth of the macro economy, but also promote balanced growth and accelerate the equalization of basic public services. Luo and Liu (2022) found from a micro perspective that the adoption of digital technology can help expand the network and promote the common prosperity of farmers using CSS2019 survey data. Ouyang (2022) believes that the digital economy helps to provide a sharing mechanism for balanced development and promote the whole society to share digital dividends. Li (2022) believes that digital economy can improve the distribution function of production factors and increase income distribution. Moreover, the integration of the digital economy and real economy can promote the sustained growth of the total economy, optimize the environment for innovation and entrepreneurship, and provide a channel for common prosperity. Zhu and Zhang (2022) found that data elements have played a role in promoting economic growth and strengthening the growth basis of common prosperity. In the process of industrial development, government governance and infrastructure, the network effect generated by the digital economy has greatly promoted the equalization of social public services in China.

From the existing research literature, there is no research literature that explores the relationship between the digital economy, entrepreneurial activity, and shared prosperity. Therefore, this paper explores this new perspective in detail, combining theoretical analysis and empirical research.

2. Theoretical analysis and research hypothesis

At the Fourth Plenary Session of the 19th CPC Central Committee, figures were clearly defined as production factors and participated in distribution for the first time. In terms of time, China's entry into the digital economy coincides with the era of digital economy. As China gradually enters the era of digital economy, the future common prosperity must rely on the digital economy, and the two have a strong compatibility (Xia and Liu, 2021). Some scholars have shown that the development of digital economy has a significant impact on economic growth. With the power of data, the development of the digital economy has improved the vitality of the economy, accelerated the efficiency of economic operation, and released a broader space for development (Zhong et al., 2021), thus

promoting the rapid growth of the macro economy. Chen and Duan (2022) found that the digital economy plays a significant role in narrowing the urban-rural income gap by giving play to the effect of market integration and modular division of labor. The digital economy can also promote the development of decentralized industries among regions, coordinate the development of urban and rural areas and the establishment of a unified national market, and promote balanced economic growth (Xia and Liu, 2021). Therefore, based on the above theoretical analysis, the research hypothesis 1 is proposed.

H1: The digital economy has a positive impact on the achievement of common prosperity.

Common prosperity is a rich life achieved by all people through hard work. Research shows that mass entrepreneurship can create new employment opportunities and occupy the market. It can not only improve people's living standards, but also help the whole country reduce poverty and promote economic growth (Ali et al., 2013). Zhao et al. (2020) used the data of China's prefecture-level cities, found that the digital economy has a significant role in promoting high-quality economic development by stimulating public entrepreneurship. Li and He (2021) used provincial panel data to study and conclude that there is a significant positive correlation between the digital economy and entrepreneurial activity in space. The reduction effect of mass entrepreneurship on rural income poverty and education poverty is significantly enhanced after breaking the threshold. The development of the digital economy contributes to the promotion of entrepreneurial activity, while the increase of entrepreneurship contributes to poverty reduction and economic growth and the realization of common prosperity. Therefore, based on the above theoretical analysis, the research hypothesis 2 is proposed.

H2: The digital economy can contribute to the achievement of common prosperity by increasing entrepreneurial activity.

Since China implemented the opening up policy, its economic development has made remarkable achievements in the world. The Chinese government has also repeatedly stressed the importance of economic openness. Economic openness is not only an important driving force for economic development, but also the establishment of a higher level of open economy will help to form new advantages in international cooperation and competition. Zhang et al. (2022) argued economic openness also has negative effects. Although some developed countries have achieved a high level of opening-up, the gap between rich and poor is still large, and common prosperity has not been achieved. At present, the digital economy has become the main economic form in China. Economic openness is conducive to the exchange of goods, services and technologies among countries, but the high level of opening to the outside world may also lead to the loss of economic dividends in some regions. Therefore, this paper believes that the level of economic openness also needs to be controlled within a reasonable range. Based on the above analysis, the research hypothesis of this paper is proposed

H3: There is a threshold effect of the level of external openness in the impact of the digital economy on the common prosperity.

3. Study Design

3.1. Model construction

Based on the theoretical analysis and the proposed research hypothesis above, referring to the research of Lin et al. (2022) and Li et al. (2022), a benchmark regression model is constructed to verify the direct impact of the digital economy on the common prosperity.

$$CP_{it} = \alpha_0 + \alpha_1 Dig_{it} + \alpha_n control_{it} + \delta_i + \eta_t + \varepsilon_{it} \quad (1)$$

Where, CP_{it} denotes the level of common prosperity development in province i and year t , Dig_{it} denotes the level of digital economy development, $control_{it}$ denotes some control variables, δ_i denotes individual fixed effects, η_t denotes time fixed effects, and ε_{it} denotes random disturbance terms.

