

# Research on Dynamic Evaluation, Evolutionary Characteristics and Promotion Path of Common Prosperity in Anhui Province

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**Abstract:** Based on the five perspectives of high-quality development, high-level governance, spiritual and cultural prosperity, public service sharing and environmental sustainability, this paper investigates the common prosperity level of cities in Anhui Province from 2012 to 2021, reveals the sources of regional differences, and depicts the distribution dynamics, evolution rules and convergence of China's common prosperity level from the regional, temporal and spatial dimensions. The results show that: the evaluation score of common prosperity in Anhui province fluctuates slightly, develops steadily and makes progress, but the difference is large; The development trend of common prosperity in Anhui Province is good, but there is an unbalanced phenomenon; There is a phenomenon of multipolar differentiation in the development of common prosperity of cities in Anhui Province; The common prosperity development of Anhui Province and the three regions presents significant conditions  $\beta$  Convergence phenomenon, Markov chain transition probability matrix also shows that the transition of common prosperity in Anhui Province is stable, and there is convergence phenomenon. Finally, the research conclusion of this paper puts forward corresponding policy suggestions for the promotion of the process of common prosperity in Anhui Province.

**Keywords:** Common prosperity; Regional differences; Dagum Gini coefficient; Kernel density estimation; Markov chain

## 1. Introduction

Common prosperity is the essential requirement of socialism and an important feature of Chinese-style modernization. It is the final result that social members achieve a good standard of living through labor, so as to reduce and eliminate the gap between the rich and the poor. In recent years, Anhui Province has made great progress in economic development, reform and innovation, ecological improvement and so on, but there are still great differences in the province's economy: unbalanced allocation of public service resources, unbalanced development of scientific competitiveness and so on. The contradiction among economy, resources and environment is prominent, and the problem of unbalanced and inadequate development is prominent.

According to previous literature research, common prosperity is mostly based on prosperity (developmental) and common (sharing). Liu Peilin<sup>[1]</sup> (2021) constructed an index system framework including two dimensions: overall affluence and shared development achievements. Wan Haiyuan<sup>[2]</sup> (2021) and others measure the level of development by per capita national income, reflect the degree of social sharing by the Gini coefficient of per capita disposable income, and construct a common wealth function relation equation with equal weight to quantify the degree of common wealth. Some studies have further expanded the indicators of common prosperity, such as Jiang Yongmu's<sup>[3-4]</sup> construction of a common prosperity index system based on four dimensions: national consciousness, sharing, development and security. But the overall gap across the country has narrowed. Yang Yiyong et al.<sup>[5]</sup> (2021) thought that common prosperity is the organic unity of common and prosperity, and designed an index system including economy, culture, ecology, rule of law, public service and so on. Wan Guanghua<sup>[6]</sup> (2023) added sustainability to the study of common prosperity, starting from three parts: development, sharing and sustainability. <sup>[7]</sup>some scholars build an evaluation model of regional coordinated development to evaluate the level of regional development and the degree of coordinated development, and then analyze the regional differences and spatial correlation pattern of regional coordinated development: the measurement indicators of regional coordinated development focus on

two aspects: coordination and development. Tan Chenglin<sup>[8]</sup> (2013) constructed the evaluation system of coordinated development of regional economy from three aspects: interregional economic relations, regional economic growth and regional economic differences. Fabrizio Germano<sup>[9]</sup> (2022) uses a macroscopic evolution method based on entropy to solve the problem of great differences in social inequality and why different degrees of inequality persist in society, and points out that a more balanced and mutually beneficial society can promote income equality and social non-stratification, on the contrary, unbalanced and non-reciprocal societies will lead to more inequality and potential stratified societies. Yang Qiang<sup>[10]</sup> (2017) constructed a coordinated development evaluation system from five aspects of urbanization, informatization, industrialization, greenization and agricultural modernization; Deng Hongbing<sup>[11]</sup> (2019) measured regional coordinated development from the coordinated development of economic, social and ecological systems. the model of common prosperity index is constructed from three aspects of development, sharing and sustainability.

To sum up, this paper summarizes the ways to achieve common prosperity at the national level: 1. urban-rural exchanges, narrowing the gap between urban and rural areas with the synergistic effect of urban-rural industrial integration and factor marketization, and promoting common prosperity; 2. firmly grasp the macro direction of sustainable development, promote the healthy development of social civilization and green industry, and inject fresh blood into the realization of common prosperity. 3. relying on policy and demand-oriented, strengthen inter-regional industrial cooperation and promote regional coordinated development. Based on this, according to the current situation of economic development in Anhui Province, this paper dynamically evaluates the degree of common prosperity in Anhui Province and describes its evolution characteristics, and finally makes some marginal contributions to the promotion path of common prosperity in Anhui Province.

## 2. Data sources, index selection and regional division

### 2.1. Data source and index selection

Table 1: Index system of common prosperity.

