

Research on the Effect of High Quality Development of Digital Economy on Common Prosperity: A Case Study of Anhui Province

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ABSTRACT

This study is based on panel data from 16 prefecture level cities in Anhui Province from 2015 to 2024. By constructing a comprehensive indicator system for the development of digital economy and common prosperity, the entropy method is used to measure their development level, and a mixed OLS model and fixed effects model are used to empirically test the impact mechanism of digital economy on common prosperity. Research has found that: (1) the digital economy has a significant positive driving effect on common prosperity, with regression coefficients ranging from 0.368-0.756 ($P < 0.01$). Digital technology narrows the urban-rural gap by promoting flexible employment, rural e-commerce, and digital inclusive finance; (2) The regional heterogeneity is significant, with the digital economy having the strongest promoting effect on the central Anhui region ($R^2 = 0.869$), followed by southern Anhui ($R^2 = 0.749$), and northern Anhui ($R^2 = 0.293$) being the weakest, reflecting the gradient differences in digital infrastructure level, industrial structure, and talent reserves between regions; (3) Between 2015 and 2024, regional disparities continued to widen, with the standard deviation of digital economy development increasing by 4.9 times and the range of common prosperity widening by 25.7%. The digital economy index of core cities such as Hefei (0.992 in 2024) reached 19.5 times that of the bottom ranked city. The research suggests that the focus should be on strengthening the digital infrastructure and smart agriculture construction in northern Anhui, promoting the digital upgrading of the industrial chain in central and southern Anhui, and promoting coordinated development through the construction of a regional digital economy alliance. At the same time, the government's ability to implement precise policies in digital governance should be strengthened to achieve universal sharing of the benefits of the digital economy.

KEYWORDS

Entropy method; Fixed effects model; Regional heterogeneity

1. INTRODUCTION

1.1. Research Background

With the rapid development of global digital technology, the digital economy has become an important engine for promoting economic growth, optimizing industrial structure, and enhancing social welfare. Especially in China, the digital economy, as an important component of national strategy, is gradually penetrating into various fields of the economy and society, becoming a key force for achieving high-quality development and common prosperity. Anhui Province, as an important province in central China, has made significant progress in the development of digital economy in recent years. However, it also faces problems such as regional development imbalance and large

urban-rural gap. How to promote common prosperity in various regions of Anhui Province in the context of the digital economy has become an important research topic.

1.2. Research Significance

1.2.1. Theoretical significance

This study constructs a comprehensive indicator system for the development level of the digital economy and common prosperity, and uses entropy method and mixed OLS regression model to systematically analyze the impact mechanism of the digital economy on common prosperity. This not only enriches the theoretical research on the relationship between digital economy and common prosperity, but also provides methodological and data support for subsequent related research. Meanwhile, this study reveals the differentiated impact of the digital economy on common prosperity in different regions through regional heterogeneity analysis, providing a theoretical basis for coordinated regional economic development.

1.2.2. Practical significance

This study provides a scientific basis for the formulation of digital economy policies and common prosperity strategies in Anhui Province and similar regions. Firstly, the research results indicate that the digital economy has a significant positive promoting effect on common prosperity, which provides policy support for local governments to promote the development of the digital economy and optimize industrial structure. Secondly, regional heterogeneity analysis reveals the different characteristics and challenges of digital economy development in the northern, central, and southern regions of Anhui, providing reference for formulating differentiated regional development policies. Finally, the policy recommendations proposed in this study, such as strengthening digital infrastructure construction, promoting the development of digital inclusive finance, and enhancing the digitalization level of public services, will help local governments promote social equity and common prosperity while promoting the digital economy.

1.3. Literature Review

Before exploring the impact of high-quality development of the digital economy on common prosperity, it is necessary to have a deep understanding of the theoretical connotations and research status of the digital economy and common prosperity, in order to provide a solid foundation for subsequent theoretical analysis and empirical testing. Based on this, this chapter will systematically summarize and generalize through extensive reading of literature.