Secondly, to test the indirect effect of digital economy on the common prosperity, this paper refers to the method of Ren et al. (2022a) and Wu et al. (2022), and constructs a mediation effect model to test the transmission mechanism.

$$pindi_{it} = \Phi_0 + \Phi_1 Dig_{it} + \Phi_n X_{it} + \delta_i + \eta_t + \varepsilon_{it} \quad (2)$$

$$CP_{it} = v_0 + v_1 Dig_{it} + v_2 pindi_{it} + v_n X_{it} + \delta_i + \eta_t + \varepsilon_{it} \quad (3)$$

where $pindi_{it}$ indicates the entrepreneurial activity in province i and year t . The meanings of other variables are the same as in equation (1). α_1 coefficients of Dig_{it} reflect the overall effect of digital economy on the development of co-prosperity in each province. v_1 reflects the direct effect of digital economy on common prosperity, and $\Phi_1 * v_2$ reflects the mediation effect of digital economy on the common prosperity. If α_1 , Φ_1 , and v_2 are significant, v_1 is significant, and $v_2 < \alpha_1$, it indicates a partial mediation effect; if v_1 is not significant, it indicates a full mediating effect.

In order to accurately test the critical point of the impact of the digital economy on the development of common prosperity and reduce the estimation deviation caused by the artificial delimitation of the threshold value, this paper selects economic openness as the threshold variable to set a single panel model (Ren et al., 2021; Wu et al., 2022), as shown in formula (4):

$$CP_{it} = \beta_0 + \beta_1 Dig_{it}(open \leq \gamma) + \beta_2 Dig_{it}(open > \gamma) + \beta_n control_{it} + \delta_i + \eta_t + \varepsilon_{it} \quad (4)$$

3.2. Variable selection and setting

Common prosperity index. This paper refers to the research literature of Chen et al. (2021) and Han et al. (2022), this paper uses the entropy method to calculate the comprehensive evaluation system of common prosperity indicators from three aspects: development, sharing and sustainability.

Table 1. Common prosperity Indicator Metric System.

Tier 1 Indicators	Secondary indicators	Tertiary indicators	Indicator Properties
Developmental	Affluence	Per capita disposable income of residents (yuan/person)	+
		Per capita consumption expenditure of residents (yuan/person)	+
		Engel's coefficient	-
		Total retail sales of social consumer goods per capita	+
		Gini coefficient	-
	Commonality	Multiplier difference between urban and rural residents' income	-
		Multiplier difference between urban and rural residents' consumption	-
	Cultural Education	Urbanization rate (%)	+
		Public library holdings per capita (volumes/person)	+
		Average number of years of education (years/person)	+
Shareability	Medical Health	Illiteracy rate (%)	-
		Number of practicing (assistant) physicians per 10,000 people (persons)	+
	Infrastructure	Number of beds in medical institutions per 10,000 people	+
		Public transportation vehicles per 10,000 people (standard units)	+
		Public toilets per 10,000 people (seats)	+
	Level of informatization	Internet broadband access subscribers per 100 population	+

Sustainability	Social Security	Number of cell phone subscribers per 100 people	+
		Proportion of urban workers participating in pension insurance (%)	+
		The proportion of urban workers participating in medical insurance (%)	+
		Proportion of the number of participants in work injury insurance at the end of the year (%)	+
		Proportion of maternity insurance participants at the end of the year (%)	+
		Proportion of the number of participants in unemployment insurance at the end of the year (%)	+
		The number of urban and rural residents with minimum living standards as a proportion of the total population (%)	+
		Social security and employment expenditure of local finance as a percentage of GDP (%)	+
	Technology Innovation	RD input intensity (%)	+
	Ecology	Number of patents granted per 10,000 people (pieces)	+
		Forest cover (%)	+
	Development Quality	Average PM2.5 concentration (µg/m3)	-
		GDP per capita (yuan/person)	+

Digital economy. The digital economy is defined as an economic activity that uses digital knowledge and information as key production factors. According to the definition of digital economy in G20 Summit and referring to Ren et al. (2022b) and Wu et al. (2021a, 2021b), this paper constructs the metric system of digital economy from three dimensions of digital industrialization, industrial digitization and digital infrastructure by using entropy value method (see Table2).

