

# Coordination Degree between International Business and Ecosystem under the Background of Global Supply Chain Reconstruction

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**Abstract:** China occupies a key part of the global supply chain for the assembly of raw materials, intermediate goods and finished products. As a major global consumer market, China has become the end of major supply chains. China's traditional commodity production mode, large-scale production and processing of cheap export commodities at the cost of the ecosystem, are resulting in the development of international commerce and ecosystem imbalance. Aiming at the CD of international commerce and ecosystem, this paper calculates the coordination degree (CD) of different areas in China, which conducts a spatial autocorrelation test. The results show that the data of international commerce from 2012 to 2021 are obtained, the index value of international commerce CD under the background of global supply chain is comprehensively calculated, and the coordination between international commerce and ecosystem in China is analyzed from the perspective of global supply chain reconstruction. The results show that there is a large gap in the CD of international commerce and the trade structure is unstable in the global supply chain reconstruction. Finally, China's international business CD is at the primary and intermediate coordination stage, with stable development over the years, and the development level of ecosystem is higher than that of international business.

**Keywords:** coordination degree (CD); ecosystem; global supply chain; international business

## 1 INTRODUCTION

Since the outbreak of the novel corona virus, concerns about the disruption of global supply chains caused by the impact of the epidemic in China and the relocation of supply chains from China, have increased significantly. Previously, there were different voices that the global financial market had not been significantly affected by the epidemic for two months, indicating that China may have overestimated the importance and substitutability of its own role in the global supply chain reconstruction [1]. However, due to the disadvantages of the rough economic development mode, the problems of resource consumption, ecosystem disorder and environmental pollution are aggravated. The continuous deepening of China's economic system reform corresponds to China's opening to the outside after the formation of an all-round and multi-level opening pattern. The scale of international commerce has further expanded, China's share in the international market has been increasing, and international commerce has played an increasingly prominent role in the national economy [2]. China's total import and export trade was less than 100 billion yuan, and in 2021, China's total import and export quota reaches 42.07 trillion yuan. Among them, the total export soared from 400 billion yuan to 23.97 trillion yuan, while the total import soared from 400 billion yuan to 18.1 trillion yuan [3]. The import and export commodities have been continuously improved. In the report of the 2020, it was proposed to treat the ecosystem like life and realize the spatial CD of economy and resources and environment. The central government attaches great importance to the CD of ecosystem and international business [4]. It is of great practical significance to calculate CD between international business and ecosystem of China, which analyze the factors influencing CD.

With the economic improvement of living standards, people's demand for fresh air, clear water and clean environment is getting higher. At present, China's international commerce is shifting from high-speed growth to high-quality development stage, foreign commerce

development must not sacrifice the environment as the price, harmonious coexistence of man and nature is the new requirement in international commerce. CD between ecosystem and international business is to achieve common and sustainable development [5]. Therefore, CD between social economy and ecosystem is still worthy of our discussion and research. In existing studies, domestic and foreign scholars have put forward many important views on the relationship between international business and ecosystem, such as He et al., (2021) view on the effect of international business. Peng (2022)'s theory of shifting environmental costs and the trade effects of environmental regulation. At present, the research on global supply chain is in the ascendance, but these studies are basically developed based on Cole & Elliott (2013) global commodity chain concept, and the research content mainly focuses on the dynamic mechanism, governance model and value analysis. There are few literatures on the coordination relationship between international business and ecosystem based on the quantitative study of global supply chain, and even fewer studies on the subdivision of various industries. Compared with foreign research on the relationship between environment and international business, domestic research is relatively late, mainly based on the previous research to quantify and expand. Some scholars have done in-depth analysis of CD between international business and ecosystem based on different methods. For example, Dechezleprêtre & Sato (2017) discussed the coordination relationship between regional economic development and ecosystem in Shaanxi Province based on the gravity model, and pointed out that strengthening regional spatial linkages, improving the environmental governance mechanism are the keys to the CD of Shaanxi Province. Liu et al. [10] used the CD model and GM (1, 1) gray prediction model to analyze and study the ecosystem and international business in the five provinces in northwest China. Other scholars discussed the CD between the ecosystem and international business in different regions and different periods from the perspective of time and space [11], such as the Yangtze River Economic Belt [12], Guizhou Province [13], etc., pointed

out CD between the ecosystem and economic development in various regions and the problems.