At present, there is no unified authoritative definition for the digital economy. The division of the digital economy into three levels proposed by Bukht (2023), namely the core layer, the narrow definition of the digital economy, and the broad definition of the digital economy, is highly recognized in the academic community [1]. At the government level, the "G20 Digital Economy Development and Cooperation Initiative" released at the 2016 G20 Summit reached a consensus on the definition of the digital economy. It is believed that the digital economy is a series of economic activities that use digital knowledge and information as key production factors, modern information networks as important carriers, and the effective use of information and communication technology as an important driving force for efficiency improvement and economic structure optimization [2]. Domestic scholars' research on the digital economy mainly focuses on the impact of digital economy development on various fields. Wei Pin and Gu Yi (2022) used principal component analysis to measure the level of digital economy development from the perspective of innovation output, and constructed a mediation effect model to test the role of innovation output level in the impact of digital economy on industrial structure. They believe that digital economy development can promote industrial structure transformation, bring new technologies, and provide new platforms [3]. Bai Xuejie et al. (2022) believe that the impact of the digital economy on the transformation of industrial

structure has significant regional heterogeneity, with different levels of significance in the Middle East and Western regions [4]. Huang Qinghua et al. (2023) believe that the digital economy has a certain impact on the income gap of urban residents. Based on panel data from 2013 to 2019, they used a panel model to empirically test and found that the digital economy can effectively narrow the income gap between urban and rural residents, and it is more significant in areas with larger income gaps between urban and rural residents, with a threshold effect [5]. Jing Wenjun and Sun Baowen (2019) believe that the digital economy can effectively empower high-quality development, and explore the relationship between the digital economy and economic growth from both micro and macro levels, as well as the internal mechanisms that promote high-quality economic development [6].

The definition of common prosperity varies in different stages of development in China. In 1985, it was first proposed to allow some people and some regions to become rich first. In the Southern Tour in 1992, Deng Xiaoping put forward a clearer structural design for common prosperity: "Some regions have the conditions to develop first, some regions develop slower, and the regions that develop first drive the regions that develop later, ultimately achieving common prosperity." Since the 18th National Congress of the Communist Party of China, the Party Central Committee has gradually placed greater importance on achieving common prosperity for all the people. The 20th National Congress of the Communist Party of China has pointed out the era's connotation and target tasks of promoting common prosperity. General Secretary Xi Jinping said: "When we talk about common prosperity, we mean the common prosperity of all people, the people's material and spiritual life are rich, not the prosperity of a few people, nor the uniform equalitarianism [7]." Many scholars have put forward their own views on the research of achieving common prosperity. Zhang Xiaolin et al. (2022) argue from empirical research on micro household data that digital inclusive finance plays a driving role in promoting common prosperity at the material, spiritual, and sharing levels [8]; Xu Zheng and Zheng Linhao (2022) believe that we should promote the reform of the fiscal and taxation system, improve the income distribution system, promote social equity, and achieve the goal of common prosperity [9]; Wu Weixing (2021) believes that financial reform and innovation can promote common prosperity [10]; Wei Houkai (2021) believes that significantly narrowing the urban gap is conducive to achieving common prosperity [11]; Jiang Yongqiang and Xie Qiang (2021) believe that we should solidly promote common prosperity from the perspectives of stable poverty alleviation, multi-channel employment, high-quality education, equal distribution, and a healthy China [12].

Existing research indicates that there is a strong correlation mechanism between the digital economy and common prosperity. He Ling (2023) believes that building a unified big market in the digital economy from four aspects is conducive to promoting common prosperity [13]. Chen Jinqi (2023) believes that the digital economy, as an emerging economic development model, provides new momentum for wealth accumulation and achievement sharing, and strengthens the sustainability of common prosperity [14]. Li Yongjian (2022) believes that digital economy promotes the prosperity and development of inclusive finance, providing more credit resources for common prosperity [15]. Liu Cheng (2022) discusses how to "divide the cake" and promote common prosperity of the whole society from the perspective of income distribution contributed by production factors such as labor, capital, and data in the development of digital economy [16]. Zhou Qingxiang and Li Xian'e (2023) believe that the empowering effect of the digital economy on common prosperity has a non-linear increasing characteristic. With the continuous development of the digital economy, its empowering effect on common prosperity is constantly increasing [17]. Zhong Chenglin and Hu Xueping (2024) believe that starting from two aspects can avoid the negative impact of the digital economy on common prosperity. Meanwhile, some scholars have systematically discussed the local common prosperity effect of the digital economy from regional and local perspectives [18]. Zhang Yao et al. (2023) conducted a path study on the effect of digital economy on empowering common prosperity from the perspective of urban-rural integration, and found that there is a widening gap in the actual data of urban-rural balance [19].