Table 2. Digital Economy Indicator Metrics System.

Secondary indicators	Tertiary indicators	Unit	Indicator Properties	Indicators Weights
Digital industrialization	Total telecom services (comparable prices)	Billion	+	0.1452
	Number of fixed telephone subscribers	million households/household	+	0.1102
	R&D expenditure of industrial enterprises above the scale	million yuan	+	0.0248
	Number of Patent Applications_Domestic	Pieces	+	0.027
	Number of Invention Patent Applications_Domestic	Pieces	+	0.0264
	Number of granted patent applications_Domestic	Pieces	+	0.0286
	Total turnover of technology contracts	million yuan	+	0.0421
	Number of industrial enterprise units above the scale	individual	+	0.0196
Industry digitization	The main business income of industrial enterprises above the scale	Billion	+	0.1007
	Total profit of industrial enterprises above the scale	Billion	+	0.1087
	Express business volume	million pieces/piece	+	0.1289
	Express business revenue	Billion yuan / million	+	0.0453

Digital infrastructure	Total retail sales of social consumer goods	yuan Billion yuan / million	+	0.1213
	Internet penetration rate	%	+	0.0063
	Number of Internet domain names (million)	million	+	0.0318
	Number of Internet broadband access ports (million)	million	+	0.0133
	Telephone penetration rate (including cell phones) (units per 100 people)	Department / 100 people	+	0.007
	Length of long-distance fiber optic cable lines (km)	Kilometers	+	0.007
	BYU Digital Finance Index	-	+	0.0057

Entrepreneurial activity. Entrepreneurial activity reflects, to some extent, the proportion of people involved in entrepreneurship in a country (Ye, 2018). In this paper, drawing on the method of Li (2021), the proportion of the total number of private enterprises and self-employed households to the total population is chosen as an indicator of entrepreneurial activity.

Control variables. To prevent the existence of omitted variables from affecting the accuracy of the results, four control variables are included in this paper. Human capital (edu) is measured by the average number of years of education of citizens over 6 years old (Li et al., 2022; Hao et al., 2023; Du et al., 2022). Economic openness is measured by the ratio of total import and export trade to regional GDP (Hao et al., 2022; Zhou et al., 2022). The number of people per square kilometer is used to measure population density. Fiscal revenue and expenditure are expressed as the ratio of general public budget revenue to general public budget expenditure (Wang et al., 2022; Yang et al., 2022; Yang et al., 2021).

Data sources and descriptive statistics. Based on the development process of the digital economy and the availability of data, this paper selects the provincial panel data from 2011-2019 as a sample to examine the role of the digital economy in promoting common prosperity. The data are mainly obtained from the China Statistical Yearbook, China City Statistical Yearbook, China Science and Technology Statistical Yearbook and the statistical bulletins of provinces and cities. The descriptive statistics of the important indicators involved in this paper are as follows.

Table 3. Variable selection and descriptive statistics.

Variable Name	Abbreviation	Obs	Mean	SD	min	max
Common prosperity	Cp	279	0.190	0.0996	0.0479	0.518
Developmental	Cpf	279	0.276	0.174	0.0219	0.927
Shareability	Cpg	279	0.164	0.0975	0.0661	0.591
Sustainability	Cpk	279	0.248	0.201	0.0137	0.876
Digital economy	Dig	279	0.0823	0.0916	0.00518	0.434
Entrepreneurial activity	Pindi	279	0.0552	0.0193	0.0241	0.118
Education level	Edu	279	9.136	1.079	4.666	12.70
Economic openness	Open	279	0.274	0.294	0.0127	1.465
Fiscal revenue and expenditure	Fin	279	0.491	0.199	0.0722	0.940
Population density.	Pop	279	2,831	1,154	515	5,821

4. Empirical analysis

4.1. Baseline regression results

Figure 1 shows the results of the baseline regression of the impact of the digital economy on

common prosperity in China. Column (1) does not include control variables, while column (2) includes all control variables. Regression coefficients of the digital economy are significantly positive regardless of whether control variables are included, indicating that the development of the digital economy has a catalytic effect on the achievement of common prosperity. The regression coefficient of education level and fiscal decentralization is significantly positive, and has passed the significance level of at least 5%, indicating that education improvement and reasonable fiscal decentralization have a significant positive impact on common prosperity. Population density has no effect on the realization of common prosperity.

