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Measuring the Development Level of Digital Economy: Taking 16 Prefecture-level Cities in Anhui Province as an Example

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Abstract: The digital economy has become the 'new engine' of economic growth with the development of information technology. Under the new normal of China's economy shifting from high-speed growth to high-quality development growth, the digital economy will become the direction and breakthrough of the new round of economic growth. Measuring the digital economy comprehensively and accurately has become a key part of the development of the digital economy. This paper constructed an evaluation index system for the development level of the digital economy of 16 prefectural-level city in Anhui Province based on municipal panel data from 2011 to 2021 in relation to three dimensions: digital infrastructure, digital government, and digital society based on the entropy weighting method. Moreover, this article compared the development level of the central, northern, and southern regions of Anhui Province using the coefficient of variation and the Thiel index. The study's results indicated significant differences in the level of digital economy development among the 16 prefecture-level cities in Anhui Province across all three dimensions and the inter-regional differences of the digital economy development level in three regions of central, northern and southern of Anhui Province are also shrinking. Furthermore, the results of Thiel index found the differences contribute within region more than between, and this gap is widening. These results may help the policymakers to understand the current situation, problems and challenges of the digital economy in Anhui Province, and make corresponding policy recommendations.

1. Introduction

The digital economy has become a new trend in global economic development due to the continuous development of the Internet, big data, artificial intelligence, and other technologies. The new round of scientific and technological revolution and industrial change is developing in depth, and digital transformation has become a general trend. Anhui Province's digital economy has experienced rapid development in recent years due to the implementation of China's digital economy development strategy. However, despite this progress, there are still some challenges and issues that need to be addressed. There is no complete and accurate indicator system for measuring the level of

development of the digital economy in China. Anhui Province is a significant province in Chinese mainland, and its level of digital economy development has always been a topic of interest. Despite being a typical agricultural province with a relatively backward economic structure and a high proportion of traditional industries, the potential for digital economy development in Anhui Province remains untapped. Therefore, studying the development of the digital economy in Anhui Province is significant for understanding its current situation, problems, and challenges, and for proposing corresponding policy recommendations. This paper uses municipal panel data from 2011 to 2021 of Anhui Province to construct an evaluation index system for the level of digital economy development. The system is based on three dimensions: digital infrastructure, digital government, and digital society, aiming to provide references for the formulation and implementation of relevant policies.

Currently, the digital economy is a widely discussed topic in academia. Research on the digital economy can be divided into three main categories: One is about the construction of the digital economy index system and the analysis of influencing factors. Xu Qingyuan et al. reviewed research on theoretical systems and measurement methods of the digital economy to compare and evaluate 12 international and domestic digital economy-related indicator systems [1]. Jiao Shuantao et al. measured the development of China's digital economy and analysed its influencing factors. They found that urban isation, human capital, government behaviour, economic growth, trade openness, and advanced industrial structure have a positive impact on the development of the digital economy [2]. Xu Xianchun et al. measured China's digital economy value added and total output and other indicators from 2007 to 2017 based on an international perspective, and compared the results with those of the United States and Australia [3]. The second is to study the spatio-temporal characteristics of the digital economy in comparison with regional differences. Han Zhaoan et al. measured the scale of China's interprovincial digital economy and analyzed its characteristics, nonequilibrium and regional differences, and found that the upward trend of the scale of China's interprovincial digital economy is more obvious in the production stage of the digital economy, and there are significant regional differences, and the level of the digital economy in the eastern and central regions is polarized [4]. Wang Juanjuan et al. constructed a digital economy level indicator system and conducted an empirical study, and the results showed that China's regional economic development level can be divided into three major echelons, and the echelon layout is formed according to the distribution of urban agglomerations [5]. Pan Weihua et al. conducted an analysis of the spatial and temporal evolution of China's digital economy development and its dynamic distribution characteristics. The results indicate that the digital economy developed more rapidly in the East, followed by the Central, Northeast, and West regions[6]. Finally, the study examines the relationship between the digital economy and other industries. Tang Yaojia et al. investigated the impact of digital economy development on market structure and innovation performance. They constructed an endogenous growth model that includes data elements and found that digital economic development generally promotes innovation level improvement. However, the impact of the digital economy on innovation performance is typically dynamic and nonlinear [7]. In their study, Wan Xiaoyu et al. used an econometric model to investigate the impact of the digital economy on regional total factor productivity. The study found that the digital economy development index, digital infrastructure sub-index, digital industry sub-index, and digital convergence sub-index all had a significant positive effect on regional total factor productivity [8]. Huang Qinghua et al. conducted an empirical study on the impact of the digital economy on the income gap between urban and rural residents in China. They used provincial panel data from 2013 to 2019 and a panel model to investigate the mechanism of action. The results indicate that the development of the digital economy can significantly reduce the income gap between urban and rural residents in China [9]. Xu Weixiang et al. analyzed the impact of digital economic development on urban carbon emissions. Their findings suggest that digital economic development significantly reduces urban carbon emissions [10].

