

Construction of China's Common Prosperity Index: an empirical analysis based on AHP-DEMATEL method

Dingyu Wang^a

Xinjiang University of Finance & Economics, Urumqi 830000, China.

^axjcdwdy@163.com

Abstract. Common prosperity is the essential requirement of socialism and common aspiration of the people. At present, the problem of unbalanced and insufficient development is still prominent in China, and the gap between urban and rural areas in terms of development and income distribution is large. As China embarks on a new journey to fully build a modern socialist country, there is a long way to go in realizing the common prosperity of all the people. Therefore, it is particularly important to study the statistical measurement of China's common prosperity index. This paper selects the measurement method of China's common prosperity index as the research object, constructs the index evaluation system of China's common prosperity index from three dimensions of development, sharing and sustainability, adopts AHP-DEMATEL method, dimensionless processing and negative index processing to build the common prosperity index measurement model, and uses SPSSPRO, SPSSAU and other program processing software to program and solve the model, and calculates the China Common Prosperity Index for 2019-2022. Finally, for the synthetic index, the empirical analysis was carried out, which concluded that in recent years, China has effectively achieved high-quality development with sustainable development as the main direction, but there are problems such as large differences between urban and rural areas and income distribution. This paper not only provides new ideas for the construction of China's common prosperity index evaluation system and model, but puts forward countermeasures and suggestions for the development of common prosperity, which has certain reference value.

Keywords: Common prosperity; indicator system; AHP-DEMATEL method.

1. Introduction

1.1. Research background

Common prosperity refers to the common prosperity of all the people, the prosperity of both the material and spiritual life of the people. General Secretary Xi Jinping has repeatedly stressed that common prosperity is an essential requirement of socialism and an important feature of Chinese-style modernization, and that the promotion of common prosperity for all people must be the focus of efforts to seek happiness for the people.

Looking back at the history of the CPC's struggle, this pursuit of material abundance and spiritual enrichment of life not only reflects the people's long-cherished wishes, but reflects the original aspiration and mission of the Communist Party of China to serve the people. During the New Democracy period, the majority of Communists aimed at seeking the liberation of the people. Since the founding of the People's Republic of China, with the principle of socialist transformation and construction, the CPC was committed to creating material prosperity and happiness for the people. In the period of reform and opening-up, the CPC put forward the good wishes of "emancipating the productive forces, developing the productive forces, eradicating exploitation, eliminating polarization, and ultimately attaining common prosperity". Then, the 17th National Congress of the Party proposed "building a harmonious society", the 18th Party Congress emphasized that "common prosperity is the fundamental principle of socialism with Chinese characteristics", the 19th Party Congress made the assertion that the main contradiction in China's society has changed, and that we should build a moderately prosperous society in all aspects, and the 20th Party Congress report pointed out that "the common prosperity is the fundamental principle of socialism with Chinese characteristics". The report of the 20th Party Congress pointed out that "Chinese-style modernization is the modernization

of common prosperity for all the people". Therefore, on the basis of a deep understanding of the connotation, scope and characteristics of common prosperity with the times, it has become an important issue to consistently promote the great cause of common prosperity in China, comprehensively evaluate the construction of common prosperity in China, and construct a scientific, consistent and feasible common prosperity index measurement method. This paper selects the measurement method of China's common prosperity index as the research object, and constructs the model of China's common prosperity index in the above research background.

1.2. Research content and significance

By studying the current status of China's economic, distributional and social development in recent years, this paper analyses the three dimensions of development, sharing and sustainability and the specific indicators involved, and forms a common prosperity index model to assess the progress of China's substantive construction of common prosperity. Co-existence is the basic way of life in human society, and affluence and a better life are the most important common interests of human beings. To a certain extent, it can be considered that the gradual realization of co-existence and sharing is essentially the historical progression of common prosperity at the primary stage of socialism. The theoretical and practical logic of the transformation of the main contradictions in Chinese society is conducive to revealing the successful path of Chinese-style modernization. The modernization to be achieved in the new era and new stage of socialism is precisely the modernization with the goal and feature of realizing common prosperity. Therefore, the realization of common prosperity is a major issue for China. The indicator evaluation system and model established in this paper for China's common prosperity is not only important for China's next policy formulation for the realization of common prosperity, but for China's improvement of the level of affluence, narrowing the gap to improve the degree of commonality and focusing on sustainable development. At the same time, the research ideas in this paper also have certain reference value for the exploration of evaluation criteria in other aspects of Chinese modernization and development, and provide a model that can be operated.

2. Literature review

Meng Sun and Xiaoye Cao constructed a common prosperity indicator system from the dimensions of affluence and sharing, and pointed out that from the global rankings of the Human Development Index, Happiness Index, Engel's coefficient, average years of schooling and other indexes, in general, the current level of economic and social development in China is roughly in the middle of the world [1]. Jing Xiao and Ping Bao think that the measurement of common prosperity in the new development stage can be constructed from three dimensions of income and property, development capacity and people's well-being to build an evaluation index system, use the five-level classification method to make a preliminary judgement on the weight of each basic index to achieve common prosperity, and use the composite method of "horizontal and vertical slotting method - BP neural network analysis method" to analyze the common prosperity. "composite method to synthesize the common prosperity index [2]. Xinbo Lu and Wei Zhao take the connotation of common prosperity as the starting point, based on the questionnaire survey, accurately identify the factors affecting common prosperity, expand the assessment dimensions and indicators, and form a multi-dimensional evaluation index system [3].

With the development of China's economy, the profound connotation of common prosperity is also expanding, and the evaluation system of common prosperity index indicators is constantly changing, and at the same time, due to the selection of different model construction methods, the model of China's common prosperity index is also different, but the basic idea is to construct the evaluation indicators, and then select the model to calculate and synthesise the China's common prosperity index.