First-level index	Second-level index	Third-level index
High quality development	Economic growth	Per capita GDP (+)
		Total labor productivity (+)
	Balanced development	Income gap between urban and rural residents (-)
		Urbanization rate (+)
	Innovation driven	Proportion of expenditure on Renewed to GDP (+)
		Three kinds of patent applications are accepted and granted per 10,000 people (+)
High-level governance	Social stability	Registered unemployment rate in cities and towns (-)
		The number of criminal cases per 10,000 people (-)
	Social harmony	Number of special education schools per 10,000 people (+)
		Percentage of employees in public administration and social organizations (+)
Spiritual and cultural prosperity	Cultural industry	The proportion of total tourism income to GDP (+)
		Proportion of employees in culture, sports and entertainment industry (+)
	Comprehensive quality	Per capita area of park green space (+)
		Per capita Public Library Collection (+)
Public service sharing	Education	Number of people with tertiary education or above per 100,000 people (+)
	Medical treatment	Number of personnel in medical and health institutions per 10,000 people (+)
	Housing	Per capita residential purchase area (+)
	Traffic	Highway mileage per 10,000 people (+)
Environmental sustainable bearing capacity	conserve energy ,reduce emissions	Energy consumption per unit GDP (-)
		Carbon emissions per unit GDP (-)
	Ecology	Air quality Index (+)
		Urban sewage treatment rate (+)

Common prosperity is closely related to economic development, which requires not only the steady improvement of the time dimension, but also the vertical regional dimension to narrow the gap. The specific index system is shown in Table 1. The relevant index data come from the National Bureau of Statistics, Anhui Provincial Bureau of Statistics, Anhui Provincial Statistical Yearbook, China Urban Statistical Yearbook, China Energy Statistical Yearbook, China Science and Technology Statistical Yearbook, China population and Employment Statistical Yearbook, Chinese Culture and related Industry Statistical Yearbook and so on.

## 2.2. Regional division

Simply taking the establishment of districts and cities as the basic unit for regional division is not conducive to grasp the characteristics of regional development, nor is it conducive to the formulation of targeted regional development policies. Therefore, after collecting the basic economic index data of 16 prefecture-level cities in Anhui Province and carrying out descriptive statistics, it is found that the numerical growth rates of all kinds of indicators in Bengbu, Chuzhou, Hefei, Huainan, Maanshan and Wuhu are approaching. The pace of regional economic development is similar and the exchange of industry, commerce and talents among regions is closely related, so the six prefecture-level cities are divided into Hefei metropolitan area. According to the same standard, Anqing, Chizhou, Huangshan, Liu'an, Tongling and Xuancheng are divided into southwest Anhui, and Bozhou, Fuyang, Huaibei and Suzhou are divided into northern Anhui. As shown in Table 2.

Table 2: Regional division of measurement of common prosperity in Anhui Province

Economic circle	Range
Hefei Capital Circle	Bengbu Chuzhou Hefei Huainan Maanshan Wuhu
Southwest Anhui	Tongling Xuancheng Luan Huangshan Chizhou Anqing
Northern Anhui	Bozhou Fuyang Huaibei Suzhou

## 3. Comprehensive Evaluation of the level of Common Prosperity in Anhui Province

### 3.1. Static Evaluation of Common Prosperity in Anhui Province

Anhui-style modernization is the modernization of the common prosperity of all the people. Over the past decade, the leading group of Anhui Province has made great efforts to promote the process of common prosperity, strive not to leave every household behind, start with the people's clothing, food, housing and transportation, and vigorously develop people's livelihood. However, due to the focus of the development strategy, there is a gap in the process of common prosperity among cities, and people's livelihood issues are left with more room for progress. The static evaluation of entropy method of common wealth index of provinces and cities in Anhui Province from 2012 to 2021 is shown in Table 3.

Table 3: 2012-2021 Common Wealth Index of cities in Anhui Province.

City	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Anqing	0.063	0.066	0.070	0.067	0.074	0.056	0.055	0.059	0.057	0.054
Bengbu	0.074	0.052	0.057	0.055	0.056	0.054	0.054	0.050	0.050	0.046
Bozhou	0.031	0.087	0.035	0.033	0.034	0.042	0.041	0.041	0.043	0.041
Chizhou	0.032	0.032	0.035	0.031	0.032	0.035	0.035	0.028	0.029	0.028
Chuzhou	0.053	0.048	0.049	0.047	0.057	0.058	0.067	0.066	0.065	0.068
Fuyang	0.044	0.046	0.044	0.046	0.051	0.058	0.064	0.066	0.068	0.066
Hefei	0.229	0.199	0.245	0.236	0.235	0.226	0.231	0.246	0.234	0.243
Huaibei	0.033	0.035	0.031	0.028	0.030	0.033	0.029	0.028	0.032	0.032
Huainan	0.040	0.036	0.040	0.039	0.050	0.039	0.057	0.035	0.044	0.044
Huangshan	0.038	0.038	0.033	0.032	0.031	0.034	0.031	0.031	0.030	0.028
Luan	0.072	0.073	0.086	0.081	0.056	0.079	0.054	0.082	0.070	0.063
Maanshan	0.061	0.055	0.060	0.060	0.064	0.060	0.062	0.057	0.060	0.060
Suzhou	0.038	0.041	0.042	0.075	0.050	0.040	0.043	0.043	0.051	0.049
Tongling	0.037	0.035	0.034	0.035	0.039	0.040	0.037	0.035	0.036	0.035
Wuhu	0.096	0.096	0.100	0.097	0.103	0.107	0.098	0.091	0.092	0.098
Xuancheng	0.057	0.062	0.039	0.036	0.039	0.041	0.043	0.040	0.040	0.045

