

# *Measurement of the common prosperity process in China based on textual analysis*

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**Abstract:** As China enters a new stage of development, the goal of the next stage of Chinese-style modernization has been changed to achieving the common prosperity of all the people, which requires the support of scientific statistical measurement of the common prosperity process, and it is of great significance to study the statistical measurement of the common prosperity process. In this paper, based on the multiple connotations of common prosperity, including the degree of prosperity and the degree of sharing, we will construct a statistical measurement index system of the common prosperity process, obtain the common prosperity index and analyse it. First, we conduct text analysis, use crawlers to retrieve relevant literature, draw word cloud map after a series of processing, establish Latent Dirichlet Allocation theme model to get 7 themes, i.e. our secondary indicators: economic development, social structure, residents' income and property, accessibility of public products, people's quality of life, fairness of income distribution, life and health. Then, the index data are standardised, ranked according to the Delphi method and the entropy weight TOPSIS method, to complete the construction of the statistical measurement model and obtain the Common Wealth Index, to synthesise the relevant literature and research, and to analyse and draw the relevant conclusions and recommendations.

## 1. Introduction

The realization of common prosperity must be supported by scientific statistical measurement. By studying the statistical measurement of the process of modernization and common prosperity in China in the new era, it is possible to gain a more comprehensive understanding of people's living conditions and wealth distribution, identify and resolve social contradictions and inequalities in a timely manner, and provide a scientific basis and data support for formulating more accurate poverty alleviation policies. At the same time, studying the statistical measurement of common prosperity in China in the new era can also improve the country's international competitiveness. In the context of globalization, a country's international competitiveness depends not only on the speed and scale of economic development, but also on the quality of life of its people and the degree of social justice. By studying the statistical measurement of the process of common prosperity, China's international competitiveness can be improved and its international discourse enhanced.<sup>[1][2]</sup>

## 2. Literature review

From the point of view of existing studies, there are the following problems in constructing the evaluation system of common prosperity indicators: first, the studies on practical measurement and analysis need to be expanded, and the measurement scope of most existing studies focuses only on the provincial and regional levels; second, it is difficult to statistically quantify some of the selected indicators. Third, the data sample has a large missing range, which also limits the statistical measurement of the level of common wealth.<sup>[5]</sup>

The possible marginal contributions of this paper are as follows: first, based on the existing literature, to study the role of the impact on common prosperity under different index systems of Chinese-style modernization, while constructing a statistical measurement index system of the common prosperity level of Chinese-style modernization and analyses the common prosperity index. Second, the evaluation system based on the common prosperity index can objectively describe the basic situation of common prosperity in Chinese-style modernization and compare the gap and impact between different indicators.<sup>[6]</sup>

## 3. Method

### 3.1 Latent Dirichlet Allocation theme model

The LDA theme model is a Bayesian probabilistic text data analysis method that adopts a three-layer structure of words, topics and documents to efficiently analyse large text data. The model uses a Bayesian framework based on a probabilistic latent semantic analysis model, which enables fast searching, retrieval and summarization of large numbers of documents, and has been widely used for topic identification and hotspot analysis in various research fields. In the LDA theme model, each document corresponds to a topic distribution, and each topic corresponds to a vocabulary distribution. During the training process of the model, the topic distribution and the vocabulary distribution are optimized through continuous iteration to finally reach the optimal state. Conjugate distribution is a term in Bayesian probability theory that refers to the prior probability and posterior probability with the same distribution law, we say that the prior probability and posterior probability with the same distribution law have the relationship of conjugate distribution. If the probability density function of the likelihood function and the probability density function of the prior distribution are conjugate, then the prior distribution is called the conjugate prior distribution of the likelihood function.

$$P(\theta | x) = P(\theta, x)P(x)$$

After derivation, the conjugate prior of the desired binomial distribution is the beta distribution and the conjugate prior of the desired polynomial distribution is the Dirichlet distribution. The probability density function of the distribution is:

$$f|(x_1, x_2, \dots, x_k; \alpha_1, \alpha_2, \dots, \alpha_k) = \frac{1}{B(\alpha)} \prod_{i=1}^k x_i^{\alpha_i-1}$$
$$B(\alpha) = \frac{\prod_{i=1}^k \Gamma(\alpha_i)}{\Gamma(\sum_{i=1}^k \alpha_i)}, \sum_{i=1}^k x_i = 1$$

