

# *A study on the influencing factors of Tianjin's economic development based on the entropy method*

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**Abstract:** Due to epidemic factors, Tianjin's economy has declined year by year. To explore the influence factors of Tianjin's economy with the different planning, this paper uses the entropy method to study the economic quality, urban civilization degree, ecological civilization construction, happiness, and governance ability. This paper found that Tianjin lacked innovation and a driving force. This paper puts forward the corresponding suggestions and solutions based on the above analysis.

## **1. Foreword**

Economic development is the growth process in the real welfare of a country or region on an average per capita basis. It is not only the quantitative increase and expansion of wealth and economic organism but also implies a change in its qualitative aspects, i.e. innovation in the economic and social structure, improvement in the quality of social life, and input-output efficiency. In short, economic development is the process of innovation or change in the continuous advanced economic and social structure of a country or region based on economic growth. Since the beginning of 2018, China has made scientific judgments on the economic situation, which made timely adjustments to develop concepts and ideas. It creatively puts forward a series of new concepts, ideas, and strategies around the contemporary theme of "what kind of development to achieve and how to achieve development", which forms and develops Chinese Economic Thought. Chinese economic thought is an essential part of Chinese thought on socialism with Chinese characteristics in the new era, a valuable ideological crystallization of the relentless Chinese exploration of the path of socialist economic development, the latest theoretical achievement of Marxist political economy in contemporary China and the 21st-century world, and a scientific guide for China's high-quality economic development and the comprehensive construction of a modern socialist country.

During the 14th Five-Year Plan period, economic and social development is the main goal of Tianjin. Therefore, Tianjin aims to realize the 235 fundamental built modern socialist metropolis vision goal, which considers the development opportunities, advantages, and conditions, adhering to the goal orientation, problem-oriented, and result orientation. Tianjin People have put forward the next five years to achieve the following main goals: economic quality, urban civilization, ecological civilization construction, people's happiness, and governance ability. In the context of the epidemic, Tianjin's economy has been declining in recent years, and its GDP ranking has continued to decline all the way, which is in urgent need to revitalize the economy. Based on this background, this study will be committed to studying the reasons for the economic decline in Tianjin in recent years and give

corresponding solutions and policy suggestions.

As one of the four major municipalities in China, Tianjin has a long history. Now Tianjin is still a heavyweight city. This place is located at the confluence and estuary of the five tributaries of the Haihe River, known as "the bottom of the nine rivers", "the river and sea to rush", said. Its geographical advantages make this city have —— Tianjin port, the world's highest grade, the largest artificial deep water port in China, the fourth largest comprehensive port, and —— Tianjin South port with a throughput of 200 million tons, so it has excellent development potential. This paper will focus on the economic decline trend of Tianjin in recent years, combine the outlook and requirements proposed in the 14th Five-Year Plan, and explore the influencing factors of the economic-level decline.

## 2. Literature review

In recent years, many scholars at home and abroad studied the economic development of China, Meng Guangwen [1], through the economic center of the gravity model, calculated the 2005-2015 Tianjin economic center of gravity space evolution trajectory, and pointed out the unbalanced Tianjin economic development space structure, put forward the future development of Tianjin corresponding urban economy.

For Tianjin's current economic situation, it has faced many challenges. For example, Zhang Zhongqiang [2] compared other urban economic development, from industrial development, employment, wages, population age, and human resources, from the perspective of four aspects. It was found that Tianjin still was a fuzzy industry orientation, strong dependence on the manufacturing industry, low wage level, and population ageing problems. These problems greatly limit the high-quality economic development of Tianjin. In terms of ecological civilization, Chen Qia[3] used the entropy method to evaluate the green development of Beijing, Tianjin and Hebei cities from 2013 to 2019. The result was shown that Tianjin's development level of green economy ranks second. In terms of environmental carrying capacity and resource carrying capacity, the lowest level is in Tianjin. From the ecological and environmental governance capacity perspective, Tianjin is second to Beijing but higher than Hebei. Finally, Chen believes that the inconsistency between Tianjin's environmental and resource-carrying capacity and its ecological governance capacity should be adequately handled while maintaining its high ecological governance capacity and improving its environmental and resource-carrying capacity. To promote the coordinated development of Beijing, Tianjin and Hebei regions, Liu Xiaojun [4] used the VAR model to study the relationship between economic and ecological sustainability in Tianjin. It was found that from 2000 to 2019, both parameters were in the run-in period. The degree of coordinated development is not high, and The two are in a mutually reinforcing relationship. Therefore, it is essential to adhere to the basic environmental protection policies.