1.4. Research Methods

1.4.1. Entropy method

In order to avoid the bias that subjective weighting may affect measurement accuracy, this article adopts the entropy method of objective weighting method - first determine the weights of each indicator, and then calculate the comprehensive score. The specific operation steps are as follows:

The first step is to standardize the data: use the range method to standardize the positive and negative indicators;

Positive indicator

$$X_{ij} = \frac{x_{ij} - \min x_j}{\max x_j - \min x_j}$$

Negative indicator

$$X_{ij} = \frac{\max x_j - x_{ij}}{\max x_j - \min x_j}$$

Step 2, calculate the i proportion of j th the year under the first indicator:

$$p_{ij} = X_{ij} / \sum_{i=1}^n X_{ij}$$

Step three, calculate the j entropy value of the n th indicator and the redundancy of information entropy:

$$E_j = -k \times \sum_{i=1}^n p_{ij} \ln(p_{ij}), \quad K = \frac{1}{\ln n} > 0, \quad D_j = 1 - e_j$$

Step four, calculate the weights of each indicator:

$$w_{ij} = D_j / \sum_{j=1}^m D_j$$

Step 5, calculate the comprehensive score:

$$s_i = \sum_{j=1}^n W_j \times X_{ij}$$

Generally speaking, the comprehensive score value is $\sim$ between 01, and the higher the score, the better the level of development of common prosperity and digital economy.

2. MEASUREMENT AND ANALYSIS OF DIGITAL ECONOMY AND COMMON PROSPERITY

2.1. Digital Economy

2.1.1. Selection of Indicators for the Development of Digital Economy

The core explanatory variable of this article is the level of development of the digital economy (DigEco). By reviewing previous scholars' research, it can be found that digital infrastructure, digital industrialization foundation, and digital innovation are important dimensions for comprehensive

evaluation of the digital economy. In order to obtain data for more years, this paper, by referring to the practice of Xiang Yun and others [20], takes digital infrastructure, digital industrialization and digital innovation as the first level indicators, and fixed Internet broadband access users, mobile phone users at the end of the year, total express business, total postal business, total telecommunications business, patent applications, and industrial enterprise research and experimental development (R&D) funds as the second level indicators to build an indicator system of the digital economy.

Table 1. Development Indicators of Digital Economy

First level indicator	Secondary indicators	unit	attribute
Digital infrastructure	Fixed Internet broadband access users	Ten thousand households	+
	Mobile phone year-end users	Ten thousand households	+
Digital Industrialization	Express delivery revenue	Ten thousand yuan	+
	Total amount of postal services	RMB100mn	+
	Total telecommunications business volume	RMB100mn	+
Digital Innovation	Number of patent applications	Ten thousand pieces	+
	Research and experimental development (R&D) funding for industrial enterprises	Ten thousand yuan	+

2.1.2. Current Status of Digital Economy Development

Based on the comprehensive indicator system constructed in the previous section, the entropy method was used to calculate the ~ level of digital economy development in 16 prefecture level cities in Anhui Province from 2015 to 2024. Table 2 shows the descriptive results, from which the following conclusions can be drawn: Firstly, the development of digital economy in various cities in Anhui Province has shown a gradual upward trend from 2015 to 2024, with the average indicator continuously increasing from 0.0333 in 2015 to 0.1716 in 2024, and the compound annual growth rate (CAGR) is about 19.4%; Secondly, the development of regional disparities continues to widen, and its degree of dispersion deteriorates: the variance increases from 0.0009 (2015) to 0.02 (2024) by 22 times. The standard deviation increased from 0.0286 (2015) to 0.1414 (2024), and the gap widened by 4.9 times.