Current research on the digital economy has yielded significant results, but there are still some shortcomings. Firstly, the issue of measuring the level of domestic digital economy development is mostly limited to a provincial perspective and lakes a comparison of the level of digital economy development between prefecture-level cities for individual provinces. Secondly, there is inadequate and imprecise system indicator system available for measuring the level of development of China's digital economy. Therefore, this paper focuses on constructing a multidimensional indicator system taking Anhui Province as a case study from 2011 and 2021. The indicator system is developed based on three dimensions: digital foundation, digital government, and digital society, measured entropy weighting. The paper aims to fill the research gap in the assessment system of digital economic development by establishing a reasonable indicator system and adopting statistical analysis methods to measure the level of digital economic development. Simultaneously, the analysis of regional differences in digital economic development reveals the characteristics and disparities of digital economic development across various regions, which may offer a fresh perspective and foundation for the theoretical study of digital economic development.

The research in this paper has two main innovations. First is the innovation of the research object. This article focuses on the quantitative analysis of the level of digital economic development, which has not been extensively studied at the provincial and subordinate prefecture city levels. Most existing studies have focused on global, national, or specific regional levels. This paper is based on empirical evidence from Anhui Province and comprehensively measures and analyses the level of development of its digital economy. It can serve as a reference for Anhui Province and similar regions. Secondly, the research methodology is innovative. Most of the existing literature uses data published by official institutions such as the Bureau of Statistics. The selection and construction of indicators are typically limited to the existing data. Differently, this paper utilises Python software for data mining and word frequency analysis to construct indicators, which may enrich the existing indicator system and provide reference opinions for other researchers.

2. Construction of the indicator system

2.1. Establishment of indicators

Table 1: Comprehensive evaluation index system for the level of digital economy development.

Target level	Secondary indicators	Tertiary indicators
Level of Digital Economy (X)	Digital Infrastructure (X1)	Internet penetration (X11)
		Cell phone penetration (X12)
	Digital Government (X2)	Financial technological support (X21)
		Strength of policy support (X22)
	Digital Society (X3)	Digital Financial Inclusion Index (X31)
		Digital Innovation Vitality Index (X32)
		Intensity of human resources support (X33)
		Telecommunication services per capita (X34)
		Number of digital patent applications (X35)
		Level of industrial structure (X36)

The digital economy encompasses economic activities that utilise data resources as key production factors, modern information networks as important carriers, and the effective use of ICT as a driving force for efficiency enhancement and economic structure optimisation. The National Bureau of Statistics (NBS) has released the Statistical Classification of the Digital Economy and its Core Industries (2021). The report defines the scope of digital economy industries into five major

categories: digital product manufacturing, digital product services, digital technology application, digital factor-driven industries, and digitized efficiency enhancement industries. Counting the digital economy accurately under this guideline is difficult due to the lack of one-to-one correspondence between this statistical classification standard and the original national economic statistics. After reviewing the relevant literature, this paper comprehensively evaluates the development level of the urban digital economy from three aspects: digital infrastructure, digital government, and digital society. The evaluation is based on ten three-level indexes constructed under these three dimensions. Table 1 displays the comprehensive evaluation index system for the development level of the digital economy.