Gibbs sampling is then performed. The corpus is defined as  $\bar{z}$ , where  $z_j$  is the  $j$ th word. Where the subscript  $m$  represents the  $m$ th article, the subscript  $n$  represents the  $n$ th word in that article, and the subscript  $j$  represents the position of that word, with  $-j$  denoting the word with the subscript  $j$

removed. We need to compute the conditional distribution of the axes corresponding to subscript  $j$  with subscript  $j$  removed. Let the observed words be  $w_j = t$ . Using Bayes' law then the formula based on Dirichlet parameter estimation eventually yields the Gibbs Sampling formula for the LDA model:

$$p(z_j = k | \vec{z}_{-j}, \vec{w}) \propto \frac{m_{m_j, -j}^{(k)} + \alpha_k}{\sum_{k=1}^K (n_{m, -j}^{(k)} + \alpha_k)} \cdot \frac{n_{k, -j}^{(j)} + \beta_t}{\sum_{t=1}^V (n_{k, -j}^{(t)} + \beta_t)}$$

In the corpus, each word  $w$  is randomly assigned to a particular topic  $z$ . Each word  $w$  is then sampled to obtain the corresponding topic  $z$ , and that topic is used to replace the original topic of that word in the corpus. This process is repeated until the Gibbs sampling formula converges. Finally, based on the topic-word co-occurrence frequency matrix obtained from the corpus, the LDA topic model can be obtained.

### 3.2 An exploration of common prosperity measures based on text mining methods

In order to better understand the characteristics of common prosperity in Chinese modernization, we decided to conduct a textual analysis. Taking "Chinese-style modernization", "common prosperity" and other keywords as the theme, we reviewed relevant literature through Google scholar, Chinese government website, CCTV news, etc. After sorting and screening, we obtained 441 relevant articles. Then the text was cleaned, the text was segmented using 'jieba' in Python, and finally the word cloud was drawn according to the word frequency. As shown in Figure 1.



Figure 1: Chinese Modernization Common Prosperity Characteristics Word Cloud Map

In the word cloud diagram, the size of the words can indicate the word frequency, and the higher the word frequency, the larger the size of the words. According to the word cloud diagram, we can know that development, economy, society, life, income, health and so on are the words that appear more frequently in the text, and these words reflect to some extent the research direction of Chinese-style modernisation, which focuses on common prosperity. Therefore, under the premise that wealth and sharing are the primary indicators, we design the secondary indicator system from seven aspects: economic development, residents' income and property, social structure, accessibility of public products, people's quality of life, fairness in income distribution, and life and health.<sup>[7]</sup>

### 3.3 Entropy weight TOPSIS method

The entropy weight TOPSIS method is an objective weighting method that combines the advantages of entropy weight method and TOPSIS method. This method first uses the entropy weight method to determine the weights of each evaluation indicator, and then uses the TOPSIS method to determine the ranking of evaluation objects. The entropy weight TOPSIS method defines the distance between the optimal solution and the worst solution of a decision problem, and calculates the relative closeness of each solution to the ideal solution. The entropy weight method mainly determines the weight based on the information reflected by the degree of variation of each evaluation indicator value. Through this approach, the entropy weighted TOPSIS method can more accurately evaluate

and rank different evaluation objects. The specific steps are as follows.

Assuming there are  $m$  evaluated objects and  $n$  evaluation indicators for each evaluated object, construct a judgment matrix:

$$X = (x_{ij})_{m \times n}, \text{ among them, } i = 1, 2, \dots, m; j = 1, 2, \dots, n$$

Standardize mixed national and provincial-level data and calculate the proportion of the  $j$ -th indicator value in the  $i$ -th year, calculate variable information entropy, information entropy redundancy, the corresponding weights of the indicators, the weighting matrix, then compute the optimal solution  $S_j^+$  and the worst solution  $S_j^-$ .