As can be seen from Table 3, the score of the common wealth index of Anhui Province from 2012 to 2021 is between 0.02 and 0.10. At the same time, the annual common wealth index of Hefei ranks first among all cities, which is inseparable from the economic take-off of Hefei in recent years. At the same time of economic development, Hefei paid special attention to the livelihood of ordinary people, vigorously developed facilities for people and implemented many safeguard measures for low-income people. At the same time, the policy of Hefei can be radiated to the Hefei capital circle, leading the surrounding cities to pay more attention to common prosperity. It can be seen that the cities in the metropolitan area of Hefei, such as Wuhu, Maanshan and Bengbu, are in the upper-middle level of all cities in Anhui Province. For the cities in southwest Anhui, there are some tears, such as Anqing and Liu'an, which rank first in the common prosperity index, and Huangshan, Tongling and Xuancheng, which are relatively backward. As a geographically close region of southwest Anhui, the relationship between cities does not seem to be so close. At the same time, the level and focus of development of different cities are also different, which is also part of the problem that leads to a large gap. The four cities in northern Anhui have made progress to varying degrees in the past decade, among which

Fuyang has jumped from 0.044 in 2012 to 0.066 in 2021, which shows Fuyang's efforts to promote the common prosperity of all the people. It is worth noting that many cities have experienced a decline in their scores for the Common Prosperity Index. This phenomenon is worth pondering. While promoting the modernization process in Anhui Province, we must take root in the people, strive for the well-being of all people, and improve the Common Prosperity Index.

### 3.2. Dynamic Evaluation of Common Prosperity in Anhui Province

Ordered weighted average operator (OWA), proposed by the famous American scholar Yager in 1988, is a method of aggregating multi-attribute decision-making information between maximum and minimum operators, which can aggregate data information effectively. Therefore, the research on the theory of information aggregation operator has been paid attention to by scholars at home and abroad, and has been widely used in many fields, such as management decision-making, image compression, information analysis and so on. Subsequently, Guo Yajun, a Chinese scholar, introduced the time series weighted average (TOWA) operator in 2007. In this paper, the evaluation object is the common prosperity index of each city, the evaluation index and the ten-year period from 2012 to 2021 to form the three-dimensional data. By adding time as data to the evaluation system, we can comprehensively evaluate the ranking of the common prosperity and development index of various cities in the past ten years, as shown in Table 4.

Table 4: Ranking of Common Prosperity Development Index.

City	Dynamic evaluation value	Ranking	City	Dynamic evaluation value	Ranking
Anqing	0.05980313	6	Huainan	0.04247644	11
Bengbu	0.05230632	8	Huangshan	0.03125102	14
Bozhou	0.04230618	12	Luan	0.06999984	3
Chizhou	0.03013479	16	Manshan	0.06000569	5
Chuzhou	0.06069655	4	Suzhou	0.04938324	9
Fuyang	0.05866652	7	Tongling	0.03566433	13
Hefei	0.23572493	1	Wuhu	0.0964949	2
Huaibei	0.03112087	15	Xuancheng	0.04396524	10

It can be seen from Table 4 that Hefei ranks first among all cities in Anhui Province with an evaluation value as high as 0.236. Hefei, as the capital city of Anhui Province, not only vigorously develops the economy, but also pays attention to the survival problems of the people at the bottom. The introduction of high-tech enterprises has provided many development jobs, and outstanding achievements have been made in public services, environmental governance, and spiritual governance. The evaluation ranking of the common prosperity of cities in the whole Hefei circle is in the upper-middle level, which shows that the regional development is excellent. However, there is a large gap in the dynamic evaluation ranking of southwest Anhui, including Liu'an, which ranks third, and Chizhou, which ranks the lowest, and there is a large gap in the economic development of various cities in the region. There is also a big gap in the specific indicators of spiritual civilization, public services and environmental carrying capacity. The dynamic evaluation ranking of the four cities in northern Anhui is not ideal, which is located in the middle and lower position. It is worth noting that in addition to Hefei, there is not a big gap between the dynamic evaluation values of other cities in Anhui Province, which also shows that the development of Anhui Province is in step, and there is a lot of room for reference and progress.