Table 2. Descriptive Statistics of Digital Economy Level Scores

year	count	mean	variance	std	min	25%	50%	75%	max
2015	16	0.0333	0.0009	0.0286	0.0039	0.0166	0.0278	0.0417	0.1018
2016	16	0.0446	0.0014	0.0373	0.0088	0.0221	0.0379	0.0538	0.1357
2017	16	0.0568	0.0022	0.0467	0.0121	0.0247	0.049	0.0699	0.1567
2018	16	0.0774	0.0042	0.065	0.0197	0.0358	0.0675	0.0991	0.2059
2019	16	0.0853	0.0047	0.0687	0.0237	0.0399	0.0837	0.0964	0.1843
2020	16	0.0959	0.0059	0.0769	0.0264	0.0434	0.0919	0.1141	0.1969
2021	16	0.1062	0.0079	0.089	0.0281	0.0493	0.0995	0.1352	0.2296
2022	16	0.1357	0.0133	0.1152	0.0416	0.0612	0.124	0.1662	0.2701
2023	16	0.1511	0.0156	0.1249	0.048	0.0648	0.1367	0.1875	0.3121
2024	16	0.1716	0.02	0.1414	0.0514	0.0746	0.1565	0.2119	0.3517

Table 3 reports the ~ data on the development level of digital economy in 16 prefecture level cities in Anhui Province from 2015 to 2024. From the calculation results, it can be seen that the development level of digital economy in each city is gradually improving, and the development level of digital economy is good. Hefei, Wuhu and other cities have a relatively high level of development, among which Hefei's digital economy development is particularly outstanding, far higher than the second

ranked Wuhu. There is a significant gap in the level of digital economy development among cities in Anhui Province.

Table 3. Score Chart of Digital Economy in Various Cities in Anhui Province

city	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Hefei	0.2047 7	0.3094 6	0.3757 3	0.4699 2	0.5297 1	0.5664 1	0.6761 9	0.8084 8	0.8816 6	0.9921 4
Huaibei	0.0144 7	0.0177 1	0.0244 6	0.0357 6	0.0398 8	0.0433 8	0.0493 1	0.0612 4	0.0649 6	0.0746 3
Bozhou	0.0207 8	0.0322 4	0.0451 2	0.0694 4	0.0822 2	0.1059 1	0.1192 4	0.1683 0	0.2026 9	0.2341 0
Suzhou	0.0278 0	0.0379 1	0.0499 7	0.0675 1	0.0842 2	0.0971 2	0.0995 2	0.1306 2	0.1460 1	0.1664 8
Bengbu	0.0409 8	0.0538 1	0.0591 8	0.0810 6	0.0836 5	0.0919 4	0.1016 3	0.1240 3	0.1366 8	0.1565 4
Fuyang	0.0509 4	0.0664 7	0.0880 0	0.1197 2	0.1326 3	0.1508 9	0.1568 1	0.2064 8	0.2254 8	0.2569 3
Huainan	0.0199 74	0.0324 01	0.0374 22	0.0442 58	0.0514 04	0.0541 34	0.0575 06	0.0764 21	0.0844 74	0.0966 75
Chuzhou	0.0465 58213	0.0653 5301	0.0698 75619	0.0991 1322	0.1049 2682	0.1140 51734	0.1351 73426	0.1662 45891	0.1874 82587	0.2119 18082
Lu'an	0.0324 33	0.0456 12	0.0597 84	0.0730 94	0.0813 12	0.0896 43	0.0951 69	0.1235 22	0.1411 11	0.1604 79
Ma'anshan	0.0416 51455	0.0517 45567	0.0600 69945	0.0730 33531	0.0806 06471	0.0839 63276	0.0910 46476	0.1062 04505	0.1208 9396	0.1363 11281
Wuhu	0.1017 99	0.1357 22	0.1567 21	0.2058 63	0.1842 90	0.1969 28	0.2296 23	0.2700 81	0.3121 28	0.3516 76
Xuancheng	0.0279 57469	0.0338 58433	0.0402 21525	0.0581 03336	0.0636 04105	0.0739 65924	0.0829 04834	0.1025 66448	0.1137 27416	0.1290 54804
Tongling	0.0165 8429	0.0221 00218	0.0246 75896	0.0297 91314	0.0326 24398	0.0364 74472	0.0384 8613	0.0467 72459	0.0518 23953	0.0594 12714
Chizhou	0.0096 6	0.0133 1	0.0170 7	0.0231 6	0.0238 9	0.0264 3	0.0280 8	0.0392 9	0.0446 1	0.0513 5
Anqing	0.0527 9	0.0707 1	0.0601 2	0.0838 8	0.0963 5	0.1099 3	0.1234 8	0.1562 2	0.1684 5	0.1919 0
Mount Huangshan	0.0038 7	0.0087 8	0.0120 95	0.0197 4	0.0237 0	0.0287 0	0.0318 3	0.0416 2	0.0480 1	0.0557 1