To further examine the impact of digital economy on common affluence, (3) - (5) shows the regression results of the development of digital economy to the development, sharing and sustainability of common prosperity. The results show that the digital economy has a positive effect on sharing and sustainability in common prosperity, but has no significant impact on development. The possible reason is that the development mainly includes two aspects: abundance and commonality. At present, China's major problems are uneven income distribution, large gap between rich and poor, and uneven development among regions. The rapid development of the digital economy cannot completely solve these problems. Therefore, the impact of digital economy on the development of common prosperity is not significant.

Table 4. Baseline regression results.

Variables	(1) cp	(2) cp	(3) cpf	(4) cpg	(5) cpk
dig	0.707* (1.95)	0.845** (2.34)	0.331 (0.33)	0.314*** (4.14)	2.485*** (3.94)
edu		0.034** (2.38)	0.167*** (4.16)	0.004 (1.19)	-0.032 (-1.28)
open		-0.121*** (-2.93)	-0.315*** (-2.70)	0.018** (2.03)	-0.115 (-1.59)
pop		-0.000 (-1.12)	0.000* (1.65)	-0.000 (-1.50)	-0.000** (-2.17)
fin		0.178** (2.11)	0.421* (1.78)	-0.050*** (-2.86)	0.773*** (5.27)
Constant	0.132*** (4.42)	-0.220 (-1.45)	-1.489*** (-3.48)	0.132*** (4.15)	0.063 (0.24)
N	279	279	279	279	279
R2	0.015	0.101	0.160	0.108	0.219

Notes: *, **, *** represent passing the 10%, 5% and 1% significance tests, respectively. The z-values are in parentheses. Same as in the following tables.

4.2. Heterogeneity analysis

4.2.1. Regional heterogeneity

Although this paper has examined the impact and transmission mechanism of digital economy on the realization of common prosperity in China, due to the large differences in resource endowment and different levels of socio-economic development among different regions in China, the regional heterogeneity between digital economy and common prosperity has been explored to ensure the completeness and adequacy of the research results in this paper, and the results are shown in (1)-(4) of Table 5. It is found that the digital economy has a significant positive impact on the realization of common prosperity in the central, western, and northeastern regions, while it does not have a significant impact on the realization of common prosperity in the eastern region. The possible reason is that the development of digital economy in the eastern region is more rapid and the overall difference is not significant, so the development of digital economy does not have a significant impact on the

realization of common affluence; while there are more regions in the central, western and northeastern regions, the development of digital economy can provide more jobs, improve the income of residents and narrow the income gap, thus contributing to the realization of common affluence.

4.2.2. Digital economy sub-dimensional analysis

The digital economy indicators in this paper are composed of three parts: digital industrialization (dig1), digital industry (dig2), and digital infrastructure (dig3). Columns (5)-(7) of Table 5 shows the results of the impact of digital economy sub-dimensions on common prosperity. The regression coefficient of digital industrialization is positive, but not significant; The regression coefficients of industrial digitalization and digital infrastructure are significantly positive. The main reason is that the development of digital industrialization has a significant impact on common prosperity. The possible reason is that there are still some problems in the development of China's digital industrialization. Digital core technology and key areas face technical barriers. China's high-end chips, industrial control software, core components, basic algorithms and other key technologies related to the digital industry are still restricted by developed countries. The further development of industrial digitalization and digital economic infrastructure will help to promote the realization of common prosperity. By promoting the combination of the Internet, big data, artificial intelligence and the real economy, industrial digitization is not only conducive to the formation of economies of scale, reducing production costs, creating more jobs, but also can improve residents' income and total factor productivity. The development of digital infrastructure enables residents in remote areas to enjoy the convenience of digital economy and share the achievements of economic development, which is conducive to the realization of common prosperity.

Table 5. Heterogeneity test results.

	Regional Heterogeneity				Digital Economy Sub-Dimensions		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
variables	East	Middle	West	Northeast	cp	cp	cp
dig	0.343 (0.598)	2.552*** (0.669)	1.992*** (0.670)	5.319* (2.848)			
dig1					0.176 (0.116)		
dig2						0.184* (0.106)	
dig3							0.173*** (0.0454)
Cons	-0.890 (0.540)	-0.659*** (0.201)	0.0114 (0.154)	-1.091* (0.548)	-0.193 (0.152)	-0.211 (0.152)	-0.0911 (0.151)
Control variables	Control	Control	Control	Control	Control	Control	Control
Fixed time	Control	Control	Control	Control	Control	Control	Control
Area fixed	Control	Control	Control	Control	Control	Control	Control
N	90	54	108	27	279	279	279
R2	0.192	0.533	0.169	0.500	0.089	0.092	0.132

4.3. Robustness test and endogeneity analysis

In order to minimize the bias of regression results due to endogenous, missing variables and reverse correlation problems, we conducted a robustness test and selected instrumental variables for endogenous analysis.