$$Y_{ij} = \frac{st\_X_{ij}}{\sum_{i=1}^m st\_X_{ij}}$$

$$e_j = -k \times \sum_{i=1}^m Y_{ij} \times \ln(Y_{ij}), \text{ among them, } k = \frac{1}{\ln m}$$

$$d_j = 1 - e_j$$

$$w_j = \frac{d_j}{\sum_{j=1}^n d_j}$$

$$R = (r_{ij})_{m \times n}, r_{ij} = w_j \cdot x_{ij}, \text{ among them, } i = 1, 2, \dots, m; j = 1, 2, \dots, n$$

$$S_j^+ = \max(r_{1j}, r_{2j}, \dots, r_{mj}), S_j^- = \min(r_{1j}, r_{2j}, \dots, r_{mj})$$

Calculate the Euclidean distance between the optimal and the worst solution for each scheme, then calculate the composite evaluation index:

$$sep_i^+ = \sqrt{\sum_{j=1}^n (s_i^+ - r_{ij})^2}, sep_i^- = \sqrt{\sum_{j=1}^n (s_i^- - r_{ij})^2}$$

$$C_i = \frac{sep_i^-}{sep_i^+ + sep_i^-}, C_i \in [0, 1]$$

In the formula: the larger the value of  $C_i$ , the better the characterization of the evaluation object.

### 3.4 Data processing

The indicators and data for the study of the "common prosperity" evaluation indicator system are mainly taken from the China Statistical Yearbook, the China Urban Statistical Yearbook, the China Urban and Rural Construction Statistical Yearbook, the China Labor Statistical Yearbook, the China Real Estate Statistical Yearbook and statistical reports published by other relevant institutions. In order to make the data variables comparable, we have standardized the data separately at national and provincial level. For positive and negative indicators, the following formula were adopted:

$$st_{x_{ij}} = \frac{x_{ij} - \min | x_{ij} |}{\max | x_{ij} | - \min | x_{ij} |} \times 100, \forall i, j$$

$$st_{x_{ij}} = \frac{\min | x_{ij} | - x_{ij}}{\max | x_{ij} | - \min | x_{ij} |} \times 100, \forall i, j$$

According to the differences between the indicators, different weighting methods are used in this paper.[3] The weights of the first-level indicators are determined using the Delphi method. After scoring by experts and combining the comprehensive judgement of the connotation of common prosperity with the existing literature research, the weights of prosperity and sharing degree are set at 30% and 70% respectively, and prosperity and sharing degree are weighted to obtain the final common prosperity index. Among them, the weights of the secondary indicators of economic development, residents' income and wealth, social structure, accessibility of public products, people's quality of life, fairness of income distribution and life and health are set at 20%, 10%, 10%, 20%, 15%, 15% and 10% respectively. The weights of the third-level indicators are determined according to the entropy weighting TOPSIS method, and the amount of information reflected in the degree of variation of each third-level evaluation indicator is calculated separately to determine its weight in the corresponding second-level indicator.

## 4. Results

### 4.1 Measuring and analysing the process of common prosperity in China

Based on the research methodology described in the previous section, this paper measures the national common wealth index from 2013 to 2022 and analyses and compares it from various aspects. Since secondary indicators are more intuitive, we show the trend of each secondary index from 2013 to 2022, as shown in Figure 2.