## 4. Analysis on the imbalance of the level of common prosperity in Anhui Province

### 4.1. Analysis method of unbalanced level of Common Prosperity in Anhui Province

#### 4.1.1. Dagum Gini coefficient decomposition

Dagum Gini coefficient decomposition can analyze the development differences and the degree of differences between regions, explore the sources of differences, and effectively solve the problem of cross-overlap between sample data. This paper divides Anhui Province into Hefei Capital Circle, Southwest Anhui and Northern Anhui to decompose the Gini coefficient. The relevant formulas are as follows.  $G$  is the Gini coefficient,  $y_{jt}$  ( $y_{hr}$ ) is  $j$  ( $h$ ) evaluation value of the common prosperity level of any city in the region,  $\mu$  is the average value of the level of common prosperity of 16 cities in Anhui Province.  $n$  is 16,  $k$  is 3, That is, the number of areas divided in this paper.  $n_j$  ( $n_h$ ) is the number of cities in the region.  $G_{jj}$  and  $G_w$  are the Gini coefficients of region  $j$  and the contributions of regional differences, respectively.  $G_{jh}$  and  $G_{nb}$  represent the contribution of the inter regional Gini coefficient

and inter regional net value of super variability in regions  $j$  and  $h$ , The contribution of  $G_t$  to the inter regional superdensity,  $D_{jh}$  represents the relative impact of the evaluation value of common prosperity level between regions  $j$  and  $h$ .

The Gini coefficient is defined as:

$$G = \frac{\sum_{j=1}^k \sum_{h=1}^k \sum_{i=1}^{n_j} \sum_{r=1}^{n_h} |y_{ji} - y_{hr}|}{2n^2\mu} \quad (1)$$

$$G_w = \sum_{j=1}^k G_{jj} p_j s_j \quad (2)$$

$$G_{nb} = \sum_{j=2}^k \sum_{h=1}^{j-1} G_{jh} (p_j s_h + p_h s_j) D_{jh} \quad (3)$$

$$G_t = \sum_{j=2}^k \sum_{h=1}^{j-1} G_{jh} (p_j s_h + p_h s_j) (1 - D_{jh}) \quad (4)$$

#### 4.1.2. Kernel density estimation

Kernel density estimation does not need any prior information, nor does it need to set a series of assumptions about data distribution. It only needs to follow the data itself and analyze the characteristics of data distribution according to its own characteristics. It is a convenient and efficient non-parametric estimation method used to investigate the dynamic evolution trend of sample distribution. It has strong robustness and practicability, and has been widely used in the study of unbalanced distribution. Assuming the density function of the random variable  $f(x)$ , the probability density at point  $x$  can be obtained by the formula:

$$f(x) = \frac{1}{Nh} \sum_{i=1}^N K\left(\frac{X_i - x}{h}\right) \quad (5)$$

Among them,  $N$  is the number of samples,  $h$  is the bandwidth,  $X_i$  is an independent and identically distributed observation value,  $x$  is the mean, and  $K(\cdot)$  is the Kernel function. In this paper, the Gaussian function is chosen as the kernel density function.

#### 4.1.3. Convergent model

$\sigma$  Convergence is an investigation of the change of "stock", which reflects that the deviation of the development level of common prosperity in different regions decreases with the passage of time. By combing the relevant literature, this paper selects the coefficient of variation to measure the  $\sigma$  convergence characteristics of the development of regional common prosperity in Anhui Province, that is, to calculate the ratio of the standard deviation to the mean of the score of regional common prosperity in Anhui Province.:

$$\sigma = \frac{\sqrt{\sum_i^{n_j} \frac{\left(\text{coicr}_{ji} - \frac{1}{n_j} \text{coicr}_{ji}\right)^2}{n_j}}}{\frac{1}{n_j} \text{coicr}_{ji}} \quad (6)$$

In the formula:  $\sigma$  Is the convergence coefficient, and  $\text{coicr}$  is the evaluation value of the level of common prosperity.

$$\ln\left(\frac{y_{i,t+1}}{y_{it}}\right) = \alpha + \beta \ln y_{it} + \eta_t + \lambda_i + \varepsilon_{it} \quad (7)$$

$$\ln\left(\frac{y_{i,t+1}}{y_{it}}\right) = \alpha + \beta \ln y_{it} + \phi \sum_{j=1}^n \ln \text{Control}_{it} + \eta_t + \lambda_i + \varepsilon_{it} \quad (8)$$

In the formula:  $y$  is the evaluation value of the level of common prosperity, the dependent variable

is the growth rate of  $y$  in adjacent years, and the core explanatory variable is the evaluation value of the level of common prosperity in the previous period,  $y$ ,  $\alpha$  is a constant term,  $\eta_t$  and  $\lambda_i$  represents time effect and regional effect, respectively,  $\varepsilon_{it}$  is a random error term,  $\beta$  The core coefficient that this article focuses on can be observed to determine whether there is a convergence effect in the development of common prosperity levels in various regions. If  $\beta$  is significantly negative, then there are changes in the development of regional common prosperity level in Anhui Province  $\beta$  The convergence phenomenon indicates that areas with poor development of common prosperity can catch up with areas with good development of common prosperity at a faster adjustment speed.:

The new economic growth theory holds that the convergence of economic variables varies with different regional external conditions, so in the process of studying the convergence of the development of regional common prosperity in Anhui Province, this paper introduces control variables into the model (4.9), including the level of opening to the outside world (open), measured by the ratio of foreign investment to GDP, under the background of double-cycle new development pattern. Improving the level of opening to the outside world will speed up the construction of urban double-cycle development pattern, improve the interconnection of development, and affect the process of Chinese-style modernization. The higher the degree of government intervention, the more it can reflect the importance the government attaches to the realization of the goal of Chinese-style modernization, thus affecting the process of Chinese-style modernization.