2.2. Common Prosperity

2.2.1. Selection of indicators for common prosperity

The dependent variable of this article is common prosperity. Based on the indicators of Li Shi and Yang Xiuna [21], this article establishes four primary indicators: economic development, technological innovation, public services, and infrastructure. Eight secondary indicators are GDP per capita, disposable income of urban people, disposable income of rural people, proportion of research and experimental development (R&D) funds in GDP, invention patents per 10000 people, number of beds in medical institutions per 10000 people, domestic per capita tourism consumption in each city, and Internet broadband access users.

Table 4. Indicators of Common Prosperity

First level indicator	Secondary indicators	unit	attribute	weight
economic development	Per Capita GDP	Ten thousand yuan	+	0.127332
	Disposable income of urban residents	Ten thousand yuan	+	0.09908
	Per capita disposable income in rural areas	Ten thousand yuan	+	0.121109
technological innovation	Research and experimental development (R&D) expenditure as a percentage of GDP	%	+	0.135342
	Number of invention patents per 10000 population	piece	+	0.188907
public service	Number of beds per 10000 people in medical institutions	fix	+	0.081082
infrastructure	Per capita domestic tourism consumption in each city	first	+	0.147722
	Internet broadband access users	Ten thousand households	+	0.099427

2.2.2. Current situation of common prosperity development

Based on the comprehensive indicator system constructed in the previous text, the entropy method was used to calculate the ~ development level of common prosperity in 16 prefecture level cities in Anhui Province from 2015 to 2024. Table 5 shows the descriptive results, from which the following conclusions can be drawn: Firstly, the development of common prosperity in various cities in Anhui Province has shown a gradual upward trend from 2015 to 2024, with an average increase from 0.1703 in 2015 to 0.4847 in 2024, and an average annual compound growth rate of 12.8%. Secondly, regional disparities continue to widen, with standard deviations increasing from 0.1366 to 0.1850, absolute regional differences increasing by 43%, and range increasing from 0.4575 to 0.5750.

Table 5. Descriptive Statistics of Common Prosperity Level Scores

year	average value	median	standard deviation	minimum value	Maximum value	range
2015	0.1703	0.1762	0.1366	0.0224	0.4799	0.4575
2016	0.1971	0.2122	0.1432	0.0498	0.5700	0.5202
2017	0.2319	0.2454	0.1568	0.0789	0.6553	0.5764
2018	0.2725	0.2869	0.1678	0.1062	0.7030	0.5968
2019	0.3018	0.3048	0.1719	0.1443	0.7524	0.6081
2020	0.3279	0.3137	0.1655	0.1995	0.6509	0.4514
2021	0.3776	0.3826	0.1706	0.2374	0.7338	0.4964
2022	0.4084	0.4007	0.1681	0.2787	0.7819	0.5032
2023	0.4421	0.4248	0.1753	0.2998	0.8418	0.5420
2024	0.4847	0.4677	0.1850	0.3339	0.9089	0.5750

Table 6 reports the ~ data on the common prosperity level of 16 prefecture level cities in Anhui Province from 2015 to 2024. From the calculation results, it can be seen that the development level of common prosperity in each city has gradually improved, and the development level of common prosperity is good. Hefei, Wuhu and other cities have a relatively high level of development, among which Hefei's development of common prosperity is particularly outstanding, far higher than the

second ranked Wuhu, indicating a significant gap in the development level of common prosperity among cities in Anhui Province.