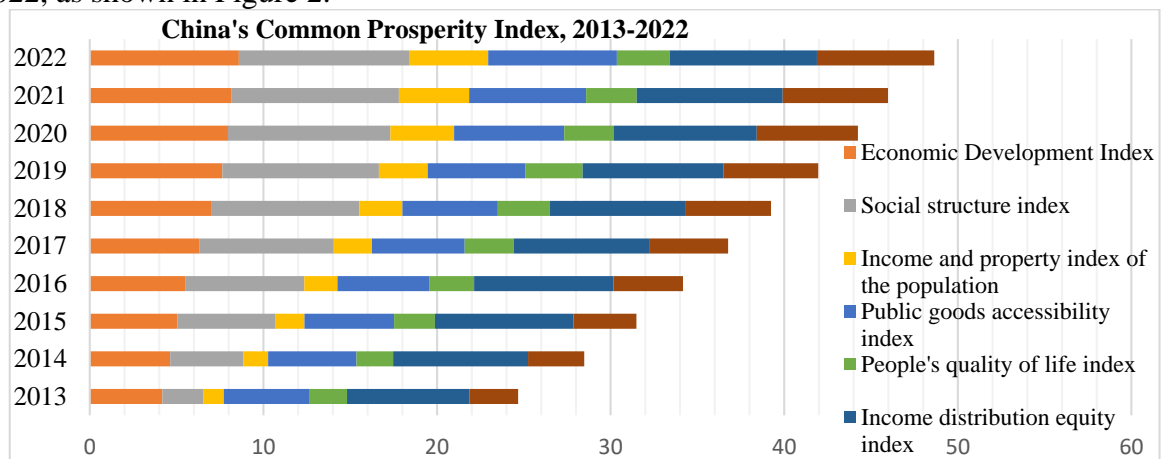


Figure 2: Trends in the National Wealth Index from 2013 to 2022

Table 1: National Common Prosperity Index, 2013-2022

vintage	overall index	Economic Development Index	Social structure index	Income and property index of the population	Public goods accessibility index	People's quality of life index	Income distribution equity index	Life Health Index
2013	24.67	4.18	2.35	1.19	4.95	2.15	7.04	2.81
2014	28.47	4.63	4.21	1.43	5.09	2.11	7.77	3.24
2015	31.48	5.03	5.67	1.66	5.17	2.35	7.98	3.62
2016	34.17	5.52	6.83	1.91	5.31	2.57	8.03	4.00
2017	36.76	6.30	7.75	2.20	5.34	2.82	7.85	4.51
2018	39.26	7.03	8.50	2.48	5.49	2.99	7.80	4.95
2019	41.95	7.63	9.02	2.81	5.62	3.31	8.12	5.45
2020	44.23	7.96	9.35	3.67	6.35	2.84	8.25	5.82
2021	45.98	8.14	9.66	4.05	6.74	2.91	8.41	6.07
2022	48.64	8.58	9.80	4.57	7.41	3.05	8.47	6.76

From 2013 to 2022, China's common prosperity index increases from 24.67 to 48.64, an increase. This fully reflects that since the 18th Party Congress, China has made remarkable achievements in promoting the realisation of the common wealth of all people, including economic development, social structure, residents' income and property, accessibility of public products, people's quality of life, fairness in income distribution and life and health. As shown in Table 1.

## 4.2 Empirical Results and Analysis

With the deepening of supply-side structural reform, China's economic structure has been continuously optimised, and new industries such as high-tech and digital economy have flourished, which has also provided institutional guarantee and power support for China's sustained and stable economic growth.[4] In the new stage of development, China's social structure has been significantly optimised and the distribution of social structure has become more balanced. By optimising the social structure and increasing employment opportunities, China has further promoted the integrated development of urban and rural areas, which strongly supports shared prosperity. The consumption and investment levels of the Chinese people have also increased, which in turn drives the high-quality development of the economy. According to research analysis, school conditions in the central and western regions of China still need to be improved and the level of education raised. At the same time, problems such as inadequate medical coverage and insufficient coordination of education reform must be resolved in a timely manner, otherwise the happiness index of people's lives will be greatly reduced. The accelerated pace of consumption upgrading has been accompanied by a continuous increase in the consumption capacity of the population, which is conducive to the sustainable development of the economy and society. Under the background of China's poverty alleviation policy, the rural revitalisation strategy and the agricultural and rural reforms have been deeply promoted, and the incomes of rural residents have risen sharply, but at the same time, the incomes of urban residents have risen sharply, and the interaction of factors such as differences in education levels, differences in occupational structures, imbalances in the development of the market economy and shortcomings in the social security system have led to a worsening of the income gap between urban and rural areas.

## 5. Conclusions

From 2013 to 2022, China's Common Prosperity Index will rise from 24.67 to 48.64, an increase of 23.97, which fully reflects that since the 18th National Congress of the CPC, China has made remarkable achievements in promoting the realisation of the common prosperity of all the people, including economic development, social structure, residents' income and property, accessibility of public products, people's quality of life, fairness of income distribution, life and health, and so on. In order to sustain the growth of the Common Wealth Index, the following recommendations are made:

At the level of economic development, scientific and technological innovation should be strengthened to promote high-quality development and the transformation and upgrading of economic structure. This will help raise productivity levels and create more employment opportunities, thereby increasing people's incomes. Promote urbanisation, optimise the layout of urbanisation and increase the urbanisation rate. This will further raise the income level of urban and rural residents.