In order to analyze the coordination problem between ecosystem and international commerce, and seek for the path to realize the CD of international commerce and ecosystem, this paper attempts to introduce ecological element into the benefit distribution mechanism of global supply chain, and set up the development level evaluation index system of international business subsystem and ecosystem subsystem in our country. Quantitative evaluation of the CD between international business and ecosystem of various industries under different types of supply chain international business, is hoping to provide certain help for the adjustment and upgrading of China's foreign trade structure and the improvement of China's ecosystem. Firstly, there are many researches on the CD between international business and ecosystem, but there are differences in the construction of index systems, and most of the weights are subjective, resulting in obvious differences in research results. Second, scholars are concerned that there is a spatial correlation between the CD of international business and ecosystem, but space is not considered in the study of influencing factors, so the regression results may be biased. Therefore, this paper constructs the index system of international business and ecosystem under the global supply chain, objectively assigns values by entropy method, uses the CD model to measure the CD, and adds spatial influencing factors into its influencing factors to carry out spatial autoregressive analysis, and gives suggestions.

## 2 EVALUATION SYSTEM CONSTRUCTION AND RESEARCH METHODS

The research area mainly includes the eastern part of the country, the central and western parts, and the southern part of the country [14]. The eastern part mainly includes Zhejiang, Shanghai, Jiangxi and Jiangsu. The central and western regions mainly include Anhui, Chongqing, Henan, Hubei, Sichuan, and Hunan. The southern region mainly includes Fujian, Guangdong and Hainan.

Table 1 Index of international trade and ecosystem assessment

System	Element	Index	Property	Weight
International trade	Trade scale	Trade revenue	+	0.36
		Investment in fixed assets	+	0.13
		Industry growth	+	0.18
	Trade structure	Export trade volume	+	0.11
		Import trade volume	-	0.11
	Trade vitality	GDP growth	+	0.02
		Growth rate of investment in fixed assets	+	0.03
		Growth rate of total retail sales of consumer goods	+	0.06
Ecological environment	Ecosystem level	Forest coverage rate	+	0.16
		Per capita water use	-	0.15
	Ecological protection	Waste discharge	-	0.13
	Ecological pressure	Proportion of investment in environmental governance	+	0.13
		Green garden investment	+	0.17

The data source of this paper is 2012-2021 data. The original data required are mainly from China Statistical Yearbook, China Urban Construction Statistical Yearbook and etc. In international business calculation, RMB is used to convert the average exchange rate (middle rate) of the US dollar.

China plays a vital role in the global supply chain. Whether in terms of digitization, manufacturing, trade and investment, China is seen as a gateway to the world economy and its position is increasingly prominent globally. Aiming at the research on the CD between international business and ecosystem in the context of global supply chain reconstruction, this paper calculated the CD between international business and ecosystem through the CD model, and conducted in-depth research on the influencing factors of CD [15]. Based on the previous research, the evaluation index system is constructed according to the principles of scientificity and availability.

In the ecosystem subsystem, ecological protection and ecological pressure are selected as the first level indicators.

## 3 CONSTRUCTION OF CD INFLUENCING FACTOR MODEL

### 3.1 CD Model

Coordination refers to the property that internal elements are different in the process of system change and coordinate with each other when forming the whole [16]. CD refers to the whole coordination development level of various elements in the system, which is a measure of CD [17]. The CD model is used to judge the coordination development level between international business and ecosystem. The formula is as follows.

$$C = \left( \frac{S_1 \cdot S_2}{(S_1 / 2 + S_2 / 2)^2} \right)^K,$$

$$U = l \cdot S_1 \cdot n S_2,$$

$$W = V \cdot U \tag{1}$$

where:  $C$  is the CD.  $S$  is the level of each subsystem.  $K$  is the adjustment coefficient, the value of  $K$  is generally 2 - 5 in this paper.  $U$  is the comprehensive coordination index of international business and ecosystem.  $l$  is the weight of economic development level,  $n$  is the weight of ecosystem level, because in the development process of a country and a region, environmental protection and economic development are equally important, so the value  $a = b = 50\%$ .  $W$  is the CD.