If the observed year of the sample is  $T$ , the convergence rate can be expressed as:

$$v = -\frac{\ln(1 + \beta)}{T} \quad (9)$$

#### 4.1.4. Markov chain

The Markov chain method analyzes the probability of each subject transitioning from one state space to another by constructing a Markov transition probability matrix. The Markov chain is a random process, i.e.  $\{X_t, t \in T\}$ , and its value is a finite set containing elements of the state of the random process, with set  $T$  corresponding to each period. Let the random variable  $X_t = j$ , that is, the system state at time  $t$  is  $j$  and the Markov property of the system satisfies equation (10).

$$P\{X_t = j | X_{t-1} = i_{t-1}, X_{t-2} = i_{t-2}, \dots, X_0 = i_0\} = P\{X_n = j | X_{n-1} = i\} = P_{ij} \quad (10)$$

Where:  $P_{ij}$  is the transition probability of a region's common prosperity level from type  $i$  in year  $t$  to type  $j$  in year  $t + 1$ . The maximum likelihood estimation can be used to obtain  $P_{ij} = n_{ij}$  divided by  $n_i$  where  $n_{ij}$  refers to the number of cities transferred from type  $i$  in year  $t$  to type  $j$  in year  $t + 1$  in the sample review period, and  $n_i$  refers to the number of cities belonging to type  $i$  in the sample review period.

## 4.2. Regional differences and Convergence of Common Prosperity in Anhui Province

### 4.2.1. Dagum decomposition of Common Prosperity level in Anhui Province

According to Figure 1, it is found that there is an overall difference in the level of common prosperity in Anhui Province, and its Gini coefficient is between 0.2834 and 0.3315. The overall difference is the smallest in 2013 and the largest in 2019. Among them, there was an increase in 2013-2015, 2018 and 2020, and a downward trend in other years.

Judging from the Gini coefficient in the region. The gap among Hefei Capital Circle, Southwest Anhui and Northern Anhui has been enlarged in varying degrees. The Hefei capital circle peaked at 0.3629 in 2019, with two small fluctuations in the decade, and the Gini coefficient was relatively stable during the decade. Southwest Anhui has great ups and downs, reaching a ten-year low of 0.1195 in 2018 and a peak of 0.2171 in 2019. Northern Anhui has the largest increase, reaching 100%, which is related to the relatively backward economic development in northern Anhui. Due to the low economic level, there is less investment in other livelihood facilities. Generally speaking, there is a gap in the development of common prosperity in the three major regions, and there is a small gap widening.

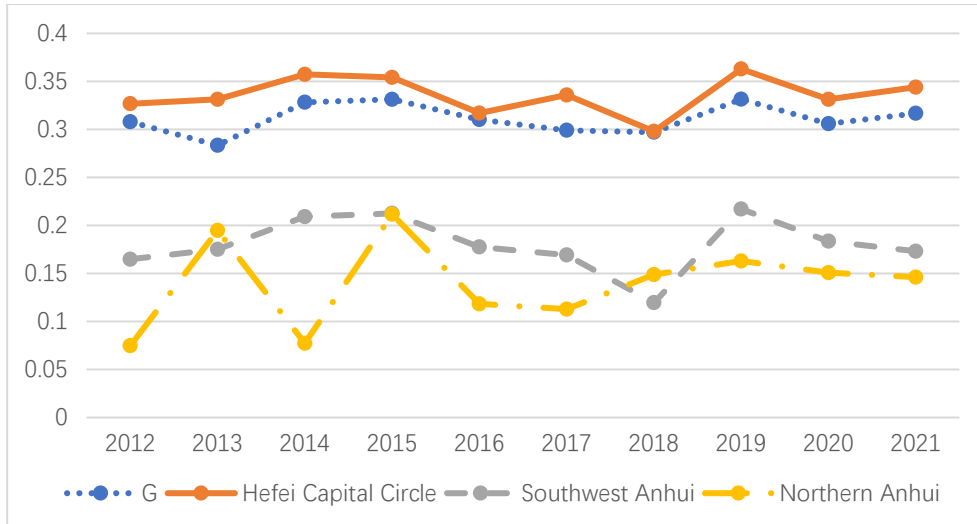


Figure 1: Overall and intra-regional differences in the level of common prosperity in Anhui Province from 2012 to 2021

Judging from the inter-regional Gini coefficient. There is an increasing trend in the Gini coefficient between Hefei Capital Circle and southwest Anhui, and 0.4001 in 2021 is the highest in the past decade, which to a certain extent reflects the large gap in economic development between the two regions. due to the economic gap, there is a large gap in the development of common prosperity. The Gini coefficient of Hefei metropolitan area and northern Anhui shows a downward trend in the past ten years, and 0.3632 in 2021 is below the average within ten years. Generally speaking, the gap between the two regions is gradually decreasing and tends to be flat. The Gini coefficient between southwest Anhui and northern Anhui is also declining, from 0.1863 in 2012 to 0.1723 in 2021. It can be seen that the decline is relatively small, which also shows that the development process of common prosperity between the two regions is similar , as shown in Figure 2.