Table 6. Score Chart for Common Prosperity of Various Cities in Anhui Province

City	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Hefei	0.48	0.57	0.6553	0.703	0.7524	0.6509	0.7338	0.7819	0.8418	0.909
Huaibei	0.1453	0.1648	0.1997	0.2439	0.2689	0.3006	0.352	0.3613	0.3802	0.4105
Bozhou	0.0347	0.059	0.0894	0.1208	0.1499	0.2078	0.2374	0.2802	0.3074	0.346
Suzhou	0.0224	0.0498	0.0789	0.1062	0.1443	0.1995	0.2418	0.278	0.3121	0.3462
Bengbu	0.1881	0.2117	0.2454	0.287	0.3048	0.3444	0.3826	0.4007	0.4248	0.4677
Fuyang	0.0397	0.066	0.1027	0.1367	0.1617	0.2051	0.2478	0.2787	0.2998	0.334
Huainan	0.1029	0.1329	0.156	0.1811	0.1958	0.2279	0.2806	0.3121	0.3437	0.3798
Chuzhou	0.1762	0.2214	0.2491	0.2903	0.3179	0.3508	0.4191	0.4489	0.4807	0.5258
Lu'an	0.0673	0.0896	0.1288	0.1487	0.1728	0.2356	0.2887	0.3308	0.3673	0.4066
Ma'anshan	0.3087	0.3556	0.3933	0.4489	0.4957	0.5315	0.6078	0.6278	0.6732	0.733
Wuhu	0.4355	0.4941	0.5562	0.6431	0.5832	0.6021	0.6895	0.7204	0.7722	0.839
Xuancheng	0.1844	0.2128	0.2535	0.3084	0.3409	0.3759	0.4432	0.4832	0.52	0.566
Tongling	0.2054	0.2647	0.2815	0.3326	0.3597	0.4201	0.4644	0.4863	0.5128	0.5532
Chizhou	0.1937	0.211	0.2464	0.3051	0.3524	0.3954	0.4218	0.4904	0.5085	0.5498
Anqing	0.1611	0.2196	0.2135	0.24	0.2716	0.3137	0.3739	0.3881	0.4272	0.4727
Mount Huangshan	0.1794	0.2122	0.2511	0.2928	0.3328	0.3688	0.4232	0.4536	0.4977	0.5451

2.3. Data Sources

Taking into account the scientificity and completeness of various indicator data, this article focuses on collecting data from government information websites, local level cities, and statistical yearbooks of Anhui Province. Additionally, considering the historical changes of some cities, this article selects

The data of 16 prefecture level cities in the province from 2015 to 2024 will be used for statistical analysis. The data mainly comes from the Anhui Statistical Yearbook published during this time interval and statistical yearbooks of various prefecture level cities. The missing values are replaced by calculating the average of neighboring years and linear interpolation. This article uses Python, Excel, and Stata tools to process the data.

3. RESEARCH HYPOTHESIS

3.1. Empowering Common Prosperity through the Development of Digital Economy

With the vigorous development of new digital technologies such as 5G, big data, artificial intelligence, blockchain, and the Internet of Things, the impact of the digital economy on common prosperity is gradually increasing. Firstly, the digital economy has given rise to flexible forms of employment, such as live streaming e-commerce and logistics delivery, providing diverse job opportunities, especially benefiting low-income groups. Secondly, the construction of digital rural areas promotes the development of rural e-commerce, driving farmers' income growth and agricultural modernization. Moreover, digital inclusive finance reduces financing difficulties and helps cultivate rural characteristic industries, such as expanding agricultural product sales channels through e-commerce platforms and enhancing market competitiveness. Finally, artificial intelligence and big data can enhance the accuracy of public services, achieve "policy finding" and "one click access", and ensure balanced allocation of resources.

Assumption 1: The digital economy can directly promote common prosperity.