4.3.1. Robustness test

(1)-(2) in Table 6 are the results of the robustness analysis. Columns (1) (2) show the regression results for

the digital economy with the upper and lower 1% tail reduction, and the recalculation of the digital economy using principal component analysis, respectively. The regression coefficient of the digital economy is still significantly positive. Therefore, the results of the robustness test support the conclusion of this paper that the digital economy has a significant contribution to the achievement of common prosperity.

4.3.2. Endogenous analysis

The selection of instrumental variables should satisfy two hypotheses: first, the correlation hypothesis. That is, the instrumental variables are strongly correlated with the endogenous variables (digital economy); second, the exclusion assumption. That is, instrumental variables are not correlated with random perturbation terms. However, the random perturbation term is difficult to be observed, so the instrumental variables need to be selected in such a way that they are not correlated with the core explanatory variables (common prosperity). In order to address the possible endogeneity problem, this paper selects Internet penetration (inter) as well as the number of cell phone subscribers (phone) as instrumental variables for the digital economy by referring to the studies of Xie et al. (2018) and Huang (2019), and further tests the findings using the instrumental variables approach.

(3)-(6) in 错误!未找到引用源。 report the 2SLS estimation results for the instrumental variables approach, (3)-(4) are the first and second stage regression results for the instrumental variable phone, (5)-(6) are the first and second stage regression results for the instrumental variable inter, respectively. In the first stage, the estimated coefficients of both instrumental variable phone and instrumental variable inter are significantly positive and both pass the 1% significance test. Moreover, the F-statistics of both instrumental variables are higher than 10, rejecting the original hypothesis that the instrumental variables phone and inter are weak instrumental variables. The results of the second-stage regression of the instrumental variables method show that the estimated coefficients of the core explanatory variables dig are still positive after adding the instrumental variables phone and inter, and they pass the significance test at the 1% level. It suggests that the development of digital economy has a facilitating effect on the achievement of common prosperity.

Table 6. Robustness test and endogeneity analysis.

Variables	(1)	(2)	(3)	(4)	(5)	(6)
			first	second	first	second
	cp	cp	dig	cp	dig	cp
dig	0.844* (1.87)	0.027*** (3.77)		0.191** (2.05)		0.583*** (3.16)
phone			0.000*** (11.55)			
inter					0.003*** (5.89)	
Constant	-0.220 (-1.45)	-0.063 (-0.41)	0.159*** (4.01)	-0.124*** (-2.83)	0.103** (2.26)	-0.171*** (-3.16)
Control variables	Control	Control	Control	Control	Control	Control
Fixed time	Control	Control	Control	Control	Control	Control
Area fixed	Control	Control	Control	Control	Control	Control
N	279	279	279	279	279	279
R2	0.094	0.131	0.496	0.500	0.335	0.319

4.4. Further analysis

4.4.1. Mechanism test

This paper analyzes the transmission mechanism of the impact of digital economy on China's common

prosperity from the theoretical level. In order to further verify the reliability of the transmission mechanism, this paper further tests the transmission mechanism by using the mediating effect model, and the results of the mediating effect regression are shown in 错误!未找到引用源。 The results of the mediated effects regression are shown in the following columns. (1) column shows that the digital economy has a significant positive impact on the realization of common prosperity; (2) column shows that the regression coefficient of the digital economy is still positive and passes the 5% significance level, which further verifies that the development of the digital economy contributes to the increase of entrepreneurial activity; column (3) shows that the regression coefficient of the digital economy is still significantly positive and smaller than column (1) when entrepreneurial activity is also added to the benchmark regression model. The regression coefficient of the digital economy in column (1) is still positive and smaller than the regression coefficient of the digital economy in column (3), thus indicating that there is a partial mediating effect, suggesting that entrepreneurial activity is an important mechanism for the digital economy to influence the realization of shared prosperity, of which the mediating effect accounts for 15.58% $((0.211 \times 0.624) / 0.845)$, which verifies the research hypothesis 2 of this paper.

Table 7. Test results of the mechanism of the effect of digital economy on common prosperity.