3. Introduction to the research idea and model

3.1. Main research ideas

We firstly understood the profound meaning and characteristics of China's common prosperity, and accordingly selected three levels of indicators to complete the construction of China's common prosperity evaluation index system. After that, we made the questionnaire of "Constructing China's Common prosperity Index" based on the AHP method, and invited 15 economics experts to fill it. Based on the results of the questionnaire, the AHP-DEMATEL method was used to form a matrix and complete the weight calculation, combining the meanings of the three levels of indicators and using dimensionless processing of the weights of the three levels of indicators, and determining the sign of the weights. Finally, the weights of the three levels and the standardised values of the three-level indicators are synthesised into the China Common Prosperity Index model.

3.2. Introduction to the AHP-DEMATEL method

The analytic hierarchy process, or AHP for short, was introduced in the early 1970s by Thomas Saaty, an operations researcher at the University of Pittsburgh, when he was studying the topic of "Electricity distribution according to the contribution of various industrial sector to the national welfare for the U.S. Department of Defense. It is a hierarchical weighted decision analysis method proposed by applying network system theory and multi-objective comprehensive evaluation methods.

According to the nature of the problem and the total goal to be achieved, AHP decomposes the problem into different constituent factors, and in accordance with the interrelated influences between the factors as well as the subordinate relationship of the factors according to the different levels of aggregation and combination, forming a multilevel analytical structural model, so as to ultimately make the problem boiled down to the determination of the relative importance of the weights of the lowest level (the scheme, measures, etc., for decision-making) relative to the highest level (the overall goal) or the ranking of relative advantages and disadvantages.

Table 1 AHP Common Scale

Scale	Implication
1	Compared with the two indicators, A is equally important than B
3	Compared with the two indicators, A is slightly more important than B
5	Compared with the two indicators, A is significantly more important than B
7	Compared with the two indicators, A is more important than B
9	Compared with the two indicators, A is extremely important than B
2, 4, 6, 8	Scale values corresponding to intermediate states between appeal judgements
Reciprocal	Indicators of the importance of B over A

In the second step, according to the comparison of indicators at different levels, the judgment matrix A can be formed. The elements $a_{ij}(i, j = 1, 2, 3, 4)$ in row i and column j of the matrix represents the result of the comparison of the degree of importance of a_i and a_j .

In the third step, the geometric mean of each scale in each row of the judgement matrix is calculated and labelled as W_i . subsequently, it is normalized to obtain the weight coefficients G_i with the following formula:

$$G_i = \frac{W_i}{\sum W_i} \quad (1)$$

At the same time, in order to ensure the scientific and rationality of the indicator system, it is also necessary to test the consistency of the questionnaire results, in which the consistency coefficient CI is calculated as follows:

$$CI = \frac{\lambda_{max} - n}{n - 1} \quad (2)$$

When $CI = 0$, it indicates that the judgement matrix has complete consistency. On the contrary if the result of CI is larger, it indicates that the consistency of the judgement matrix is worse. Taking into account the randomness error and other factors, CR should be introduced into the consistency test as the random consistency ratio. The specific formula is as follows:

$$CR = \frac{CI}{RI} \quad (3)$$

If the consistency ratio $CR < 0.1$, it passes the consistency test. The values of RI and corresponding n are shown in the table:

Table 2 Stochastic Consistency Indicators **RI**

n	1	2	3	4	5	6	7	8
RI	0	0	0.58	0.90	1.12	1.24	1.32	1.41

CR can be used to measure the consistency of the judgement matrix. If $CR \leq 0.1$, it indicates that the judgement matrix is acceptable in consistency, and vice versa to exclude invalid data collected.

DEMATEL (Decision-making Trial and Evaluation Laboratory) is a system analysis method that uses graph theory and matrix tools to explain problems. Through the logical relationship between the elements of the system and the direct influence matrix, it can calculate the degree of influence of each element on the other elements and the degree of influence, so as to calculate the degree of cause and center of each element, as a basis for constructing the model, so as to determine the causal relationship between the elements and the position of each element in the system.

DEMATEL analyses typically consist of five steps:

Step 1: Provide the 'Relationship Matrix', i.e. the raw data.

Step 2: Calculate to obtain the 'canonical direct influence matrix', which is a normalization of the 'relationship matrix' (i.e. the raw data), which is normally normalized by 'maximization', i.e. all numbers are divided by the maximum value in the 'relationship matrix'.

Step 3: Calculate the 'integrated impact matrix T', which is calculated as: integrated impact matrix $T =$ canonical direct impact matrix * inverse matrix of (unit matrix - canonical direct matrix).

Step 4: Combined with the 'integrated impact matrix T', the values of the various indicators are calculated to include the value of the degree of influence D, the value of the degree of influence C, the value of the degree of centrality $D + C$, and the value of the degree of cause $D - C$.

Impact D value: It is the sum of the elements of the rows of the 'integrated impact matrix T'.

$$f_i = \sum_{j=1}^n t_{ij}, \quad (i = 1, 2, \dots, n) \quad (4)$$

Influenced C value: It is the sum of the elements of the columns of the 'integrated impact matrix T'.

$$e_i = \sum_{j=1}^n t_{ji}, \quad (i = 1, 2, \dots, n) \quad (5)$$

Cause degree $D - C$ value: It is the difference between the D value and the C value.

$$m_i = f_i - e_i, \quad (i = 1, 2, \dots, n) \quad (6)$$

Centrality $D + C$ value: It is the sum of the D and C values.

$$n_i = f_i + e_i, \quad (i = 1, 2, \dots, n) \quad (7)$$

Step 5: Combine the "centrality D+C value", that is, the importance of the elements, and normalize against it to finally calculate the weight profile of each element.

The AHP-DEMATEL method combines AHP and DEMATEL, assigns values to each indicator, and gives a rule for calculating the final weights of the indicators. Some scholars weight the initial weights of the AHP method and the standardized impact degree of the DEMATEL method to calculate the final weights, while some scholars use the initial weights of the AHP method and the combined impact matrix of the DEMATEL method to obtain the impact weights, and then weight them again with the initial weights to calculate the final weights. Some scholars use the initial weights of the AHP method and the combined impact matrix of the DEMATEL method to obtain the impact weights, and then reweight them with the initial weights to calculate the final weights. Since the AHP method only considers the influence weights of the lower indicators on the upper indicators, the indicators are actually related to each other, an indicator contributes to its upper indicators, and also contributes more or less to other upper indicators and other factors of the same level, and these more or less contributions will ultimately have a certain impact on the system. While the DEMATEL method discusses the influence of one factor on all other factors, the combination of the two methods considers not only the influence of factors on higher-level indicators, but also the mutual influence between factors, which can effectively improve the scientific and objective nature of the assignment of indicators [4]. In this paper, the AHP-DEMATEL method of Ying Qu, Yajing Lu, Ziyu Liu; and Mingxin Yang was selected to complete the model construction.