At the level of economic development, the level of per capita disposable income should be raised by strengthening macroeconomic regulation and control, expanding domestic demand, promoting industrial upgrading and employment growth, increasing people's wages and social security benefits, and creating a better life for all. Investment in the housing sector should be increased, the reform of the housing supply side should be promoted, and multiple supply should be promoted so as to ensure that people have a place to live, increase per capita housing area, and improve the living environment and living conditions of residents. It is necessary to strengthen the improvement of consumption

quality and service level, encourage people to engage in high-quality and high-value-added consumption, optimise the consumption structure and guide people to consume more rationally, so as to increase the per capita year-end deposit.<sup>[8]</sup>

At the level of social structure, it is necessary to gradually improve the standard of urban low-income insurance, expand the population of low-income insurance, and increase the ratio of the number of urban low-income insurance holders to the proportion of urban population, so as to protect the basic living needs of the urban poor. It is also necessary to strengthen the reform of the rural low-income insurance system, improve the standard of rural low-income insurance, expand the population of low-income insurance, and increase the ratio of the number of rural low-income insurance holders to the proportion of the rural population, so as to guarantee the basic living needs of the rural poor. Policy support for middle-income groups should also be strengthened to increase their social security rights and income levels, promote innovation and entrepreneurship, and help them realise value-added and wealth accumulation.

In terms of the accessibility of public goods, the coverage of urban pension insurance and medical insurance for urban workers should be increased, reimbursement ratios should be raised, and a universal protection system centred on basic public health care and basic old-age pension should be fully established to ensure that everyone can enjoy basic medical care and old-age pension protection. Education reform should be strengthened, investment in education should be increased, school and teacher conditions<sup>[1]</sup> should be improved, the ratio of primary school students to teachers should be increased, and the number of years of education for the labour force should be extended, so as to ensure that every child receives a good education and to achieve equal opportunities in education. Railway construction should be strengthened to increase the ratio of railway mileage to the province's area, and there is also a need to strengthen the harmless treatment of urban domestic waste and the treatment of domestic sewage to form a complete and harmonious urban ecological environment. The construction and management of public green spaces and recreational areas should be stepped up, and the area of parks and green spaces per capita should be increased, so as to provide more places for residents to live and for everyone to enjoy a good ecological environment.

At the level of people's quality of life, it is necessary to enhance the disclosure of labour market information and vocational training, promote the optimization of the industrial structure and the expansion of new job opportunities, reduce the urban registered unemployment rate moderately, raise people's employment and income levels, and achieve common prosperity.

In terms of fairness in income distribution, it is necessary to strengthen investment in rural areas, vigorously promote agricultural modernisation and rural revitalisation, raise farmers' incomes and living standards, and narrow the income gap between urban and rural areas. Investments in education and skills training should be strengthened to enhance farmers' access to education and training, increase their skills and knowledge, and raise their employment competitiveness and income levels. It is of vital importance to strengthen fiscal transfers to local governments and increase support for less developed regions, helping them to accelerate their development and narrow the income gap between urban and rural areas. It is necessary to strengthen the supervision and regulation of wages, welfare and social security, rationalise the ratio of income distribution, and work out a fair, reasonable and sustainable income distribution mechanism to narrow the income gap between urban and rural areas<sup>[9][10]</sup>

At the level of life and health, it is necessary to increase investment in health technicians and healthcare institutions, improve the coverage and quality of healthcare services, increase the number of health technicians per 1,000 population and the number of beds per 1,000 population in healthcare institutions, and narrow the gap between urban and rural areas and regions. Maternal health monitoring and protection should be strengthened, maternal health and fertility rates should be improved, and maternal mortality rates should be reduced. It is also necessary to strengthen health

care and nutritional supplements for infants and young children, and to improve the survival rate and health of newborns. Health education and publicity for the entire population should be strengthened, health knowledge popularised and healthy lifestyles fostered.

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