

Research on Evaluation of China's Regional Foreign Trade Development Level Based on Entropy Method

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Abstract: This paper uses the data of 9 representative provinces in China's east, middle and west in 2020 to establish a comprehensive index evaluation system of China's foreign trade development through entropy method, and makes an overall analysis and regional heterogeneity analysis and evaluation of China's foreign trade development level. The results show that the high-quality development of foreign trade is the leading direction of China's foreign trade development in the future, and the development level of China's foreign trade shows obvious regional heterogeneity. Based on this, this paper puts forward countermeasures and suggestions to implement the new development concept, build a new development pattern, and give play to the leading and comparative advantages, so as to help China's high-quality foreign trade development.

Keywords: China's Foreign Trade; High Quality Development; Entropy Method; Indicator System

1. Introduction

In recent years, under the circumstances of global economic slowdown, rising trade protectionism, scientific and technological blockade, and the normalization of the COVID-19, China's economy has changed from high-speed growth to high-quality development, and China's foreign trade development has also been greatly affected. In this context, this paper uses quantitative methods to measure the overall and regional development characteristics of China's foreign trade in terms of total volume, structure and quality, and explores the high-quality development path of China's foreign trade.

2. Method

2.1 Index system construction

This paper mainly constructs 12 secondary indicators from three dimensions of foreign trade scale, structure and quality. The specific calculation method is shown in Table 2-1.

Table 2-1 Evaluation System of Foreign Trade High Quality Development Indicators

Level I indicators	Scale (A)				Structure (B)				Quality (C)			
Secondary indicators	total imports and exports	Growth rate of total import and export	Domestic demand scale	Dependence on foreign trade	Export dependency	TC index	Proportion of general trade exports	Proportion of processing trade exports	Innovation	coordination	green	sharing
computing method	Total imports+total exports	(Current year - last year)/last year	Total retail sales of consumer goods	Total import and export/GDP	Total exports/GDP	(export import)/(export+import)	General trade exports/total exports	Export volume of processing trade/total export volume	Number of invention patent applications authorized	Contribution rate of net exports to GDP =Net export increment/ GDP increment	Proportion of green expenditure=energy conservation and environmental protection expenditure/general budget expenditure of local government	Trade employment contribution rate=total employment × Total import and export/GDP
IndexNo.	A1	A2	A3	A4	B5	B6	B7	B8	C9	C10	C11	C12

2.2 Entropy processing

Suppose i is a province, j is an indicator, t is a year, and X_{ijt} is the observation value of the j th indicator of province i in year t .

Step 1: standardize the indicators to eliminate the impact of dimensions on the results:

$$X'_{ijt} = \frac{X_{ijt} - \text{Min}(X_{ijt})}{\text{Max}(X_{ijt}) - \text{Min}(X_{ijt})}$$

When the value of the above formula is 0, in order to ensure that it is meaningful to take logarithm when calculating entropy weight, the overall data will be shifted and increased by 0.00001 [2].

Step 2: calculate the proportion P of each index and calculate the entropy value, where n is the sample size.

$$P_{ijt} = \frac{X'_{ijt}}{\sum_i \sum_t X'_{ijt}}$$

$$Q_j = -\frac{1}{\ln n} \sum_i \sum_t P_{ijt} \ln(P_{ijt})$$

Step 3: calculate the index difference coefficient E_j and index weight W_j. The larger the difference coefficient is, the more important the indicator is and the greater the weight is.

$$E_j = 1 - Q_j$$

$$W_j = \frac{E_j}{\sum_{j=1}^{12} E_j}$$

Step 4: calculate the weighted sum to obtain the comprehensive index Z.

$$Z = \sum_{j=1}^{12} W_j * X'_{ijt}$$

3. Results

3.1 High quality development of foreign trade is the leading direction of China's foreign trade development in the future

Among the 30 provinces in China, 3 representative provinces are selected from each region according to the eastern, central and western regions, with a total of 9 samples, as shown in Table 4-2. 12 index data of each province in 2020 are selected for analysis. The data mainly comes from the China Statistical Yearbook of the past years on the official website of the National Bureau of Statistics. Use Eviews software to process the data with entropy method, and calculate the comprehensive evaluation values of each index, as shown in Table 3-1.

Table 3-1 Comprehensive Evaluation Values of Indicators in 2020

Level I indicators	Scale (A) 32.18%				Structure (B) 26.09%				Quality (C) 41.73%			
Secondary indicators	A1 total imports and exports	A2 Growth rate of total import and export	A3 Domestic demand scale	A4 Dependence on foreign trade	B5 Export dependency	B6 TC index	B7 Proportion of general trade exports	B8 Proportion of processing trade exports	C9 Innovation	C10 coordination	C11 green	C12 sharing
Entropy	0.6783	0.9410	0.8573	0.8003	0.7851	0.9097	0.8824	0.8365	0.6666	0.7517	0.9274	0.7165
Coefficient of difference	0.3217	0.0590	0.1427	0.1997	0.2150	0.0903	0.1176	0.1635	0.3334	0.2483	0.0726	0.2835
weight	14.32%	2.62%	6.35%	8.89%	9.56%	4.02%	5.23%	7.28%	14.84%	11.05%	3.23%	12.61%
ranking	2	12	8	6	5	10	9	7	1	4	11	3

It can be seen from Table 3-1 that among the first level indicators, the weight of foreign trade quality is as high as 41.73%, indicating that high-quality development is the primary task for China to build a socialist modern country in an all-round way at present and in the future; The weight of foreign trade scale is 32.18%, indicating that China should stabilize the basic foreign trade market in terms of scale in the future and keep the total volume of foreign trade stable with progress.