The degree of civilization of a city is closely related to scientific and technological innovation. For example, Xie Sixian [5] studied the Beijing-Tianjin-Hebei region of China, and the evaluation system of the regional economy and scientific and technological innovation was constructed. The results were shown that the Beijing-Tianjin-Hebei region had significant early development differences. There is an extensive shock range, especially in Tianjin. From 2015 and 2017, the trend of the regional science and technology innovation index declined significantly. In analyzing the combined effects of the coupling of the two systems, foreign trade, human resources investment, development atmosphere, technological progress, and infrastructure construction have all played a significant and positive role in promoting the coordinated development of the Beijing-Tianjin-Hebei region. However, excessive policy support will limit the power of technology and economic development. It is not difficult to find that scientific and technological innovation has played a crucial role in Tianjin's economic revitalization through this study. Income is the critical factor that determines people's happiness.

Moreover, Zhang Dongjin [6] takes the Beijing, Tianjin, and Hebei region as an example and focuses on the impact of the income gap on the happiness of urban residents. From a macro perspective, for Tianjin, the economic structure, social security system, and health policies greatly help improve residents' happiness.

Comprehensive above found that most of the articles are around the Beijing-Tianjin-Hebei region's overall collaborative analysis[7-8], rarely alone through economic quality, urban civilization, ecological civilization construction, people's happiness, governance ability evaluation of Tianjin economic development and analysis the current economic situation of the article [9]. Therefore, this article will provide a scientific theory for Tianjin's economic development perspective from the five social and economic development [10].

### 3. The entropy method model

There are two methods of calculating the weights of indicators: subjective and objective weighting. The subjective weighting method is represented by the hierarchical analysis method, where the score matrix of each indicator is obtained by scoring by experts. It is used to find the score of each indicator. However, the disadvantage of the hierarchical analysis method is obvious, namely that it relies too much on the experts' scores for each indicator and requires a high level of competence and experience. The objective weighting method is represented by the entropy method. Entropy is a measure of the uncertainty of a thing. The more information a thing contains and is fully presented, the lower its uncertainty. Therefore, for data indicators, the higher the entropy value is, the richer the amount of information is and the greater the corresponding weight is. Following this logic, the weighting of the indicators is carried out.

The example of  $n$  samples  $m$  indicators, and  $x_{ij}$  being the  $j$ th indicator of the  $i$ -th sample, is used to demonstrate how the entropy method calculates the composite score of a sample.

Specific steps of the entropy method used in this study

1) Indicator normalization process so that heterogeneous indicators are normalized.

The indicators in the question are all positive, so there is no need to take absolute values. Directly follow the formula below to normalize the data.

2) Calculate the weight of the value of the  $j$ th sample under indicator  $j$  for this indicator.

3) Calculation of the entropy value of the  $j$ th indicator

4) Determine the redundancy of information entropy

5) Determine the weight of each indicator

After obtaining the weights of each indicator, the composite score of each sample can be calculated.

This paper uses the entropy method to influence Tianjin's five economic indicators and sort the results. The greater the weight of the development, the more perfect.

The reasons for selecting these five indicators are according to the five indicators affecting Tianjin's economic development mentioned in the 2022 Tianjin Economic Development Report, the five indicators for economic quality, urban civilization, ecological civilization construction, people's happiness, governance ability, as the economic development index comprehensive evaluation, the five indicators are detailed in Table 1.

As can be seen from the table, the five dimensions of economic aggregate, urban civilization degree, ecological civilization construction, people's happiness, and governance capacity are all positive indicators. That is, the bigger, the better. After the dimensionless processing of the data, the weights of each index are obtained.

### 4. Data sources

This paper data from 2021, according to the economic aggregate, urban civilization, ecological

civilization construction, people's happiness, and governance ability five dimensions of the economic development index evaluation system. These five indicators correspond to the city's GDP, municipal scientific achievements registration, municipal green space area, per capita disposable income, and the number of proposals of the Tianjin People's Congress, to analyze the comprehensive economic development level of Tianjin, pointing out the deficiencies of the index, and guide its better development.

Due to the different index attributes, some indicators are bigger the better, and some are smaller the better. Therefore, to facilitate data processing, the constructed index system is classified.

Table 1: Weight of each index

entropy weight method			
Item	Information entropy value e	Information utility value d	weight
The city's GDP	0.824	0.176	0.189
Number of municipal scientific achievements registered	0.845	0.155	0.166
The city's green space area	0.823	0.177	0.186
per capita disposable income	0.808	0.192	0.205
Number of motions filed by the Tianjin Municipal People's Congress	0.764	0.236	0.252

As can be seen from Table 1, the number of proposals from the Tianjin People's Congress is the highest, the per capita disposable income is second, and the number of municipal scientific achievements registration is the lowest.

According to the above analysis, Tianjin's GDP can best reflect the economic development of Tianjin. Therefore, we take this index as the dependent variable and other indicators as the independent variables to analyze Tianjin's future economic development trend. Through ling regression prediction, we find that Tianjin's GDP has an apparent upward trend. From 2016 to 2020, the driving force of innovation and the ecological environment are important factors leading to the economic downturn in Tianjin. Tianjin is facing great pressure of economic transformation, eliminating backward ability and strengthening the main tasks of introducing innovative talents. Tianjin's GDP is shown in Figure 1.