4. Construction of evaluation index system

Referring to the articles "Construction of common prosperity index model" and "People's Think Tank: Scientifically Constructing a Stage-by-Stage Evaluation Indicator System for Common prosperity", based on the connotations and basic characteristics of common prosperity, we selected 3 first-level indexes, 13 second-level indexes, and 61 third-level indexes to construct the evaluation index system of China's common prosperity index.

4.1. Selection of developmental indicators

Development is a prerequisite for achieving common prosperity, so we believe that developability should be one of the first-level indicators to reflect the overall prosperity of China's economy, people's income and expenditure, and infrastructure development.

Under the development indicator, we have selected three secondary indicators: rising income level, improving consumption structure; and improving infrastructure. The prerequisite for common prosperity is affluence, and the income level is an indicator that directly reflects the current affluence of the Chinese people. The specific indicators of the third level are the growth of GDP per capita, the national average minimum hourly wage, the number of hours worked, urban and rural per capita disposable income, the ratio of per capita disposable income to per capita GDP, the amount of per capita resident investment, the amount of per capita resident savings, and the urban registered unemployment rate.

Common prosperity requires the continuous improvement of people's material living standards, and the upgrading of the consumption structure directly reflects the current consumption level and development trend of the Chinese people, specifically including the three-level indicators of Engel's coefficient, per capita consumption expenditure of urban residents, per capita consumption expenditure of rural residents, per capita total retail sales of consumer goods, the consumption rate of the population, and the proportion of consumption expenditure on services.

The improvement of infrastructure is the basis for the continuous development of the economy and the material well-being of people, and the specific three-level indicators are the urban sewage treatment rate, the per capita area of sports facilities, the density of the road network, the internet penetration rate are the mobile phone penetration rate.

4.2. Selection of shared indicators

Sharing is the foundation of common prosperity. The sharing nature of common prosperity must reflect elements such as "common", "fair" and "equal". Therefore, we believe that the nature of sharing includes social harmony and concord, financial and fiscal benefits, equal public services, narrowing the income gap, diversification of spiritual needs, urban-rural coordination and regional coordination.

Social harmony and concord is one of the specific requirements for common prosperity, and the specific three-level indicators include: the number of suspected criminals prosecuted and the number of lawyers per 10,000 people.

Fiscal and tax benefits are the economic basis for the government's efforts to achieve common prosperity, and the specific three-level indicators are: fiscal revenue per capita, dependence on transfer payments, share of tax revenue, share of major taxes, ratio of livelihood expenditure to general public budget expenditure, and dependence on land premiums.

The promotion of equalisation of basic public services is the focus of the realisation of common prosperity, and the specific three-level indicators include the number of practicing (assistant) doctors per 1,000 inhabitants, the number of beds in medical institutions per 1,000 inhabitants, the number of beds for the elderly per 1,000 elderly, the old-age insurance dependency ratio, the average public education expenditure per primary school pupil, the average public education expenditure per junior secondary school pupil, the pupil-teacher ratio in primary schools, the pupil-teacher ratio in junior secondary schools, the minimum living standard for urban and rural residents, and the ratio of social security expenditure to general public budget expenditure. minimum living standard and the ratio of social security expenditure to GDP.

In promoting common prosperity, it is necessary to consciously and proactively narrow regional, urban-rural and income disparities so that the fruits of development are shared more and more equitably by all people and people's sense of gain, happiness and security is continuously enhanced. Urban-rural coordination includes, in particular: the urbanisation rate of the resident population and the ratio of the disposable income of urban and rural residents. Regional coordination includes: the coefficient of regional economic development gap, the coefficient of regional GDP per capita gap. Reducing income disparity includes in particular: Gini index of low income, group income growth, labour compensation as a share of GDP.

Common prosperity is the material and spiritual prosperity of the people. Specific three-level indicators of diverse spiritual needs include: per capita consumption expenditure on education, culture and entertainment, per capita ownership of public library collections, and the comprehensive reading rate of the population to measure the spiritual prosperity of the people.

4.3. Selection of sustainability indicators

Improving the quality and efficiency of the economy is the way to sustainable development, and the specific three-level indicators include: the size of the digital economy as a share of GDP, energy consumption per unit of GDP, labor productivity growth, R&D investment growth, tertiary sector value added as a share of GDP, the number of high-value invention patents per 10,000 people, and R&D expenditure as a share of GDP.

Green mountains and green waters are golden mountains and silver mountains. To achieve sustainable development, it is necessary to ensure an excellent ecological environment, and the specific indicators at three levels are: forest coverage, the proportion of good air quality days in cities at the prefectural level and above, the average concentration of PM2.5 in cities at the prefectural level and above, and the proportion of surface waters that are at or above class III.

The improvement of the overall quality of human life has provided support for sustainable development, with specific indicators at three levels: life expectancy at birth, the gross enrolment rate in higher education and the average number of years of education of the working-age population.