2.2. Data sources and indicator explanation

The data in this paper is primarily sourced from China Urban Statistical Yearbook the from 2011 to 2021. The Digital Financial Inclusion Index is obtained from the Beijing Digital Finance Research Center. The Digital Innovation Vitality Index is sourced from the Peking University Enterprise Big Data Research Center. The strength of policy support index is determined by analysing the frequency of words related to the digital economy in the working report of the Anhui provincial government. It is estimated by calculating the ratio of words related to the digital economy to the total word frequency.

The Digital Infrastructure can be measured by two factors: Internet penetration and Mobile phone penetration. Internet penetration is defined as the number of broadband internet users per 100 people, and mobile phone penetration is the number of mobile phones per 100 people. The level of Financial technological support is determined by the proportion of government expenditure on science and technology to regional GDP. Additionally, the level of digital innovation can be indicated by the number of digital patent applications per 1,000 people, and the Level of industrial structure can be reflected by the proportion of the tertiary industry to the total GDP.

2.3. Data processing

This paper selects data from 2011 to 2021 as the research sample based on an evaluation of the indicator system's comprehensiveness and data availability. The missing data is supplemented using the linear interpolation method. The entropy weight method is employed to assign weights to each indicator due to the different scales of each indicator, which may cause measurement errors. Hence, data normalization is imperative. The data in this paper was standardized using the mean and standard deviation of each indicator data, resulting in a more precise measurement.

3. Research methodology

3.1. Entropy weight method

The entropy method is an objective assignment technique that calculates the weight of each indicator based on its relative change degree on the system as a whole. This is done by measuring the information entropy of the indicator and assigning weights based on the degree of difference between the sign value of each indicator. Indicators with a larger degree of relative change are assigned a higher weight. The weight calculation process of the entropy weight method involves assuming that the data has n samples and m indicators. Table 2 displays the results of weight calculation

Step 1: Normalization process, eliminating the data outline, using the maximum and minimum values to convert the data of each indicator to between 0 and 1;

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

Step 2: Calculate the weight of each of the samples at i under the j indicator for that indicator;

$$p_{ij} = \frac{x_{ij}}{\sum_{i=1}^{n} x_{ij}} \quad (2)$$

Step 3: Calculate the entropy value of the j indicator e_j;

$$e_j = -k \sum_{i=1}^{n} p_{ij} \ln p_{ij} \quad (3)$$

Step 4: Use the entropy value e_j to derive the information entropy redundancy of the j indicator d_j;

$$d_j = 1 - e_j \quad (4)$$

Step 5: Calculate the weight of the j indicator based on the information entropy redundancy w_j;

$$w_j = d_j \Big/ \sum_{j=1}^{m} d_j \quad (5)$$

Table 2: Results of weight calculation.

Methods	Target level	Secondary indicators	Tertiary indicators
Entropy weight method	X (100%)	X1 (15.78%)	X11 (10.19%)
			X12 (5.59%)
		X2 (26.32%)	X21 (13.66%)
			X22 (12.66%)
		X3 (57.9%)	X31 (5.78%)
			X32 (12.79%)
			X33 (6.57%)
			X34 (22.18%)
			X35 (4.62%)
			X36 (5.96%)

3.2. The Coefficient of variation

This paper uses the standard deviation to mean ratio as a measure of the relative dispersion of observed data. The method is applied to measure the degree of difference in the development of the digital economy in Anhui Province. The formula for this method is as follows:

$$r = \frac{\sqrt{\sum_{i=1}^{n} (y_i - \bar{y})^2 / n}}{\bar{y}} \quad (6)$$

Where r is the coefficient of variation, $\bar{y}$ is the average value of regional digital economy, y_i is the development level of digital economy of each prefecture-level city in the region, and n is the sample size. The degree of difference in the level of regional digital economy development is smaller when the coefficient of variation is smaller. This means that there is less overall difference in the digital economy within the region.

3.3. The Thiel index

The Thiel index was developed as a method of calculating income level differences between individuals using the concept of information entropy. The index has the advantage of effectively splitting differences into intra-group and inter-group differences while calculating the contribution of each group's degree of difference to the total degree of difference. The formula for the Thiel index is as follows:

Firstly, the Thiel Index of the level of development of the digital economy is calculated:

$$T = \frac{1}{n}\sum_{i=1}^{n}\frac{p_i}{u}\ln\frac{p_i}{u} \tag{7}$$

Where T denotes the Thiel index of the comprehensive score of digital economy development level, $n=16$, p_i denotes the comprehensive score of digital economy development level of the i prefecture-level city, and u denotes the average value of the comprehensive score of digital economy development level of the 16 cities.