### 3.2 Influencing Factors of CD

In the traditional analysis of production function, input generally only considers capital, labor and other factors that can be measured in money, while ignoring the input of ecological factors. This paper holds that ecosystem is also a factor of production, which affects economic activities together with labor and capital. Assuming that labor  $L$ , capital  $C$  and ecosystem  $E$  are used for production, in the global supply chain, import trade uses capital intensively and export trade uses labor and ecology intensively, then

the profit function of import trade can be expressed as *Profit*:

$$Profit_1 = p_1 Q_1 - r \cdot C = A \cdot p_1 L^\alpha \cdot C^\beta \cdot E^\gamma - r \cdot C \quad (2)$$

where,  $\alpha$ ,  $\beta$  and  $\gamma$  respectively represent the degree of influence of labor, capital and environment on output,  $p_1$  represents the supply price or sales price of import trade,  $Q_1$  represents the supply or sales volume,  $r$  represents the interest rate, and  $C$  is the amount of capital invested in import trade. The profit function of export trade can be expressed as follows.

$$Profit_2 = p_2 Q_2 / n - w \cdot L_2 - E \quad (3)$$

where,  $p_2$  is the sales price or purchase price of export trade,  $n$  is the number of enterprises in export trade,  $w$  is the wage of export trade,  $L_2$  is the labor input of export trade, and  $E$  is the environmental cost of export trade.

According to Eq. (2), the profit of export trade is determined by the unit value of export trade, the supply of import trade, the number of enterprises in export trade, labor cost and environmental cost. The profit without considering the environmental cost is the profit of the current international business of export trade. If the environmental cost is considered, the further contraction of the profit in this link is not even enough to make up for the expenditure of environmental cost. Therefore, from the perspective of international business, the export profit is determined jointly by the international business subsystem and the ecosystem subsystem. The development level of the international business subsystem depends on the unit value obtained by export trade, and the development level of the ecosystem subsystem is determined by the environmental cost. The trade benefits are higher, the environmental costs are smaller, the profits of export trade are greater, that is, the international business and ecosystem are more coordinated. The profit of export trade is negative, indicating that the environmental cost is higher than the trade benefit, the development level of international business is higher than the development level of ecosystem, and measures should be taken to improve the environment [18].

Enterprises in different supply chain types have different ways to participate in competition. In order to obtain positive profits, the core enterprises in the global supply chain of export trade will transfer the production links with serious environmental pollution to developing countries with factor advantages, consume environmental resources for production, and then import them to their own countries. It makes the countries in export trade participate in fierce competition at high cost and obtain meager production and processing income. In this case, the way to increase profits in export trade is to upgrade forward to import trade. In the global supply chain of import trade, export trade enterprises, in order to strive for greater supply, are willing to accept low supply conditions and consume a lot of environmental resources. The way to improve profits is to upgrade backward import trade, increase added value and reduce environmental costs.

### 3.3 Data Analysis

The development level of international business can be evaluated from both qualitative and quantitative aspects. The unit value added of export trade reflects the qualitative level, which is expressed in terms of trade in view of the availability of data. The evaluation of volume can be reflected by  $Q_1$  and  $n$ . In this paper, export scale and foreign capital utilization are used to measure the development level of international business. The evaluation index is shown in Tab. 2.

**Table 2** Evaluation index system

International trade	Import and export situation	Import and export business
		Import and export growth
		Import and export ratio of GDP
	Utilization of foreign capital	Number of foreign-funded enterprises
		Industrial added value of foreign-funded enterprises
		Total assets of a foreign-capital enterprise
Ecological environment	Energy sustainable development capacity	Coal mine consumption index
		Power consumption index
	Environmental quality	Discharge of three wastes
		The rate of three wastes discharging up to standard
		Comprehensive utilization of three wastes

The ability of ecological sustainable development and the quality of the environment are the key points of evaluating the ecosystem subsystem. The main energy sources used in China's industrial production include coal, oil, electricity, and natural gas. Crude oil is the main part of oil consumption, and the three industrial wastes are the main pollutants that cause environmental damage. Therefore, we choose the index system as shown in Tab. 1 to evaluate the ecosystem subsystem.