Among the secondary indicators, most of the secondary indicators established under the framework of the new development

concept of "innovation, coordination, green, openness and sharing" rank high[3], indicating that the comprehensive implementation of the new development concept will lead to high-quality development of foreign trade, with a relatively low proportion of C11, indicating that the leading role of green and low-carbon transformation in foreign trade is not obvious. Among the lower ranking indicators, B7 and B8 show that they play no significant role in the development of foreign trade, and will further promote the added value of general trade and processing trade in the future; A3 shows that domestic consumption plays a weak role in promoting foreign trade, especially imports. In the future, we should strengthen the internal circulation and give play to the potential of domestic demand in the domestic market.

3.2 China's foreign trade development has obvious regional heterogeneity

The comprehensive scores and index scores of 9 provinces in China in 2020 are further calculated according to the index weights in Table 3-1, as shown in Table 3-2.

Table 3-2 Evaluation and Calculation Results of Foreign Trade Development Indicators of Each Province in 2020

region	province	composite index Z	A Index score	B Index score	C Index score
Eastern region	Jiangsu	0.56831	0.22743	0.14592	0.19496
	Zhejiang	0.59987	0.20492	0.18500	0.20995
	Guangdong	0.84585	0.31468	0.16847	0.36269
Central region	Hunan	0.23905	0.07105	0.10328	0.06472
	Anhui	0.23219	0.08010	0.08943	0.06265
	Henan	0.25619	0.08725	0.11095	0.05798
Western region	Shaanxi	0.18741	0.05992	0.08284	0.04466
	Ningxia	0.12930	0.00001	0.09278	0.03652
	Xinjiang	0.12509	0.03240	0.06712	0.02557

It can be seen from Table 3-2 that the comprehensive index of foreign trade development of nine representative provinces in China shows obvious regional heterogeneity. Among them, the composite index of Jiangsu, Zhejiang and Guangdong in the eastern region is greater than 0.55, and Guangdong is the highest, reaching 0.85; The value of Hunan, Anhui and Henan in the central region is about 0.23, ranking in the middle; The index of Shaanxi, Ningxia and Xinjiang in the western region is lower than 0.2. The scores of the first level indicators are also affected by regions, with similar laws.

Based on the analysis of the reasons, due to its developed economic level, open geographical location, and advantages in capital, talents, technology, transportation, etc., the overall level of foreign trade in the eastern region is high; The central region runs through the east and west, connecting the north and south, and has great opening potential. However, the current foreign trade is mainly processing trade, and the competitiveness of products with high energy consumption and low added value is not strong; In recent years, under the guidance of national major opening strategies such as the "the Belt and Road", the western development, and rural revitalization, the western region has obvious advantages in the development of foreign trade industry, but there is a big gap with the eastern provinces.

4. Suggestion

4.1 Build a new development pattern and implement the new development

concept

Under the guidance of the new development pattern of "focusing on internal circulation and mutual promotion of domestic and international double circulation", China should focus on expanding domestic demand, increasing R&D investment and promoting competitive products and services to go global in the future. For the high-quality development path of foreign trade, based on the new development concept of "innovation, coordination, green, openness and sharing", innovation drive is the foundation. In the future, China should master the ability of independent innovation in key technologies and improve the added value of export products; Green development is a trend. We should encourage the import of goods, new energy, energy-saving and environmental protection

technologies and services that are in short supply in China, and promote the green and low-carbon transformation of foreign trade.

4.2 The eastern region gives play to its leading advantages, and the central and western regions give play to their comparative advantages to jointly lead the high-quality development of trade

The eastern region should clearly define its position as a leading region for foreign trade development. Relying on the coordinated development of Beijing, Tianjin and Hebei, the regional integration of the Yangtze River Delta, and the integrated development strategy of the Guangdong Hong Kong Macao Greater Bay Area, it should promote multilateral and regional economic and trade cooperation, comprehensively benchmark international high standard trade rules, and promote trade and investment liberalization and facilitation. In the future, the central and western regions should give full play to the comparative advantages of low human, logistics and production costs and the frontier of the "the Belt and Road" initiative, absorb the experience of advanced eastern provinces, speed up infrastructure construction, promote the construction of industrial transfer demonstration zones, deeply integrate into construction opportunities such as the "the Belt and Road" initiative, actively strive for national policies and resources, and create a new highland for inland reform and opening up.

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