Table 3 China Common Prosperity Index Evaluation Indicator System

First-level indicators	Second-level indicators	Third-level indicators
Development	Rising income levels	GDP per capita growth(%)
		National average minimum hourly wage (yuan/hour)
		Working hours (hours/week)
		Urban and rural per capita disposable income (yuan)
		Disposable income per capita as a share of GDP per capita (%)
		Investment per inhabitant(yuan)
		Balance of deposits per inhabitant(yuan)
	Upgrading of the consumer structure	Urban registered unemployment rate
		Engel's coefficient
		Consumption expenditure per urban resident(yuan)
		Per capita consumption expenditure of rural residents(yuan)
		Total retail sales of consumer goods per capita (billion yuan)
	Well-established infrastructure	Consumption rate of the population (%)
		Share of consumption expenditure on services
		Municipal wastewater treatment rate (%)
Per capita sports space(square metres)		
Regional road network density		
Sustainability	Improving the quality and efficiency of the economy	Mobile phone penetration rate (units per 100 population)
		Internet penetration (%)
		Size of digital economy as a share of GDP (%)
		Energy consumption per unit of GDP (tonnes of standard coal per million yuan)
		Total labour productivity growth (%)
		Growth in R&D investment (%)
	Excellent ecological environment	Value added of tertiary sector as a share of GDP
		Number of high-value invention patents per 10,000 population (pieces)
		R&D expenditure as a share of GDP (%)
		Forest cover (%)
Shareability	Social harmony and concord	Proportion of good air quality days in cities at the prefecture level and above (%)
		Average PM2.5 concentration in cities at prefecture level and above (µg/m3)
	Fiscal Tax Inclusion	Proportion of surface waters at or better than category III (%)
		Life expectancy at birth (year)
		Gross enrolment ratio in tertiary education (%)
		Average years of schooling of the working-age population (year)
Equalisation of public services	Number of suspected offenders prosecuted (10,000)	
	Lawyers per 10,000 persons (person)	
	Per capita financial income (yuan/person)	
	Transfer dependency (%)	
	Share of tax revenues (%)	
Equalisation of public services	Share of large taxes (%)	
	Ratio of livelihood expenditure to general public budget expenditure (%)	
	Land grant dependency (%)	
	Number of practising (assistant) physicians per 1,000 population (person)	
Equalisation of public services	Number of beds in medical institutions per 1,000 population (bed)	
	Number of beds for the elderly per 1,000 elderly persons (bed)	
	Pension insurance dependency ratio	

		Expenditure on public education per pupil in ordinary primary schools (yuan)
		Expenditure on public education per pupil in general junior secondary schools (yuan)
		Pupil-teacher ratio at primary level
		Pupil-teacher ratio at lower secondary level
		Minimum living standard for urban and rural residents (yuan/year)
		Ratio of social security expenditure to GDP (%)
	Reduced income gap	Gini index
		Income growth of low-income groups (%)
		Labour remuneration as a share of GDP (%)
	Diverse spiritual needs	Per capita consumption expenditure on education, culture and recreation (yuan)
		Public library holdings per capita (volume)
		Combined reading rate of the population (%)
	Urban and rural coordination	Urbanisation rate of resident population (%)
		Ratio of disposable income of urban and rural residents
	Regional coordination	Coefficient of variation in regional economic development
Coefficient of variation in regional GDP per capita		

5. Calculation and synthesis of the Common Prosperity Index model

This paper is based on data from 2019-2022 for the calculation and synthesis of the common prosperity index model.

5.1. Data sources

The source of data for the first and second level indicators in this paper is the questionnaire "Constructing China's Common Prosperity Index", which was completed by 15 experts in the field of economics based on the AHP method. The data for the third level indicators for the period 2019-2022 are obtained from the official government websites, such as the National Bureau of Statistics.

The comparison scale in the questionnaire "Constructing China's Common Prosperity Index" is divided into five levels, such as more important, more important, equally important, less important and less important, which correspond to the scores of 5, 3, 1, 1/3 and 1/5, respectively. The questionnaire was compared a total of 3 times for the dimensions and a total of 27 times for the secondary indicators.

Examples of questionnaire comparisons are shown in Table (4).

Table 4 Comparison matrix for first-level indicators

Factors for two-by-two comparative judgements	Even less important	Less important	Equal importance	More important	Even more important
A. development than B. shareability	1/5	1/3	1	3	5
A. development than C. sustainability	1/5	1/3	1	3	5
B. shareability than C. sustainability	1/5	1/3	1	3	5

5.2. Modelling based on the AHP-DEMATEL method

The initial AHP weights W^1 are calculated by arithmetic averaging: first, the evaluation matrix is normalized by columns (each element is divided by the sum of the columns in which the device is located), then the normalized columns are summed (summed by rows), and finally, each element of the vector obtained after summation is divided by n to obtain the initial weights $W^1 = (w_1 w_2 \dots w_n)$ and satisfying $0 \leq w_i \leq 1, \sum_{j=1}^n w_i$. The formula is as follows.

$$w_i = \frac{1}{n} \sum_{j=1}^n \frac{a_{ij}}{\sum_{k=j}^n a_{ik}} \tag{8}$$

In the DEMATEL method, the degree of influence of each factor and the degree of being influenced are combined to calculate the influence weight W^2 . Here the formula $d = f^T \cdot e$ is used to obtain the relationship matrix on the degree of influence and the degree of being influenced, take the diagonal elements of the matrix to form a vector of the degree of influence on the risk factor $d_i = f_i \times e_i$ to calculate the degree of influence of factor i , the degree of influence is f_i and the degree of being influenced is e_i , and then normalized according to the formula to obtain the influence weight W^2 , and $0 \leq W^2 \leq 1$. The normalization formula is as follow.

$$W^2 = d_i / \sum_{i=1}^n d_i \tag{9}$$

Determining the integrated weights. The initial weights and impact weights above are calculated according to $W = W^1 W^2$, and normalized to get the canonical data, which is the integrated weight \bar{W} , and the results are sorted from largest to smallest, which is the integrated weight of the factor, to get the strength of the degree of influence of risk factors [4].

We through the SPSSAU software were used AHP and DEMATEL method of data calculation, and finally through EXCEL using $W = W^1 W^2$ formula to produce the final weight \bar{W} results shown in Table (5).