This paper employs the Thiel index method to analyse the differences within and between regions in the digital economy. The following are the specific steps for decomposition:

$$T = T_{WR} + \mathrm{T_{BR}} = \sum_{j=1}^{m} f_i \frac{u_j}{u} T_j + \sum_{j=1}^{m} f_i \frac{u_j}{u}\ln\frac{u_j}{u} \tag{8}$$

$$T_j = \frac{1}{m_k}\sum_{k=1}^{m_k}\frac{p_{ji}}{u_j}\ln\frac{p_{ji}}{u_j} \tag{9}$$

$$\text{Contribution rate within the region} = \frac{T_{WR}}{\mathrm{T}} \tag{10}$$

Where T_j denotes the Thiel Index of the j region, f_j denotes the proportion of the number of units in the j region to the total number of units, u_j denotes the average of the scores of the j region on the level of development of the digital economy, and p_{ji} denotes the comprehensive scores of the j region on the level of development of the digital economy in the i prefecture-level cities.

4. Empirical analysis

4.1. Comparative analysis of digital economy of prefecture-level cities

According to data from the China Academy of Information and Communications Technology, the digital economy in Anhui Province surpassed one trillion yuan in 2021, ranking 13th in the country. The digital economy has continued to grow rapidly, with a growth rate that ranks 10th in the country.

This growth rate has exceeded 10% for three consecutive years until 2023. As of the end of September this year, the province had built 47,848 5G base stations. In the first eight months of this year, the software service industry in Anhui Province generated a main business income of 62.42 billion yuan, a 24.1% increase from the previous year. The completed software business income was 38.8 billion yuan, a 30.5% increase year-on-year. The province is actively promoting enterprise digital transformation, with a focus on cloud-based digital empowerment. Currently, over 16,000 enterprises in Anhui Province have integrated with cloud resources.

The digital economy has developed differently in each prefecture-level city in Anhui Province due to the region's complex and diverse landscape, as well as its proximity to neighboring eastern coastal cities such as Jiangsu and Zhejiang to the east and west, and inland provinces such as Hubei, Jiangxi, and Henan to the south and north. Table 3 shows the measurement results of digital economy level based on entropy weight method.

Table 3: Measurement results of digital economy level based on entropy weight method.

City	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Hefei	21.05	24.2	30.27	34.12	44.17	55.61	59.32	68.14	67.23	81.16	79.46
Wuhu	21.11	25.3	28.96	36.31	44.35	53.7	57.56	66.6	55.06	60.89	68.08
Bengbu	12.4	15.44	20.02	20.49	26.23	29.31	30.04	33.57	35.83	40.42	44.72
Huainan	9.94	14.75	18.69	18.56	21.38	24.12	26.09	25.93	32	31.87	38.23
Maanshang	11.65	15.63	20.94	23.06	28.61	33.71	34.57	40.59	42.02	52.53	54.87
Huaibei	7.25	9.39	11.78	15.85	18.62	21.52	23.6	28.78	31.47	35.02	41.88
Tongling	19.25	25.85	32.45	33.83	31.68	29.5	30.46	34.92	44.65	48.06	47.51
Anqing	9.17	11.37	12.42	18.17	22.88	26.95	25.32	26.91	29.93	34.94	40.51
Huangshan	19.53	22.47	24.36	24.45	27.5	29.58	32.74	39.33	38.55	43.47	46.77
Chuzhou	10.21	15.39	16.67	19.9	22.62	26.89	28.74	36.86	31.68	36.98	37.53
Fuyang	4.41	5.65	6.9	9.47	13.56	15.27	21.44	22.79	24.65	27.73	32.11
Suzhou	4.67	6.68	10.36	14.22	19.22	25.33	26.72	27.83	25.94	30.88	36.33
Lu’an	5.06	7.82	8.38	13.46	18	20.87	38.67	36.43	38.61	41.45	44.82
Bozhou	5.34	6.61	9	10.26	13.91	16.28	23.25	25.26	25.9	29.31	29.4
Chizhou	11.71	14.48	16.97	19.23	23.05	27.4	27.12	32.4	30.55	35.23	38.95
Xuancheng	13.73	15.9	20.61	25.72	26.68	30.15	33.82	37.87	39.57	43.77	44.69
Bozhou	3.83	6.47	10.66	13.32	17.83	22.08	30.63	33.31	34.09	38.34	39.55
Chizhou	14.04	17.22	22.78	25.53	30.45	35.18	37.09	41.8	42.03	46.87	51.73
Xuancheng	15.67	18.7	24.78	30.55	32.68	37.55	41.87	46.98	49.58	53.78	56.21