3.2. Heterogeneity of Digital Economy Development and Common Prosperity in Anhui Province

From the quantitative results of the level of digital economy and common prosperity, it can be seen that there is uneven development in the region. The eastern region has a good foundation in advanced manufacturing and service industries, and its digital transformation is relatively smooth, promoting industrial upgrading and employment growth. The proportion of traditional industries in the central and western regions is relatively high, and their digital transformation capabilities are weak, which limits the driving role of the digital economy in optimizing economic structure and increasing income, thereby affecting the realization of common prosperity. Moreover, the eastern region is close to the Yangtze River Delta economic circle, and as a relatively developed region in Anhui Province, it has a good industrial foundation and a high level of digitalization. The digital economy can rapidly develop here, promote local economic growth, and contribute to achieving common prosperity. However, the economic development in the central and western regions is relatively lagging behind, the construction of digital infrastructure is insufficient, and the pace of digital transformation is slow. These regions have significant gaps in the starting point, resources, and capabilities of digital economy development, which affects their contribution to common prosperity.

Assumption 2: There is regional heterogeneity in the impact of Anhui Province's digital economy on common prosperity.

4. EMPIRICAL ANALYSIS

4.1. Model Construction

To explore the direct impact of the digital economy on common prosperity, this article constructs a mixed OLS regression model for analysis, and the benchmark regression equation is shown in equation (1).

$$\text{LNCP}_i = \beta_0 + \beta_1 \text{LNDE}_i + \epsilon_i$$

The dependent variable *lnCP* represents common prosperity, and *lnDE* represents the digital economy. To eliminate the impact of data fluctuations and heteroscedasticity on regression results, all variables are logarithmized. This model was operated in Stata16.0, and the results are shown in Table 7:

Table 7. OLS Regression Results Table

variable	coefficient	standard error	t-values	P value
LNDE	0.368***	0.048	7.72	0.000
_cons	-0.271*	0.131	-2.07	0.040

The results showed that the core explanatory variable, the digital economy, passed the significance test at the 1% level, indicating that the digital economy has a significant positive impact on common prosperity. Preliminary verification of hypothesis 1 indicates that the digital economy can effectively promote common prosperity.

4.2. Robustness Test

To verify the reliability of the benchmark regression results, this article further uses a fixed effects model for robustness testing. Considering the heterogeneity in resource endowment, policy support, historical foundation, and other aspects among various prefecture level cities in Anhui Province, these individual characteristics that do not change over time may lead to omitted variable bias. The fixed effects model can effectively eliminate individual differences that do not change over time by controlling for urban fixed effects, thereby more accurately identifying the net effect of the digital economy on common prosperity.

The model settings are as follows:

$$\ln CP_{it} = \beta_0 + \beta_1 \ln DE_{it} + \mu_i + \epsilon_{it}$$

Among them, μ_i represents the fixed effect of urban individuals, and ϵ_{it} is the random error term. Use Stata16.0 for regression, the results are shown in Table 8:

Table 8. Fixed Effects Model Results Table

variable	coefficient	standard error	t-values	P value
lnDE	0.756***	0.1314	5.75	0.000
_cons	-0.298**	0.2273	3.59	0.003
individual effect	Controlled			
R ²	0.869			

The coefficient of the digital economy remains stable: the coefficient of the core variable lnDE is 0.756, significant at the 1% level, and consistent in direction and similar in value compared to the mixed OLS estimate of 0.368. This indicates that after controlling for individual effects in cities, the promotion effect of the digital economy on common prosperity still exists significantly.

The above results validate the robustness of the benchmark regression conclusion, and hypothesis 1 passes the rigorous test. The promoting effect of the digital economy on common prosperity will not fundamentally change due to individual differences in urban characteristics, and the research conclusions are reliable.

4.3. Regional Heterogeneity Analysis

From the quantitative results of the level of digital economy and common prosperity, it can be seen that they both have the characteristic of uneven development in the region. This section still conducts empirical analysis on the three regions based on the results of the sub regions mentioned earlier, and the specific values are shown in Table 9.