Table 5 Weighting and ranking of the Common Prosperity indicators obtained using the AHP-DEMATEL method

method results indicators		AHP		DEMATEL		AHP-DEMATEL	
		Weight	Sorting	Weight	Sorting	Weight	Sorting
First-level indicators	Development	0.3516	2	0.319	3	0.33587	2
	Sustainability	0.3909	1	0.348	1	0.40736	1
	Shareability	0.2575	3	0.333	2	0.25677	3
Development	Rising income levels	0.4446	1	0.358	1	0.47160	1
	Upgrading of the consumer structure	0.2808	2	0.33	2	0.27456	2
	Well-established infrastructure	0.2746	3	0.312	3	0.25385	3
Sustainability	Improving the quality and efficiency of the economy	0.3087	3	0.337	1	0.31216	3
	Excellent ecological environment	0.3558	1	0.335	2	0.35765	1
	Comprehensive Quality Enhancement	0.3355	2	0.328	3	0.33020	2
Shareability	Social harmony and concord	0.1438	3	0.138	7	0.13897	6
	Fiscal Tax Inclusion	0.1379	6	0.145	2	0.14003	5
	Equalisation of public services	0.1397	4	0.145	2	0.14186	3
	Reduced income gap	0.1607	1	0.141	6	0.15868	1
	Diverse spiritual needs	0.1465	2	0.143	4	0.14671	2
	Urban and rural coordination	0.1334	7	0.142	5	0.13266	7
	Regional coordination	0.138	5	0.146	1	0.14110	4

5.3. Dimensionless processing with negative indicators

In the process of calculating and synthesizing the common prosperity index, because each indicator is different in scale, economic significance, manifestation and tendency to play a role in the overall

goal, it is not comparable, so it must be processed in a dimensionless way to eliminate the influence of the indicator's scale. In this paper, the normalization method is used for the dimensionless processing of each indicator, and the specific formulas are as follows:

$$x_i^* = \frac{x_i - x_{min}}{x_{max} - x_{min}} \tag{10}$$

That is, the value of each variable minus the minimum value of that variable divided by the difference between the maximum and minimum values of that variable. Where x_i^* is the result of the variable after normalisation, x_i is the value of the specific tertiary indicator variable, x_{min} is the minimum value of the variable in the group and x_{max} is the maximum value of the variable in the group [4]. If a data happens to be the minimum value, it is normalised to 0, and if the data happens to be the maximum value, it is normalised to 1. Therefore, the dimensionless results obtained by the normalization method are all distributed within the interval (0,1), and the mathematical units between the data remain consistent.

Since the units and/or means of the indicators are different, the coefficient of variation (COV) is calculated using the ratio (relative value) of the standard deviation δ_i to the mean \bar{x}_i for comparison, with the following formula.

$$(COV)_i = \frac{\delta_i}{\bar{x}_i} \tag{11}$$

Based on the obtained coefficient of variation, the weights w_i are then normalised to obtain the weights, which are calculated as follows:

$$w_i = \frac{(COV)_i}{\sum_{i=1}^n (COV)_i} \tag{12}$$

In the evaluation system of the common prosperity index indicators, some indicators are negatively correlated with the common prosperity index, and we correct the weights according to the importance of each indicator.

The final results of the dimensionless processing of the three-level index data for 2019-2022 using SPSSPRO are shown in Table (6).

Table 6 Summary of the results of the treatment of dimensionless and negative indicators for the third-level indicators

Third-level indicators	Standardised values in 2019	Standardised values in 2020	Standardised values in 2021	Standardised values in 2022	Variation coefficient	Weight
GDP per capita growth(%)	0.38	0.00	1.00	0.10	1.01389	1.66%
National average minimum hourly wage (yuan/hour)	0.00	0.03	0.52	1.00	1.22069	2.00%
Working hours (hours/week)	0.00	0.18	0.91	1.00	0.967	-1.58%
Urban and rural per capita disposable income (yuan)	1.00	0.00	0.29	0.46	0.96083	1.57%
Disposable income per capita as a share of GDP per capita (%)	0.18	1.00	0.20	0.00	1.28397	2.10%
Investment per inhabitant(yuan)	0.48	0.00	0.48	1.00	0.82954	1.36%
Balance of deposits per inhabitant(yuan)	0.00	0.52	1.00	0.48	0.81739	1.34%
Urban registered unemployment rate	0.00	0.39	1.00	1.00	0.82114	-1.34%
Engel's coefficient	0.00	0.87	0.70	1.00	0.69443	-1.14%

Consumption expenditure per urban resident(yuan)	0.98	0.00	0.98	1.00	0.66686	1.09%
Per capita consumption expenditure of rural residents(yuan)	0.75	0.00	0.75	1.00	0.69168	1.13%
Total retail sales of consumer goods per capita (billion yuan)	0.00	1.00	0.01	0.00	1.97412	3.23%
Consumption rate of the population (%)	1.00	0.47	0.63	0.00	0.78808	1.29%
Share of consumption expenditure on services	1.00	0.00	0.48	0.18	1.05296	1.72%
Municipal wastewater treatment rate (%)	0.62	0.00	1.00	1.00	0.72067	1.18%
Per capita sports space(square metres)	0.34	0.00	0.74	1.00	0.84543	1.38%
Regional road network density	0.00	0.33	0.67	1.00	0.86066	1.41%
Mobile phone penetration rate (units per 100 population)	0.09	0.00	0.45	1.00	1.17107	1.91%
Internet penetration (%)	0.00	0.64	0.72	1.00	0.71613	1.17%
Size of digital economy as a share of GDP (%)	0.00	0.50	0.75	1.00	0.75903	1.24%
Energy consumption per unit of GDP (tonnes of standard coal per million yuan)	0.57	1.00	0.14	0.00	1.05409	-1.72%
Total labour productivity growth (%)	0.60	0.00	1.00	0.27	0.92055	1.50%
Growth in R&D investment (%)	0.68	0.33	1.00	0.00	0.8582	1.40%
Value added of tertiary sector as a share of GDP	0.65	1.00	0.29	0.00	0.89278	1.46%
Number of high-value invention patents per 10,000 population (pieces)	0.00	0.00	0.39	1.00	1.09055	1.78%
R&D expenditure as a share of GDP (%)	0.00	0.53	0.66	1.00	0.7588	1.24%
Forest cover (%)	0.00	0.08	0.08	1.00	1.6549	2.70%
Proportion of good air quality days in cities at the prefecture level and above (%)	0.00	0.91	1.00	0.82	0.6755	1.10%
Average PM2.5 concentration in cities at prefecture level and above (µg/m3)	0.70	1.00	0.10	0.00	1.06574	1.74%
Proportion of surface waters at or better than category III (%)	0.00	0.49	0.66	1.00	0.77538	1.27%
Life expectancy at birth (year)	0.00	0.70	1.00	0.70	0.70711	1.16%
Gross enrolment ratio in tertiary education (%)	0.00	0.35	0.77	1.00	0.83775	1.37%