There are significant differences in the development of individual cities. In terms of the development level of each prefecture-level city, Hefei, Wuhu, and Maanshan city have maintained a high level of development in the digital economy from 2011 to 2021. Maanshan has experienced the fastest rate of growth in the ranking of the province. Wuhu and Maanshan city are situated in the eastern part of Anhui Province, in close proximity to the economically developed areas of the Yangtze River Delta, such as Nanjing city, which makes them well-suited for the development of the digital economy. Hefei city is leveraging its status as the capital city to create a highland for the digital economy. As part of this effort, the city has introduced a special plan for the development of the digital economy. Conversely, the level of digital economy development of Fuyang, Bozhou and Suzhou city has been at the bottom of the province. The three cities are located in the northern part of Anhui Province and their main industries are agriculture and agricultural by-products. The infrastructure in these cities is relatively weak, resulting in an overall value chain that is at the lower end. As a result, there is greater pressure for transformation and upgrading, making it more difficult for the economy to develop outwardly compared to other cities.

In terms of digital infrastructure, the annual rates of Internet and cell phone penetration in each prefecture-level city of Anhui Province have been fluctuating and increasing. Hefei, Chizhou, Maanshan, and Huangshan are leading the province in this regard. While the digital economy infrastructure level of four prefectural-level cities, namely Fuyang, Huainan, Bozhou, and Lu'an, is relatively low. The level of development in this area is approximately half that of Hefei. The internet penetration rate in the four prefectural-level cities is approximately 30%, and the cell phone penetration rate is around 68%. The digital infrastructure development in Hefei city, Xuancheng, Huangshan, and Chizhou city is at a higher absolute level than in other prefectures in Anhui Province.

Regarding digital digital government, the digital government score of each prefecture-level city has been fluctuating and rising as a whole, with a development rate exceeding 150%. Upon closer examination, it appears that Wuhu has been providing the highest level of support for digital economy policy and financial expenditure in the province. Meanwhile, Hefei and Tongling have digital government development levels that are on par with the provincial average. However, Bozhou, Chizhou, and Lu'an are lagging behind the rest of the province in 2021, indicating that the governments of these three prefectural-level cities have historically paid less attention to the digital economy than other cities. It is worth noting that Hefei, Wuhu, and Tongling have experienced the fastest absolute growth levels.

An analysis of the digital society score in Anhui Province's level of digital economy development from 2011 to 2021 reveals a continuous rise in the development of digital society in all prefecture-level cities. Upon closer inspection, Hefei City, Wuhu City, and Maanshan City exhibit significantly higher levels of digital social development than the provincial average, demonstrating excellent performance. The scores of other cities do not vary significantly, with Bozhou, Fuyang, and Suzhou performing the worst.

4.2. Overall analysis of regional disparities

Anhui Province can be divided into three regions according to geographic location: Central region: Hefei, Lu'an, Chuzhou, Anqing; Northern region: Suzhou, Huaibei, Bengbu, Fuyang, Huainan, Bozhou; Southern region: Huangshan, Wuhu, Maanshan, Tongling, Xuancheng, Chizhou. Regional differences in the level of development of the digital economy vary across different regions, and there are also disparities among the prefecture-level cities within each region. This paper analyses the three regions of Anhui Province for spatial analysis. The coefficient of variation is used to measure the degree of difference in the development of the digital economy. Thiel index is used to reveal the regional differences in the digital economy and its structural characteristics. Figure 1 shows the coefficient of variation based on the entropy weight.