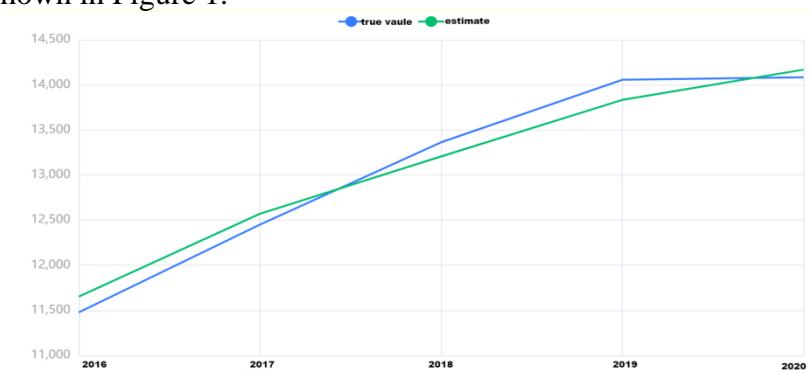


Figure 1: Tianjin's GDP

## 5. Conclusion and suggestion

According to the above research, it was found that Tianjin currently lacked innovation and a driving force. Tianjin is still in the industrial transformation and upgrading stage, with good prospects for development, and Beijing-Tianjin-Hebei coordinated development and different planning policy.

Tianjin will eliminate the downward economic trend towards higher quality and faster development. The following are the five dimensions of Tianjin development particular suggestions.

In terms of economic quality, Tianjin should find the proper city positioning, explore the industrial positioning suitable for Tianjin's development as soon as possible, accelerate the industrial transformation and upgrading of Tianjin, and improve the visibility of Tianjin's industry across the country.

In terms of the degree of urban civilization, Tianjin should further establish a good image of the city, enhance the comprehensive competitiveness of the city, improve people's civilized quality, create a cultural landscape, create a good investment environment, vigorously support innovation, accept innovative talents, and encourage bold attempts.

In terms of ecological civilization construction, Tianjin should improve its industrial structure, take energy conservation and emission reduction and environmental protection as the core concept of Tianjin, select energy conservation and green materials for construction materials, and strengthen the publicity of green environmental protection, to enhance citizens' awareness of green civilization.

In terms of people's happiness, Tianjin should increase the employment rate, improve the social tolerance of all professions to increase the per capita disposable income, increase investment in education, and improve the medical coverage and pension system so that the people can have support for the elderly.

In terms of governance capacity, we will improve the fault tolerance and correction mechanism and further create a good atmosphere for cadres to do things.

## References

- [1] Chen Qiaowei, Yi Yongxi, Zou Xiangni. *An Evaluation of the Comprehensive Urban Carrying Capacity—based on the entropy method takes the Beijing-Tianjin-Hebei region as an example* [J]. *Guide to Economic Research*, 2021 (22): 142-146.
- [2] Liu Xiaojun, Chao Qi. *Empirical Analysis of the Interaction between High-quality Tianjin Economic Development and Ecological Sustainable — Based on VAR Model* [J]. *Tianjin Economy*, 2021 (12): 8-14.
- [3] Meng Guangwen, Wang Chunzhi, Lu Xiaonan, Wang Hongmei. *Space evolution and future outlook of Tianjin Economic Development* [J]. *Economic Geography*, 2017,37 (05): 87-93 + 115.
- [4] Liu S. J., Chao Q. *The interaction between high-quality economic development and ecological sustainability in Tianjin—an empirical analysis based on VAR model* [J]. *Tianjin Economy*, 2021(12):8-14.
- [5] Xie Siwei, Hu Wei. *Coupling and coordination of high quality economic development and science and technology innovation: the example of Beijing-Tianjin-Hebei region* [J]. *Statistics and Decision Making*, 2021,37(14):93-96.
- [6] Zhang Zhongqiang, Qiu Shujuan. *Challenges and Opportunities faced by Tianjin Economic development* [J]. *Tianjin Economy*, 2021 (05): 17-21.
- [7] Li Jiayu. *Research on the development of green finance to boost the economic development of Tianjin* [J]. *Marketing World*, 2021(04):19-20.
- [8] Liu Xiaojun, Chao Qi. *Empirical analysis of the interactive relationship between high-quality economic development and ecological sustainability — based on VAR model* [J]. *Tianjin Economy*, 2021 (12): 8-14.
- [9] Zheng Wanji, Feng Kai. *Spatial Radiation effect of Economic growth of Tianjin Binhai New Area* [J]. *Regional research and development*, 2020,39 (06): 54-58 + 83.
- [10] Wang Fang. *Building a new system of open economy to promote the economic development of Tianjin* [J]. *Tianjin Economy*, 2019(12):13-19.