Based on the above index selection, the evaluation function of the CD between International trade and ecosystem is further established.

$$C(a/b) = \exp \left[ - (Profit_a - Profit')^2 / S^2 \right] \quad (4)$$

$C(a/b)$  represents the CD between system  $i$  and system  $j$ , and its value is between (0, 1).  $Profit_a$  is the comprehensive development index of system  $Profit'$ . Coordinate values required by system  $b$  to system  $a$ .  $S$  is the variance of the comprehensive development index of ecosystem.

### 3.4 Comparative Analysis of Industry CD of Different Types of Supply Chains

The CD of various industries in the global supply chain of export trade can be divided into three levels (see Fig. 1). At the first level, the CD of electronic communication equipment manufacturing and transportation equipment manufacturing is always greater than 108, which is in the degree of good coordination and high-quality coordination, because in China's trade industry, these two industries have a high level of trade, while consuming less energy and causing less environmental pollution. At the second level,

the CD of the machinery industry and the pharmaceutical manufacturing industry is always greater than 105, in a state of coordination, of which the machinery industry is between barely coordinated and primary coordination, and the coordination of the pharmaceutical manufacturing industry has changed greatly, from good coordination in 2020 to moderate coordination in 2017. At the third level, the coordination level of the chemical raw material manufacturing industry, electrical equipment manufacturing industry and instrument and meter manufacturing industry fluctuates greatly. In 2020, the CD of the three industries is lower than 05, which is at the imbalance level [19]. By 2017, the chemical raw material manufacturing industry and electrical equipment manufacturing industry rose from imbalance to coordination. The degree of imbalance in the instrumentation manufacturing industry is more serious, indicating that the international business level of these three industries is low compared with other industries, and the environmental cost is relatively high.

From the vertical point view, the CD of various industries is basically developing to a more coordinated degree. Before 2013, the CD of chemical raw material manufacturing, machinery industry and electrical equipment manufacturing industry was barely coordinated, especially the chemical raw material manufacturing industry in 2020 at a serious imbalance level. After 2013, the CD of these three industries has improved rapidly, which is inseparable from China's more open market environment and more stringent ecosystem standards.

In the global supply chain of export trade, Chinese industries are generally in the export trade of the supply chain, with low added value, small trade benefits compared with other links, and the production link consumes the most energy and produces the most pollution. The above analysis is only a comparative analysis of various industries in China. The evaluation index of the international business subsystem considers China's export volume, but does not consider China's unit benefits in the global supply chain. In order to further explain the coordination of environmental costs and trade benefits in all links of the global supply chain, this paper uses price terms of trade and income terms of trade to further study the electronic information industry as a representative. China is at the low end of the global supply chain of the electronic information industry, with low added value and a worsening trend of price terms of trade.

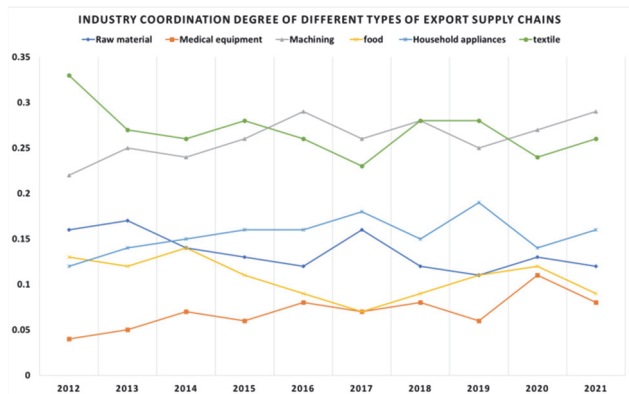


Figure 1 Different CD types of export supply chains

Although the terms of trade of income have improved rapidly, this industry is dominated by foreign capital, and most of the growth in income is gained by foreign capital, and local enterprises have less trade benefits and lower level of trade development. Theoretically, research and development, design, brand and other productive service links consume less ecological factors and have low environmental costs, while low-end manufacturing links consume more ecological factors and have high environmental costs. Therefore, from the perspective of the global supply chain, the CD of China's electronic information industry is lower than other links [20].

In the global supply chain for import trade, except for the metal products sector, which decreased to the misalignment level in 2012, the coordination of the other sectors remained above 01 6(see Fig. 2), indicating that the level of coordination in these sectors is higher than the primary coordination.