Average years of schooling of the working-age population (year)	0.00	0.22	0.87	1.00	0.93541	1.53%
Number of suspected offenders prosecuted (10,000)	1.00	0.36	0.82	0.00	0.83044	-1.36%
Lawyers per 10,000 persons (person)	0.00	0.39	0.84	1.00	0.81167	1.33%
Per capita financial income (yuan/person)	0.44	0.00	0.94	1.00	0.79021	1.29%
Transfer dependency (%)	0.00	0.51	0.35	1.00	0.89144	-1.46%
Share of tax revenues (%)	0.35	0.74	1.00	0.00	0.84269	1.38%
Share of large taxes (%)	1.00	0.81	0.84	0.00	0.67854	1.11%
Ratio of livelihood expenditure to general public budget expenditure (%)	1.00	0.39	0.18	0.00	1.10822	1.81%
Land grant dependency (%)	0.67	1.00	0.00	0.28	0.90183	-1.47%
Number of practising (assistant) physicians per 1,000 population (person)	0.00	0.30	0.30	1.00	1.05668	1.73%
Number of beds in medical institutions per 1,000 population (bed)	0.43	0.00	1.00	1.00	0.80081	1.31%
Number of beds for the elderly per 1,000 elderly persons (bed)	0.14	1.00	0.06	0.00	1.56782	2.56%
Pension insurance dependency ratio	0.00	0.01	0.07	1.00	1.82475	2.98%
Expenditure on public education per pupil in ordinary primary schools (yuan)	1.00	0.00	0.04	0.04	1.78975	2.93%
Expenditure on public education per pupil in general junior secondary schools (yuan)	1.00	0.02	0.00	0.00	1.9541	3.19%
Pupil-teacher ratio at primary level	1.00	0.65	0.00	0.00	1.20422	-1.97%
Pupil-teacher ratio at lower secondary level	1.00	0.37	0.00	0.33	0.97683	-1.60%
Minimum living standard for urban and rural residents (yuan/year)	0.00	0.07	0.42	1.00	1.2248	2.00%
Ratio of social security expenditure to GDP (%)	0.12	1.00	0.00	0.24	1.32582	2.17%
Gini index	0.00	0.13	0.20	1.00	1.35647	-2.22%
Income growth of low-income groups (%)	1.00	0.30	0.24	0.00	1.1209	1.83%
Labour remuneration as a share of GDP (%)	0.24	1.00	0.24	0.00	1.17267	-1.92%

Per capita consumption expenditure on education, culture and recreation (yuan)	0.02	0.00	0.03	1.00	0.68234	1.12%
Public library holdings per capita (volume)	0.00	0.50	1.00	1.00	0.76594	1.25%
Combined reading rate of the population (%)	0.00	0.29	0.71	1.00	0.88832	1.45%
Urbanisation rate of resident population (%)	0.00	0.71	0.89	1.00	0.69116	1.13%
Ratio of disposable income of urban and rural residents	1.00	0.58	0.26	0.00	0.93489	-1.53%
Coefficient of variation in regional economic development	0.00	0.35	1.00	0.51	1.01389	-1.66%
Coefficient of variation in regional GDP per capita	1.00	0.98	0.00	0.13	1.22069	-2.00%

5.4. Index synthesis

Based on the standardization of the tertiary indicators, the final weights were obtained by multiplying them by the corresponding weights of the primary and secondary indicators according to the following formula:

$$W_i = w_i \cdot w_i^1 \cdot w_i^2 \tag{13}$$

Where: W_i is the final weight corresponding to the three-stage index, w_i is the weight of the three-stage index after normalization, w_i^2 is the weight of the second-stage index corresponding to the three-stage index, and w_i^1 is the weight of the first-stage index corresponding to the three-stage index;

Ultimately, the final synthetic formula for the Common Prosperity Index by weighted summation is as follows.

$$P = \sum_{i=1}^N x_i^* \cdot W_i \tag{14}$$

Where: P is the Common Prosperity Index, N is the number of items of the corresponding three-level indicator, and x_i^* is the standardised value of the third-level indicator.

We use EXCEL to perform the calculations and finally, the weights of this common prosperity index indicator for 2019-2022 are shown in the following Table (7).

Table 7 Final weights for each of the third-level indicators

First-level indicators	w_i^1	Second-level indicators	w_i^2	Third-level indicators	w_i	W_i
Development	0.335869	Rising income levels	0.4716	GDP per capita growth(%)	0.0166	0.0026
				National average minimum hourly wage (yuan/hour)	0.0200	0.0032
				Working hours (hours/week)	-0.0158	-0.0025
				Urban and rural per capita disposable income (yuan)	0.0157	0.0025
				Disposable income per capita as a share of GDP per capita (%)	0.0210	0.0033
				Investment per inhabitant(yuan)	0.0136	0.0022
				Balance of deposits per inhabitant(yuan)	0.0134	0.0021
		Urban registered unemployment rate	-0.0134	-0.0021		
		0.27456	Engel's coefficient	-0.0114	-0.0011	