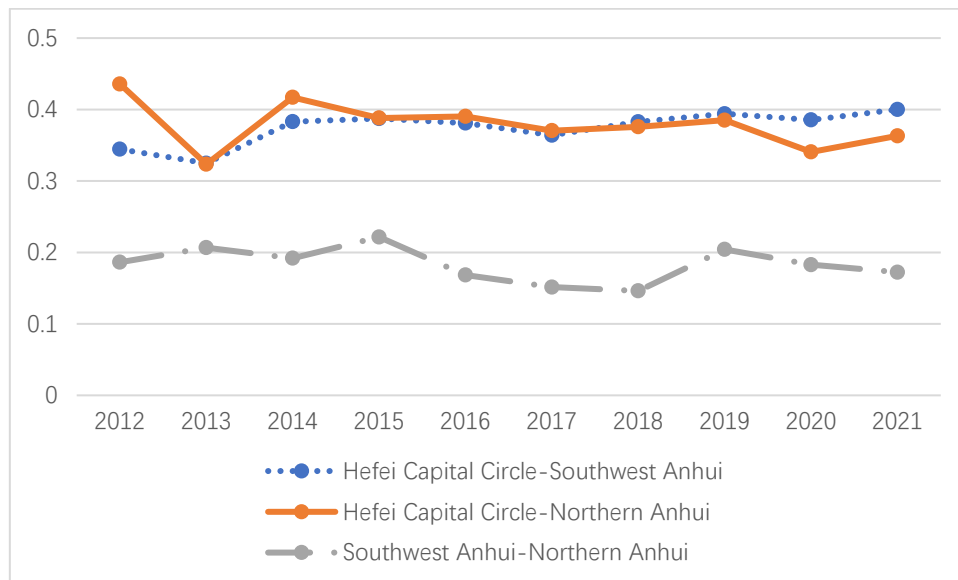


Figure 2: Regional differences of Common Prosperity in Anhui Province from 2012 to 2021

In terms of the sources of differences and contributions. As can be seen from the data in the Table 5, from the overall evolution process, the contribution rate of overvariable density and inter-regional gap changes greatly during the sample period, and the intra-regional gap contribution rate is relatively stable. From the perspective of specific evolution process, the contribution rate of inter-regional gap is the largest in all years, and accounts for a large proportion. From a numerical point of view, the contribution rate of supervariable density was 6.20% in 2012, which reached the highest value of 30.15% in 2013, and then declined continuously, reaching a new low of 8.13% in 2018. Different from the changing trend of the contribution rate of hypervariable density, the contribution rate of inter-regional gap is relatively stable.

Table 5: Sources and contributions of Regional differences in the level of Common Prosperity in Anhui Province from 2012 to 2021.

Year	Intra-regional difference		Regional differences		Hypervariable density	
	Difference	Contribution rate	Difference	Contribution rate	Difference	Contribution rate
2012	0.09	28.97%	0.20	64.84%	0.02	6.20%
2013	0.09	31.93%	0.11	37.92%	0.09	30.15%
2014	0.10	30.48%	0.19	58.78%	0.04	10.75%
2015	0.10	31.16%	0.16	48.97%	0.07	19.87%
2016	0.09	28.99%	0.19	62.73%	0.03	8.28%
2017	0.09	30.52%	0.17	58.13%	0.03	11.35%
2018	0.08	27.45%	0.19	64.42%	0.02	8.13%
2019	0.10	31.37%	0.17	52.14%	0.05	16.49%
2020	0.09	30.39%	0.16	53.07%	0.05	16.54%
2021	0.10	30.14%	0.18	56.06%	0.04	13.80%

4.2.2. Distribution and dynamic Evolution of Common Prosperity in Anhui Province

Kernel density estimation can infer the distribution of population data from a limited number of samples. This paper collects the common prosperity index data of the whole province, Hefei metropolitan area, southwest Anhui and northern Anhui, and uses Kernel density estimation method to analyze the dynamic evolution characteristics of common wealth index from 2012 to 2021. The results are shown in Figure 3.