Specifically, these seven industries can be divided into four levels: the CD of food manufacturing and clothing and leather manufacturing is always higher than 2018, which belongs to the range of good coordination and high-quality coordination. The CD of rubber products industry and plastic products industry fluctuates between 0.17 ~ 0.19. The CD of wood furniture manufacturing industry and metal products industry fluctuates greatly. Although the CD decreased from 2020 to 2021, the CD increased after that, and finally reached the level of good coordination close to high-quality coordination. The CD of textile industry fluctuates between 0.16 and 0.18, which is in the range of primary coordination. According to the above analysis, the CD of the seven industries in the global supply chain of import trade develops relatively smoothly, but the development of the comprehensive evaluation index of the two subsystems has a gap and great fluctuation, and the fluctuation of the international business subsystem is greater than that of the ecosystem subsystem, indicating the instability of the trade structure.

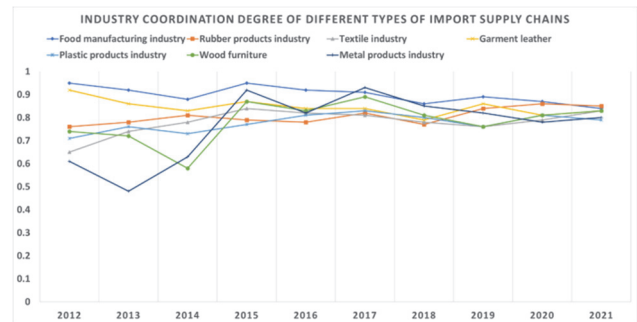


Figure 2 Industry CD of different types of import supply chains

In addition, in order to further explain the gap between the various links of the global supply chain, the coordination of trade benefits and environmental costs in the global supply chain is analyzed by taking the textile and garment industry as the representative of the global supply chain of import trade. Through the analysis, it is found that China's textile and garment industry is at the low end of the supply chain, the price terms of trade and income terms of trade of the textile and garment industry are rapidly improving, and the level of trade development has a trend of improvement. The added value of the textile industry is higher than the added value of the garment and leather

manufacturing industry, but because the environmental cost of the garment industry is much lower than that of the textile industry, the CD of the garment industry is greater than that of the textile industry.

From the above analysis, it can be seen that the industry CD in the global supply chain of export trade has a wide distribution range; especially the chemical raw material manufacturing industry has developed from serious imbalance to good coordination, while the industry CD in the global supply chain of import trade is relatively stable. The reason for this phenomenon is that most of the industries in the global supply chain of export trade are high-tech industries and capital-intensive industries, the export volume and the number of foreign-funded enterprises change greatly, and the consumption of environmental resources is unstable. Most of the industries in the global supply chain of import trade are traditional export industries, and the development level of trade and environment is relatively stable.

From the perspective of the representative industries in the global supply chain of different types of international commerce, the trade benefits of the electronic information industry tend to decrease compared with other links, and the trade status of the textile and garment industry in the global supply chain has increased. The trade level of high value-added links is higher than that of low value-added links, and the environmental cost of brand and marketing links is lower than that of research and development and design links. Therefore, the CD of import trade supply chain is higher than that of export trade supply chain.

### 3.5 Comprehensive Development of International Business Subsystem

Using the above formula, the comprehensive development index of the international business subsystem is calculated, and the results are shown in Fig. 3.

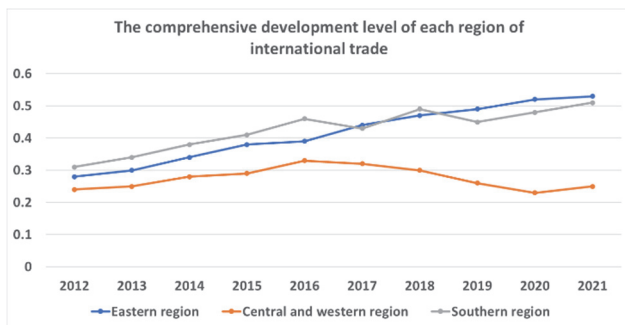


Figure 3 The comprehensive development level of each region of international trade

By time evolution, although the overall development level of China's international business is rising in the past 10 years, the improvement is small, the development of foreign trade is slow and the water level is low. In 2012, the overall growth rate of foreign trade was flat at 0.16, and in 2021, it only increased to 0.24, and its average value was only 0.19. In terms of the evolution of international business over time in all provinces, the comprehensive development level of international business in the mid-western regions has improved.