		Upgrading of the consumer structure		Consumption expenditure per urban resident(yuan)	0.0109	0.0010	
				Per capita consumption expenditure of rural residents(yuan)	0.0113	0.0010	
				Total retail sales of consumer goods per capita (billion yuan)	0.0323	0.0030	
				Consumption rate of the population (%)	0.0129	0.0012	
				Share of consumption expenditure on services	0.0172	0.0016	
		Well-established infrastructure	0.25385		Municipal wastewater treatment rate (%)	0.0118	0.0010
					Per capita sports space(square metres)	0.0138	0.0012
					Regional road network density	0.0141	0.0012
					Mobile phone penetration rate (units per 100 population)	0.0191	0.0016
					Internet penetration (%)	0.0117	0.0010
Sustainability	0.407357	Improving the quality and efficiency of the economy	0.31216	Size of digital economy as a share of GDP (%)	0.0124	0.0010	
				Energy consumption per unit of GDP (tonnes of standard coal per million yuan)	-0.0172	-0.0014	
				Total labour productivity growth (%)	0.0150	0.0012	
				Growth in R&D investment (%)	0.0140	0.0011	
				Value added of tertiary sector as a share of GDP	0.0146	0.0012	
				Number of high-value invention patents per 10,000 population (pieces)	0.0178	0.0014	
				R&D expenditure as a share of GDP (%)	0.0124	0.0010	
		Excellent ecological environment	0.35765		Forest cover (%)	0.0270	0.0025
					Proportion of good air quality days in cities at the prefecture level and above (%)	0.0110	0.0010
					Average PM2.5 concentration in cities at prefecture level and above (µg/m3)	0.0174	0.0016
					Proportion of surface waters at or better than category III (%)	0.0127	0.0012
		Comprehensive Quality Enhancement	0.33020		Life expectancy at birth (year)	0.0116	0.0010
					Gross enrolment ratio in tertiary education (%)	0.0137	0.0012
					Average years of schooling of the working-age population (year)	0.0153	0.0013
Shareability	0.256774	Social harmony and concord	0.13897	Number of suspected offenders prosecuted (10,000)	-0.0136	-0.00077	
				Lawyers per 10,000 persons (person)	0.0133	0.00075	
		Fiscal Tax Inclusion	0.14003		Per capita financial income (yuan/person)	0.0129	0.00074
					Transfer dependency (%)	-0.0146	-0.00083
					Share of tax revenues (%)	0.0138	0.00079
					Share of large taxes (%)	0.0111	0.00063
					Ratio of livelihood expenditure to general public budget expenditure (%)	0.0181	0.00103
					Land grant dependency (%)	-0.0147	-0.00084
		Equalisation of public services	0.14186		Number of practising (assistant) physicians per 1,000 population (person)	0.0173	0.00099

				Number of beds in medical institutions per 1,000 population (bed)	0.0131	0.00076
				Number of beds for the elderly per 1,000 elderly persons (bed)	0.0256	0.00148
				Pension insurance dependency ratio	0.0298	0.00172
				Expenditure on public education per pupil in ordinary primary schools (yuan)	0.0293	0.00169
				Expenditure on public education per pupil in general junior secondary schools (yuan)	0.0319	0.00184
				Pupil-teacher ratio at primary level	-0.0197	-0.00114
				Pupil-teacher ratio at lower secondary level	-0.0160	-0.00092
				Minimum living standard for urban and rural residents (yuan/year)	0.0200	0.00116
				Ratio of social security expenditure to GDP (%)	0.0217	0.00125
				Reduced income gap	0.15868	Gini index
		Income growth of low-income groups (%)	0.0183			0.00118
		Labour remuneration as a share of GDP (%)	-0.0192			-0.00124
		Diverse spiritual needs	0.14671	Per capita consumption expenditure on education, culture and recreation (yuan)	0.0112	0.00067
				Public library holdings per capita (volume)	0.0125	0.00075
				Combined reading rate of the population (%)	0.0145	0.00087
		Urban and rural coordination	0.13266	Urbanisation rate of resident population (%)	0.0113	0.00061
				Ratio of disposable income of urban and rural residents	-0.0153	-0.00083
		Regional coordination	0.14110	Coefficient of variation in regional economic development	-0.0166	-0.00095
				Coefficient of variation in regional GDP per capita	-0.0200	-0.00115

6. Conclusions and significance

6.1. Research conclusions

In this paper, the AHP-DEMATEL method is mainly used to measure the weights of the primary and secondary indicators of China's common prosperity index in the past four years, and the comprehensive weights obtained are ranked in descending order to reflect the importance of the indicators affecting China's common prosperity development in the four-year period from 2019 to 2022. Through the normalisation method, the three-level indicators were dimensionless and negatively treated, and the corresponding standardised values and weights were derived, on the basis of which the common prosperity index was synthesised, and the following conclusions were drawn:

(i)The results of the ranking of the comprehensive weights based on the AHP-DEMATEL method show that Among the first-level indicators in the system we constructed, the sustainability indicator has the highest weight and the sharing indicator has the lowest weight; Among the second-level indicators corresponding to development, the income level improvement indicator has the highest weight and the infrastructure improvement indicator has the lowest weight; Among the second-level indicators corresponding to sustainability, the ecological environment improvement indicator has the highest weight and the economic quality and efficiency improvement indicator has the lowest weight;

Among the second-level indicators corresponding to development, the income gap reduction indicator has the highest weight and the urban-rural coordination indicator has the lowest weight. Among the secondary indicators corresponding to sustainability, the indicator of excellent ecological environment has the highest weight, while the indicator of improved economy has the lowest weight; among the secondary indicators corresponding to equity, the indicator of narrowing income gap has the highest weight, while the indicator of urban-rural coordination has the lowest weight. According to the Party's 14th Five-Year Plan, the realisation of the goal of common prosperity should be guided by quality and efficiency and satisfy people's aspirations for a better life, so it can be seen that the weights of the first and second level indicators of common prosperity by the AHP-DEMATEL method are more reasonable, and that China needs to focus on high-quality development and take sustainable development as the main line of the process of realising common prosperity. In the process of realising common prosperity, China must take high-quality development as the main line and sustainable development as the main direction, so as to improve people's well-being and enhance the quality of life.