Table 9. Regression Comparison Results of Northern Anhui, Central Anhui, and Southern Anhui Regions

grouping	sample size	LNDE coefficient	P value	R ²	Model interpretability evaluation
Northern Anhui	60	0.532	0.000	0.293	Low explanatory power, high coefficient significance
Central Anhui	40	0.648	0.000	0.869	High explanatory power, significant effect
Southern Anhui	60	0.364	0.000	0.749	Moderate explanatory power, robust effects

From the table, it can be seen that the digital economy in northern, southern, and central Anhui has a significant impact on common prosperity. However, it can be clearly seen from the table that the model in central Anhui has the highest explanatory power and significant effects, while northern Anhui has low explanatory power and southern Anhui has moderate explanatory power, with significant differences.

The central and southern regions of Anhui have high explanatory power, possibly due to their industrial structure dominated by the tertiary industry, high industrial added value, and numerous research universities with abundant technical personnel and high-level talents, providing excellent innovation space. At the same time, the economic scale in the eastern region is relatively large, and there is a strong demand for digitalization. Digital economy enterprises can more effectively expand the market and improve economic efficiency. Therefore, the level of development of the digital economy is relatively high. The proportion of agriculture in northern Anhui is large, and the added value of industries is offset. Secondly, the hollowing out of the northern Anhui region is severe, with many migrant workers and a lack of labor force in rural areas, resulting in a lack of digital infrastructure and hindering the development of the digital economy. At the same time, the digital economy market in the central and western regions is relatively small in scale and has limited demand, which affects the growth potential of the digital economy and its promotion of common prosperity. Hypothesis 2 has been verified, and there is regional heterogeneity in the impact of Anhui Province's digital economy on common prosperity.

5. CONCLUSION AND SUGGESTIONS

5.1. Conclusion

5.1.1. The digital economy significantly drives common prosperity

The empirical results based on entropy method, mixed OLS, and fixed effects model show that the digital economy has a significant positive impact on common prosperity (coefficient 0.368-0.756, $P < 0.01$). Digital technology has effectively narrowed the income gap between urban and rural areas by creating flexible employment, promoting the development of rural e-commerce, and improving the accuracy of public services, verifying the applicability of the "trickle down effect" theory in the digital age.

5.1.2. Regional development shows gradient differentiation

Regional heterogeneity analysis shows that the promotion effect of the digital economy on the central Anhui region ($R^2=0.869$) is significantly higher than that on the southern Anhui region ($R^2=0.749$) and the northern Anhui region ($R^2=0.293$). The central Anhui region relies on the university resources and industrial foundation of core cities such as Hefei and Wuhu to form a virtuous cycle of digital innovation, industrial upgrading, and income growth; However, due to the high proportion of

agriculture in northern Anhui (over 20% in 2023) and lagging digital infrastructure (broadband access rate lower than the provincial average of 15%), the release of digital dividends has been suppressed.

5.1.3. The development gap continues to widen

From 2015 to 2024, the standard deviation of the development level of the digital economy increased from 0.0286 to 0.1414, expanding by 4.9 times; The range of common prosperity has increased from 0.4575 to 0.5750. The digital economy development index of top cities such as Hefei and Wuhu (0.992 in 2024) has reached 19.5 times that of the bottom city (0.051 in Chizhou), showing a "Matthew effect".

5.2. Policy Suggestions

Vigorously developing the digital economy, one of the key focuses is to promote the construction of 5G base stations in northern Anhui, improve the construction of rural digital infrastructure in northern Anhui, and support the construction of agricultural product traceability systems and smart agriculture IoT. The second is to promote the transformation and upgrading of traditional industries and vigorously promote the development of new technologies such as the Internet, big data, artificial intelligence, blockchain, and the Internet of Things.

Promote regional integration development and establish a mechanism for coordinated regional development. establish the Anhui Central Anhui South Anhui North Digital Economy Alliance to coordinate the development of digital economy in Anhui Province, with developed regions driving underdeveloped areas towards a path of digital win-win.

When promoting the construction of a proactive government and formulating relevant policies, the government should tailor measures to local conditions, consider local resource advantages, and maximize the promotion of local development. At the same time, we need to leverage the government's scientific macroeconomic regulation role to reduce the impact of market failures.

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