Variables	(1)	(2)	(3)
	cp	pindi	cp
Dig	0.845** (0.361)	0.211** (0.0838)	0.714* (0.362)
Pindi			0.624** (0.274)
Constant	-0.220 (0.152)	-0.165*** (0.0352)	-0.117 (0.157)
Control variables	Control	Control	Control
Fixed time	Control	Control	Control
Area fixed	Control	Control	Control
N	279	279	279
R2	0.101	0.640	0.120

4.4.2. Threshold test

To accurately test the cut-off point of the impact of the digital economy on the common prosperity, this paper chose the level of openness to the outside world as the threshold variable for empirical testing. Firstly, we determine whether there is a threshold utility in the model, and conduct the single threshold test and double threshold test in turn, and the test results are shown in 错误!未找到引用源。 The results are shown in the following table. 错误!未找到引用源。 shows that the value of the single threshold is 0.07, which is significant at the 10% level; the p-value of the double threshold is 0.75 and the result is not significant. Therefore, only a single threshold exists. The threshold value of the single threshold is 0.6127, the lower limit of the confidence interval is 0.5899 and the upper limit is 0.6276.

Table 8. Threshold estimation results.

Models	F-value	P-value	10% Threshold	5% critical value	1% critical value	Threshold value	Confidence interval
Single Threshold	25.78	0.07	21.8415	27.3321	31.4533	0.6127	(0.5899, 0.6276)
Double Threshold	6.10	0.75	24.9014	38.5771	54.1428		

The regression results of the parameters of the threshold model show that there are significant differences in the impact of the digital economy on the common prosperity in different threshold intervals (see Table 9).

Specifically, in the interval below the threshold, i.e., when the foreign trade dependence is less than 0.6127, the likelihood of achieving common prosperity increases by 1.291 percentage points for each percentage point increase in the development level of digital economy, and it passes the 1% significance test. When crossing the threshold of 0.6127, the regression coefficient of digital economy is not significant. This proves the research hypothesis H3 of this paper.

Table 9. Threshold model regression results.

Variables	Regression coefficient	Control variables	Fixed time	Area fixed	R2
Dig (open \leq 0.6127)	1.291*** (3.61)	Control	Control	Control	0.179
Dig (open $>$ 0.6127)	0.567 (1.62)	Control	Control	Control	

5. Conclusions and Policy Recommendations

This paper constructs a comprehensive measure of digital economy and common prosperity based on provincial panel data in China from 2011-2019, and empirically tests the impact of digital economy on common prosperity using fixed effects model, mediating effects model and threshold model, and draws the following conclusions: First, digital economy has a significant contribution to the realization of common prosperity, with the most significant impact on sharing and sustainability in common prosperity. and sustainability are the most significant; the above findings still hold through robustness tests using the reduced tail treatment, adjusted explanatory variables calculation method and instrumental variables method; the results of regional heterogeneity regressions prove that the digital economy promotes common prosperity more significantly in the central as well as western regions, has a weaker promotion effect on the northeastern region, and has no effect on the eastern region; second, the mediating effect test finds that the digital economy also has a significant positive impact on common prosperity by enhancing entrepreneurial activity; finally, the threshold test results show that the level of external openness affects the promotion of the digital economy on common prosperity.

Through the above analysis, this paper puts forward the following policy recommendations. First, China should continue to promote the development of the digital economy. The digital economy is an important component of China's current economic growth, and with the progress of science and technology, the further development of the Internet, big data, artificial intelligence, meta-universe, etc., the application of the digital economy will only become more extensive. However, China's digital technology is still facing the problem of foreign "neck", China must increase investment in research and development, training of personnel, early to master the core digital technology in their own hands, which is the key to the sustainable development of China's digital economy. Second, the realization of common prosperity must be placed in the general environment of the development of the digital economy. The development of digital economy is an important driving force to promote the realization of common prosperity. To address the imbalance in the development of digital economy among regions, the state and the government should expand the construction of new-generation information infrastructure such as 5G Internet and industrial Internet, especially to strengthen the construction of remote areas. Third, continue to promote "mass innovation and entrepreneurship". Studies have proved that the increase of entrepreneurial activity has a significant contribution to the realization of common prosperity. To a certain extent, entrepreneurial activity also reflects market dynamics, lowering the threshold for entrepreneurship and meeting the needs of people who want to start their own businesses. With a vibrant market and income for residents, life can be happier. Fourth, the level of openness to the outside world needs to be controlled within a certain range. The state and government need to grasp the demarcation point so that the goal of common prosperity can be reached faster in the era of growing digital economy.

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Declaration of Competing Interest

All the authors claim that the manuscript is completely original. The authors also declare no conflict of interest.

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