(ii)Analysing the results of the dimensionless processing of the three-level indicators and the processing of the negative indicators by the normalisation method, it is concluded that the weight of the indicator of disposable income per capita as a proportion of GDP per capita is the highest among the positive indicators, followed by the indicator of the national average minimum hourly wage and the indicator of total retail sales of consumer goods per capita, and the indicator of the rate of urbanisation of the resident population is the lowest, while the weight of the indicator of the number of hours worked is the highest among the negative indicators, followed by the indicator of the unemployment rate and the indicator of the rate of prosecution, and the weight of the unemployment rate is the highest. The weight of the unemployment rate indicator is the highest, while the weight of the number of suspected criminals prosecuted indicator is the lowest.

(iii)The results of the synthetic comparative analysis of China's common prosperity index for the four years from 2019 to 2022 show that although China's common prosperity index declined from 2019 to 2020, it increased in the three years from 2020 to 2022, with the largest increase in 2021. The arrival of the epidemic in 2020 had a great impact on China's economy and people's happiness. In 2020, the arrival of the new epidemic had a great impact on China's economy and people's happiness, and the instability of the social environment slowed down the development of China's common prosperity; With the completion of the moderately prosperous society in 2021, China has become the only major economy to achieve positive economic growth when the world economy is affected by the epidemic and is almost at a standstill, and the common prosperity has experienced a high development rate along with the rapid recovery of China's economy; 2022 is the first year of China's economic return to normal after the epidemic has subsided, and China's common prosperity is heading for high-quality development. In 2022, the first year of normalisation after the recovery from the epidemic, the Common Prosperity Index will undoubtedly continue to grow in a high-quality developing China.

6.2. Countermeasures and suggestions

The realisation of common prosperity requires a long period of time and persistent efforts, and it is necessary to adhere to the principle of doing one's best and living within one's means, and to formulate a way to promote common prosperity in the light of the actual stage of economic and social development. Based on the conclusions of the study, this paper proposes the following countermeasures based on the insights gained from the study:

First, we should broaden our perspectives, promote a comprehensive approach and explore a model of common prosperity that is compatible with development, sharing and sustainability. Shared prosperity encompasses political, economic, social, cultural and environmental aspects, etc. At present, research on the path to achieving common prosperity is more at the political and economic levels, and is not comprehensive enough to be studied only from the perspective of prosperity inequality and income distribution. Combined with this paper's comprehensive measurement of the

common prosperity index from the perspectives of development, sharing and sustainability, sharing has the smallest impact on China's common prosperity index, so in order to realise the "five-in-one" comprehensive prosperity, the focus should shift from sharing to sustainability and development, especially sustainability, which has the highest weight and impact on the common prosperity index. In particular, sustainability has the highest weight and impact on the Common Prosperity Index.

Second, the growth of people's income and the equity of income distribution should be implemented in economic development. According to the Common Prosperity Index model established in this paper, the weight of the income level among the development indicators is 47.2 per cent, with the highest weights being the ratio of per capita disposable income to per capita GDP and the national minimum hourly wage. Therefore, China's Common Prosperity Index will only rise if it adheres to the practice of effectively raising people's incomes in the midst of high-quality development, and allows people to genuinely feel that economic development has brought about an improvement in their own lives. Promoting shared prosperity requires optimising distribution in the midst of growth, rather than simply adjusting distribution around stocks. Among the indicators of shared prosperity, narrowing the income gap is the most important; improving the viability of the middle and low income population, raising the income level of the middle and low income population, lowering the Gini index, and increasing people's non-labour income are the key, and the focus of; forming an "olive-shaped" pattern of income distribution and promoting shared prosperity.

Third, the promotion of common prosperity in high-quality development should be based on the stage of economic development. Economic development has obvious stage characteristics, which determines the need for different policies at different stages of development. At present, China is entering the stage of high-quality economic development from the stage of high-speed economic development, according to the model of China's common prosperity index formed in this paper, the economic quality and efficiency of sustainability has the greatest weight, so the government should focus on promoting the development of high-tech industries in the current stage of economic construction work, and encourage enterprises to invest in high-tech product research and development, which is the key to improving and promoting common prosperity and focus on This is the key and focus of improving and promoting common prosperity. In addition, the development of increasing the average number of years of education of the working-age population and the gross enrolment rate of higher education is closely related to economic quality and efficiency, which can provide excellent manpower and talent reserves for China's economic transformation and scientific and technological research and development, and the government should take measures to encourage the working-age population to improve their own qualities in order to adapt to China's economic transformation in the future; at the same time, the government should strengthen the protection of intellectual property rights and enhance the effective supply of science and technology. supply and its transformation [5].

6.3. Prospect

An analysis of the road to common prosperity in the new era shows that common prosperity is an important feature of Chinese-style modernisation and one of the important goals of socialist modernisation. As the world's most populous and largest developing country, China needs a solid economic foundation to support its modernisation and promote common prosperity for all its people in such a mega-economy. On the political front, the people must adhere to the political leadership of the Communist Party of China (CPC); on the economic and social front, they must focus on high-quality development and social harmony and stability; on the cultural front, they must promote cultural prosperity; and on the ecological front, they must realise the beautiful expectations of green development and sustainability. In the new era, we must focus not only on equity but also on efficiency to firmly promote the realisation of high-quality common prosperity. Only by integrating social resources can we create a synergy of development and promote the all-round quality development of the country in the political, economic, cultural, social and ecological fields.

References

- [1] Hao Sun, Xiaoye Cao. Measurement and evaluation of common prosperity in Chinese provinces [J]. Zhejiang Social Sciences. 2022(6), p. 4-18+155.
- [2] Xiaojing Qian, Baoping Ren. Theoretical connotation of common prosperity in the new development stage and construction of evaluation index system [J]. Research on financial issues. 2022 (07), p. 5-13.
- [3] Xinbo Lu, Wei Zhao. Research on evaluation index system of common prosperity based on multidimensional measurement [J]. Scientific Decision Making. 2021(12), p. 124-137
- [4] Ying Qu, Yajing Lu, Ziyu Liu, Mingxin Yang. Research on weight calculation method based on AHP-DEMATEL method [J]. Practice and Understanding of Mathematics. 2016(7), p. 38-46
- [5] Guanghua Wan, Jing Lan, Zhen Liu. Construction and measurement of common prosperity indicator system based on people's happiness [J]. Economic Science. 2023[2], p. 5-25