Based on the coefficient of variation measurement, the development of digital economy in Anhui Province shows low levels of difference, with a coefficient of variation below 0.5. All regions exhibit a fluctuating downward trend, with the northern Anhui region showing the most significant decline. The digital economy development coefficient of variation in northern Anhui falls below the provincial average and is at lowest level compared to other regions. The Central Anhui region exhibits the greatest disparity in digital economy levels, which is primarily attributed to the city of Hefei leveraging its status as the provincial capital to establish a new model for digital economic development, but the inadequate intercity collaboration has hindered the development of other cities' digital economies.

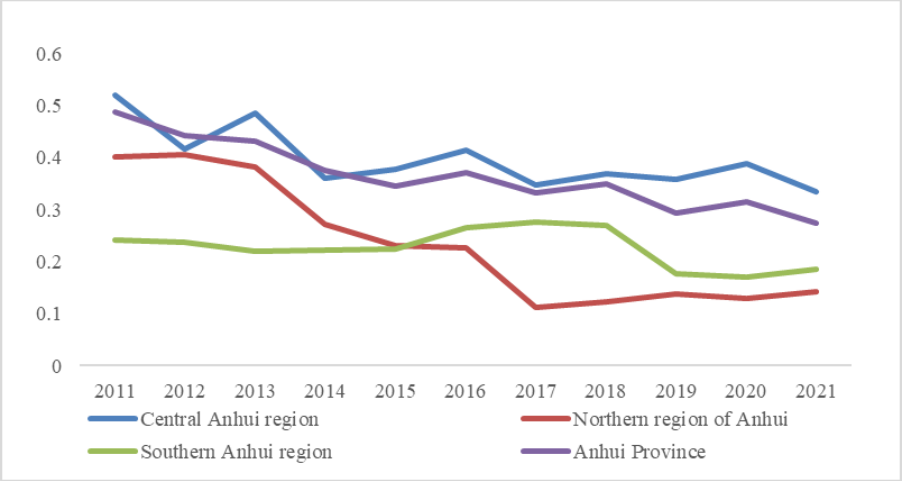

Figure 1: The coefficient of variation based on the entropy weight.

Table 4: Measurement results of digital economy level based on entropy weight method.

Index	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Theil index	0.413	0.426	0.396	0.346	0.304	0.343	0.258	0.267	0.226	0.225	0.239
T-Central Region	0.443	0.351	0.407	0.31	0.342	0.378	0.298	0.327	0.322	0.359	0.304
T-northern Region	0.356	0.371	0.347	0.231	0.183	0.191	0.097	0.1	0.13	0.108	0.12
T-Southern Region	0.232	0.23	0.19	0.199	0.178	0.209	0.215	0.212	0.133	0.138	0.155
TWR	0.248	0.246	0.236	0.202	0.184	0.207	0.157	0.164	0.143	0.146	0.619
TBR	0.165	0.18	0.16	0.144	0.12	0.136	0.101	0.103	0.083	0.079	0.381
WR Contribution rate	0.601	0.577	0.596	0.584	0.605	0.603	0.609	0.614	0.633	0.649	0.625
BR Contribution rate	0.399	0.423	0.404	0.416	0.395	0.397	0.391	0.386	0.367	0.351	0.375

Table 4 presents the results of measuring the Thiel Index for the level of digital economic development in Anhui Province from 2011 to 2021. The Thiel Index shows a clear convergence between the evolutionary trend of northern and southern Anhui in terms of the overall difference in the level of digital economic development. Before 2017, there was a fluctuating downward change, while after 2017, there was an upward trend. The Thiel index fluctuation in northern Anhui is the largest, ranging from a high of 0.356 in 2011 to a low of 0.097, but gradually rising in recent years. Southern region in Anhui has the lowest Thiel index level, decreasing from 0.232 in 2011 to 0.133 in 2019, followed by an upward trend in the subsequent two years. Central Anhui has a higher Thiel index level and shows a clear trend of change with the other two regions, fluctuating from a high of 0.413 in 2011 to a level of 0.239 in 2021. From 2011 to 2021, the contribution rate of intra-regional differences to the overall differences significantly exceeds that of inter-regional differences. The contribution rate of intra-regional differences is above 0.55 and rising, while the contribution rate of inter-regional differences only averages around 0.4. Therefore, reducing intraregional differences in the digital economy is the key to solving regional imbalances. Interregional differences in the digital economy cannot be considered the main cause of overall differences. The rate of intra-regional differences significantly exceeds the contribution rate of inter-regional differences. The contribution rate of intra-regional differences to the overall differences from 2011 to 2021 is above 0.55 and rising, while the contribution rate of inter-regional differences only averages around 0.4. Thus, it is challenging to attribute overall differences to interregional disparities in the digital economy. Instead, addressing intraregional differences in the digital economy is crucial to resolving regional imbalances.