From the perspective of spatial comparison, the development of international commerce in mid-western

China is very uneven, and the development level of international commerce in eastern China is high. The region with the lowest level of international business development is the western region, with an average value of only 0.14, indicating a significant difference in international business development level. Other provinces are located in the inland, especially in the upstream areas, where the traffic bottleneck is prominent, the location conditions are relatively poor. The comprehensive development level of international business in some provinces in the western region has declined instead of rising, which may be because the export scale is too small and the contribution rate to the total export volume of the country is too low, which has lowered the comprehensive development level of international business in the western region to a certain extent. The western region depends on the import for a long time, the export scale is small, and the trade competitiveness index is too low, so the comprehensive development level of international business is also at a low level.

### 3.6 Comprehensive Development Level of Ecosystem Subsystems

The comprehensive development index of the ecosystem subsystem was calculated, and the results are shown in Fig. 4.

By time evolution, the overall ecological protection level in China presents a wave upward trend, increasing from 0.29 in 2012 to 0.42 in 2021, but the increase amplitude is not large, and the improvement speed of China's ecological status needs to further improve. Based on the specific analysis of provinces and regions, it was found that the western region ranked first and last in terms of the improvement of ecological comprehensive development in the past 10 years, and the comprehensive development speed of ecological protection in different regions was significantly different.

From the spatial contrast analysis, the ecological protection level of agricultural intensive areas is higher than that of industrial intensive areas, and the ecological integrated development level of provinces and regions is significantly different. The average ecological comprehensive development level of Qinghai province is 0.64, which is much higher than other provinces in central and western China.

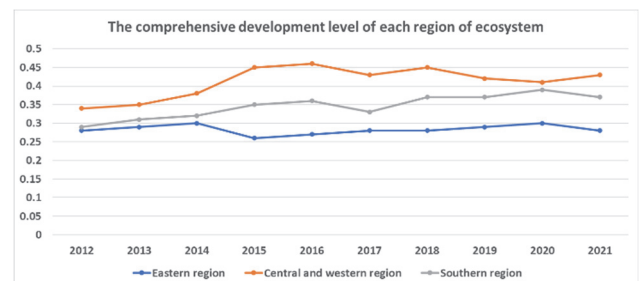


Figure 4 The comprehensive development level of each region of ecosystem

The middle governments have taken a series of measures to improve the ecological situation in Qinghai, and the analysis results show that the various measures have achieved remarkable results to some extent. In addition, the



level of ecological comprehensive development in the mid-western regions is slightly better than in other regions, and the average value of ecological comprehensive development water is 0.46. In the industrial intensive area, the adjustment of the development water of the biosynthesis is not large and the level is low.

From Fig. 5, the comprehensive development level of China's international trade and ecosystem shows a steady upward trend, and the overall development trend is better. Due to the different advantages of sub-systems in different regions, the spatial differences between different regions in China are gradually obvious, the specific manifestations are south > East > Central and western regions. Among them, the mid-western regions and the eastern regions respectively rely on their advantages in ecosystem and international trade, and the comprehensive development level is higher, while the central and western regions have no advantages in international trade and ecosystem, resulting in the lowest system integration level.



Figure 5 Comprehensive evaluation of China's international trade and ecosystem

## 4 RESULTS AND DISCUSSION

### 4.1 Standard for Classification of CD

According to the existing research [19], the CD is divided into 6 levels, as shown in Tab. 3.

Table 3 The grading CD

Interval range	Coordination level	CD
[0, 0.20)	1	Severe disorder
[0.20, 0.40)	2	Moderate disorder
[0.40, 0.50)	3	Primary disorder
[0.50, 0.60)	4	Primary coordination
[0.60, 0.80)	5	Moderate coordination
[0.80, 1.0)	6	Severe coordination

If the actual value of the comprehensive development index is closer to the fitting value, the CD value is greater, indicating the CD is higher. On the contrary, the larger the difference between the actual value and the fitting value, the CD value is smaller, indicating the CD of the two systems is lower. If the actual value is equal to the fitted value, the value of the CD is 1, indicating that the two systems are completely coordinated. In other words, the CD is closer to 9.9, the system is more coordinated, and the closer it is to 0, the system is more uncoordinated. In general, if the coordination level is not lower than 0.6, the two systems are considered to coordinate. Therefore, according to the value range of the coordination coefficient, the CD level listed in Tab. 3 is set.