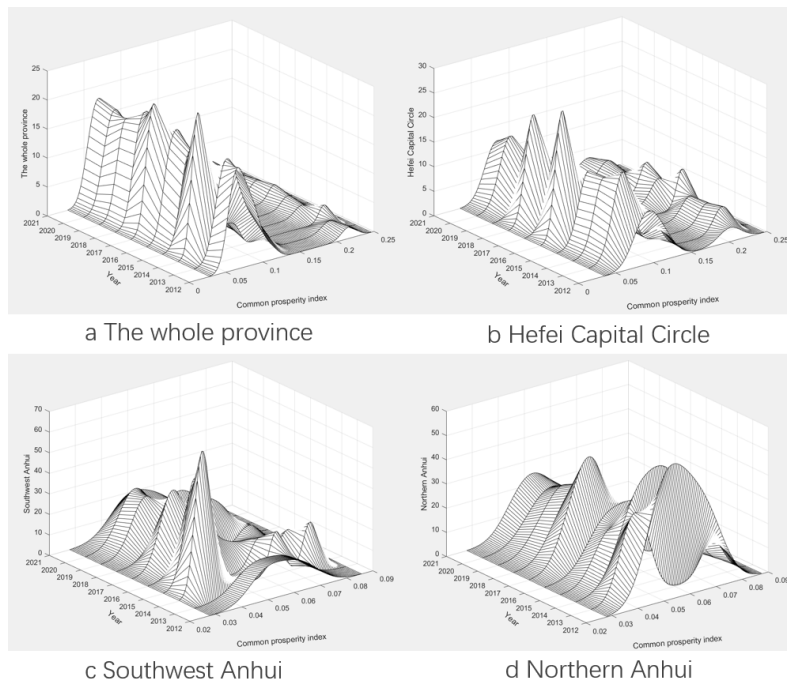


Figure 3: Dynamic Evolution Map of Kernel density estimation of Common Wealth Index in different regions

From the nuclear density curve of the common wealth index of the whole province (see Figure 3 a), we can see that the dynamic evolution process of the distribution of the common wealth index of Anhui Province shows the following rules: 1. From the point of view of distribution, during the ten years from 2012 to 2021, the development trend of the nuclear density curve of the common wealth index is relatively slow, indicating that the development trend of the common prosperity index in Anhui Province is slow. Corresponding to the score of the common wealth index, we can see that the scores of many cities in 2021 are even lower than those in 2012. 2. from the form of distribution, the peak height of the core density curve of common wealth index fluctuates, and the width of the curve increases continuously, indicating that the distribution of common wealth index in Anhui Province has become more scattered, and the regional difference shows an expanding trend. The distribution of the nuclear density curve is carried out continuously by the multi-peak situation, indicating that the development of common prosperity in Anhui Province appeared multipolar differentiation in the early stage, and did not change much in the later period of the sample period, which can also be seen that the progress of common prosperity in Anhui Province is slow. 3. From the point of view of the extensibility of the distribution, the nuclear density curve of common prosperity in Anhui Province shows a significant



right deviation distribution, that is, the phenomenon of right trailing appears, but the degree of right deviation is not much different. It shows that while the cities with higher level of common prosperity in Anhui Province maintain sustained growth, the gap between the cities with lower level of development has been reduced.

From the nuclear density curves of Hefei Capital Circle, Southwest Anhui and Northwest Anhui (see Figure. 3 b to Figure. 3 d), it can be seen that the nuclear density curves of these three regions have certain commonness, specifically shown in the following aspects: 1. There are multiple peaks in each region, which shows that the common wealth index of each region has ups and downs, which shows that all regions have been slow in the process of common prosperity and development. 2. The nuclear density curve of each region has different degrees of right trailing, which shows that the development of common prosperity in all regions has been improved. At the same time, there are many differences in the nuclear density curves of different regions, which mainly exist in the following aspects: 1. Compared with the southwest of Anhui, there are large fluctuations in the peaks of Hefei Duquan and northern Anhui. Hefei Duquan and northwest Anhui have multi-stage differentiation. 2. Compared with the trailing situation in southwest Anhui, the trailing phenomenon in Hefei capital circle and northern Anhui is more complex, which shows that the gap between cities in the interval is not obvious, while the urban gap in southwest Anhui is increasing day by day.

**4.2.3. Analysis on the Convergence of Common Prosperity in Anhui Province**

Figure 4 shows the common prosperity and development of the whole province and the three regions α The variation trend of convergence coefficient. In terms of regions, the average daily income has an upward and downward trend, and the overall fluctuation is relatively slow, which indicates that in some regions α The convergence characteristics are not obvious. Table 6 shows β Results of convergence test.