5. Conclusion

This paper focuses on Anhui Province and presents an index system for measuring the level of

digital economic development. The system is based on three dimensions: digital foundation, digital government, and digital society. The level of digital economic development in Jiangxi Province and its 16 prefectural-level municipalities was measured and analysed using the entropy weighting method. Additionally, the level of digital economy in three regions of Anhui Province, namely central Anhui, northern Anhui, and southern Anhui, was compared and analysed using the coefficient of variation and the Thiel index. The specific analysis results are as follows:

Firstly, the digital economy in Anhui Province has experienced rapid growth. However, there are significant regional differences in the Internet and cell phone penetration rates among prefecture-level cities, with fluctuations and increases observed between 2011 and 2021. The infrastructure index also shows a nearly double difference between lower and higher level areas. The digital government dimension score has experienced a growth rate of over 150%, indicating a relatively fast development rate. Similarly, the digital society is also experiencing an upward trend in its development level.

Secondly, the development of the digital economy in Anhui Province is unbalanced and differentiated, as evidenced by the analysis of 16 prefectural-level cities and the three regions of northern Anhui, central Anhui, and southern Anhui. The coefficient of variation indicates that the development difference of cities in central Anhui is significantly higher than that of the other two regions. Based on the analysis of the Thiel index, it can be concluded that the contribution rate of central Anhui is significantly higher than that of other regions. The decomposition of the Thiel index reveals that the contribution rate of intra-regional differences is higher than that of inter-regional differences, and this trend has been expanding over the years.

References

[1] XU Qingyuan, SAN Zhiguang, MA Chaojiang. A review of research on digital economy measurement index system at home and abroad[J]. Research World, 2018, (11): 52-58.

[2] JIAO Shuaitao, SUN Qiubi. Research on the measurement of China's digital economy development and its influencing factors[J]. Research World, 2021, (07): 13-23.

[3] XU Xianchun, ZHANG Meihui. Research on the measurement of the scale of China's digital economy--Based on the perspective of international comparison[J]. China Industrial Economy, 2020, (05): 23-41.

[4] HAN Zhao'an, ZHAO Jingfeng, WU Haizhen. A study on the size measurement, non-equilibrium and regional differences of China's inter-provincial digital economy[J]. Research on Quantitative and Technical Economics, 2021, 38(08): 164-181.

[5] WANG Juanjuan, SHE Ganjun. Measurement and regional comparison of the development level of China's digital economy [J]. China Circulation Economy, 2021, 35(08): 3-17.

[6] PAN Weihua, HE Zhengchu, PAN Hongyu. Spatio-temporal evolution and distribution dynamics of China's digital economy development[J]. China Soft Science, 2021, (10): 137-147.

[7] TANG Yaojia, WANG Yu, TANG Chunhui. Digital economy, market structure and innovation performance[J]. China Industrial Economy, 2022, (10): 62-80.

[8] WAN Xiaoyu, LUO Yanqing. Measuring the development level of digital economy and its effect on total factor productivity [J]. Reform, 2022, (01): 101-118.

[9] HUANG Qinghua, PAN Ting, SHI Peihao. The impact of digital economy on the income gap between urban and rural residents and its functioning mechanism[J]. Reform, 2023, (04): 53-69.

[10] XU Weixiang, ZHOU Jianping, LIU Chengjun. Spatial effects of digital economy development on urban carbonemissions [J]. Geography Research, 2022, 41(01): 111-129.