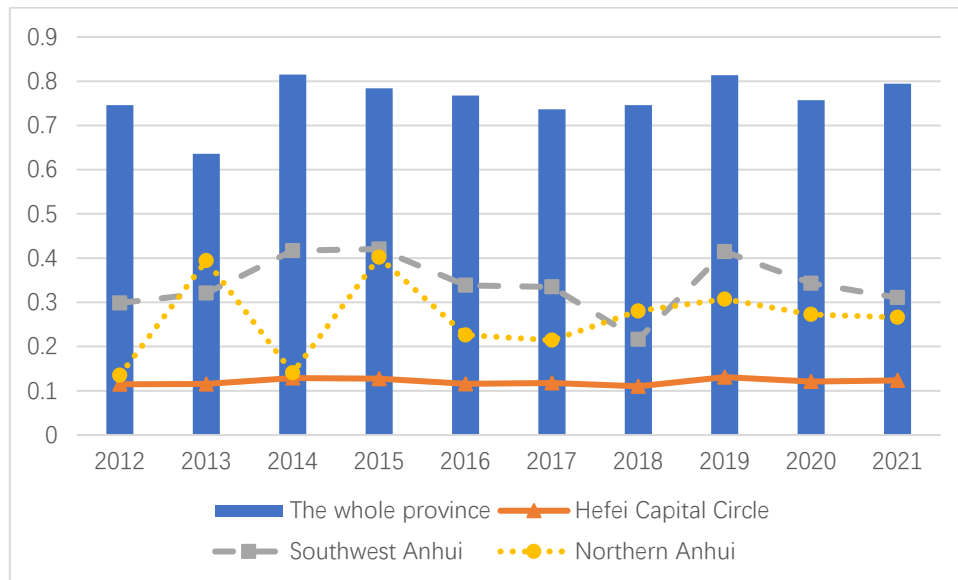


Figure 4: Trend chart of convergence coefficient in each region

Table 6: Absolute β convergence

Variable name	The whole province	Hefei Capital Circle	Southwest Anhui	Northern Anhui
lny	-0.912*** (-4.640)	-0.884 (-2.348)	-0.806* (-3.046)	-0.867* (-4.002)
_cons	-2.675*** (-4.579)	-2.291 (-2.347)	-2.509* (-3.023)	-2.919* (-4.134)
N	144	54	54	36
r2 a	0.405	0.406	0.377	0.433

**4.2.4. Analysis on the State transfer of Common Prosperity in Anhui Province**

In this paper, the common wealth index is divided into four state types: low level, medium-low level, medium-high level and high level. On this basis, according to the Markov chain model, the state transition probability matrix for different periods (1 year and 2 years) from 2012 to 2021 is calculated, and the results are shown in Table 7.

Table 7: Markov chain analysis

Duration (years)	Status	Low	Medium to low	Medium to high	High
1	Low	0.818	0.145	0.018	0.018
	Medium to low	0.190	0.619	0.143	0.048
	Medium to high	0.040	0.120	0.560	0.280
	High	0.047	0.023	0.163	0.767
2	Low	0.840	0.160	0.000	0.000
	Medium to low	0.056	0.556	0.278	0.111
	Medium to high	0.045	0.182	0.545	0.227
	High	0.079	0.000	0.158	0.763

According to the calculation results of Table 7, the common prosperity development index of Anhui Province has the following dynamic evolution characteristics. The distribution of the development index of common prosperity in Anhui Province has a strong stability, and the internal mobility between cities in different states is low. Table 7 shows that the probability on the main diagonal is greater than that on the non-diagonal. For example, when the investigation duration is one year, the probability of the cities with low, medium-low, medium-high and high-level common prosperity in Anhui Province remaining unchanged after one year is 81.80%, 61.90%, 56.00% and 76.70%, respectively, while the highest probability of transferring the initial state type to other state types after one year is only 48.00%. Lower than the probability on the diagonal. At the same time, the transition probability matrix with a duration of 2 years is roughly the same as that with a duration of 1 year, which fully confirms the strong stability and low mobility of the development index distribution of common prosperity in Anhui Province.

## 5. Main conclusions and suggestions

### 5.1. Main conclusion

During the decade from 2012 to 2021, the overall common prosperity development index of Anhui Province has increased. Specific to each city, the rising trend of the common prosperity development index is obvious for the cities with good economic development, while for the cities with backward economic development, the ranking of the common prosperity index is more obvious. For example, Huangshan City ranked 12th in Anhui Province in 2012 and dropped to 15th in 2021. At the same time, the level of economic development is not completely proportional to the development of common prosperity. For example, the economic development ranking of Lu'an City is at the lower-middle level, but the static and dynamic rankings of the common prosperity development index are in the forefront.

The Gini coefficient of common prosperity development in Hefei capital circle has a relatively gentle fluctuation, and the imbalance of common prosperity development in Hefei capital circle is much greater than that in southwest and northern Anhui. At the same time, there is a large gap between Hefei Capital Circle and Southwest Anhui and Northern Anhui, while the gap between Southwest Anhui and Northern Anhui is small. Most of the reasons for these gaps come from the proportion of regional disparities. In the test of convergence, it can be concluded that the characteristic of  $\alpha$  convergence is not obvious, while that of  $\beta$  convergence is obvious.

From the nuclear density test and Markov chain analysis, we can see that there is a phenomenon of multipolar differentiation in the development of common prosperity of cities in Anhui Province, and it lasts for a long time. At the same time, the gap between cities with higher common wealth index and lower cities is gradually decreasing.

### 5.2. Countermeasure and suggestion

Based on the above research conclusions, this paper puts forward the following policy recommendations.

If we want to realize Chinese-style modernization, we must achieve common prosperity, and there is connectivity between the two. With the economic development, cities in Anhui Province also need to pay attention to people's livelihood. To achieve high-quality economic development, abandon some enterprises with high pollution and low energy efficiency and face-saving projects, in the process of development, we should not only focus on the economy, but also need to understand the needs of the people. We will vigorously build public service facilities and build more institutions for the benefit of the people, so as to achieve harmony between man and nature. Do a good job of regional coordinated development "a game of chess". According to the differences between regions, it is the main source of the development gap of common prosperity among cities in Anhui Province. on the one hand, we

should actively promote economic and cultural exchanges among various regions and vigorously build a road system to make local exchanges more portable. at the same time, the successful development experiences of various regions learn from each other, and various departments take the initiative to communicate with each other to build a positive feedback platform. To establish closer relations between regions, promote complementary cooperation between the government and the market, let the population flow from relatively backward areas to developed areas, and capital flow from developed areas to relatively backward areas, and promote convection at the macro level, the government should take the initiative to provide diversion measures and convenient services.

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