### 4.2 Temporal Change of the CD of International Trade and Ecosystem

The international trade and ecosystem of all regions in China during 2012 - 2021 are generally at a relatively high level ( $0.9 < C < 1$ ), which indicates that there is a strong correlation between international trade and ecosystem of all regions in China, and all regions can take into account the protection of ecosystem while pursuing international trade.

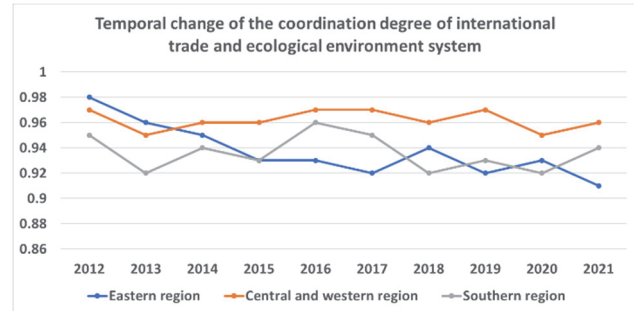


Figure 6 Comprehensive evaluation of China's international trade and ecosystem

As can be seen from Fig. 6, the international trade and ecosystem of all regions in China showed an overall upward trend during the 10 years from 2012 to 2017, which indicates that the CD level of international trade and ecosystem of all regions in China is constantly rising to a certain extent. Among them, the eastern and western regions showed a steady upward trend, and the overall CD changed from transitional development to CD. The CD of the central region also increased steadily in the past 10 years, and the CD of the South China region fluctuated slightly from 2012 to 2021, but the overall trend was also rising. Thus, the coordination development level of international trade and ecosystem in various regions of our country is constantly improving, and gradually developing into a good trend.

### 4.3 Coordination Results

The coupled co-regulation of the international business-biological environmental system is calculated to develop the level of water, as shown in Tab. 4. With the passage of time, the three CD of water level showed a steady step up state, and the overall CD state of China became better. In 2012, the CD of the system was 0.38, and by 2021, it will be increased to 0.51, and China's international business-ecosystem has realized the transformation from a mild imbalance to a near-imbalance state. However, the average value of coordination in 9 provinces and regions in 10 years is only 0.432, and our country is on the verge of imbalance. Moreover, when the CD is at its highest level in 2021, it is still in a state of near imbalance, failing to achieve a significant improvement in the state of CD. Thus, China's international trade and biological environmental protection coordination state still has great development.

The development speed of international business subsystem is slow, the development level is the lowest, and the gap between the CD level of the middle and western regions is the biggest, which is the main reason for the poor

coordination and coordination state of each region in China and the big regional differences.

**Table 4** Comparison of China's international trade-ecosystem coordination development

Region	International trade	Ecosystem	Coordination level	CD	Factors
Eastern region	0.43	0.21	0.72	5	Ecosystem lag type
Central and western region	0.26	0.29	0.59	4	Economic development lag type
Southern region	0.5	0.3	0.71	5	Ecosystem lag type

## 5 CONCLUSION

Overall, China's increasingly important position in the global supply chain has injected new vitality into the global economic development. As the global economy continues to change, China's position and role in the global supply chain will continue to be strong. With the economic globalization, China is gradually embedded in the production network of the global supply chain. Most of China's exports are manufactured goods with low added value and high pollution. The effective way to change this situation is to upgrade the import trade of the supply chain, but there are obvious differences in the upgrading modes of global supply chain under different international business mechanisms. Through the comparison of the CD between international commerce and ecosystem in China, it is found that the CD of supply chain in different industries is different. There are differences in the coordination of supply chains in different industries. In the global supply chain of export trade, there is a large gap in the CD of various industries with low profits. Exports mainly rely on quantity rather than quality, and the international terms of trade deteriorate. In the global supply chain of import trade, China's international commerce and ecosystem are at the stage of primary and intermediate coordination, with stable development over the years. In general, the CD of import trade global supply chain is higher than that of export trade global supply chain although there are still some limitations, and future study should also concern this aspect.

The above conclusions provide a theoretical basis for improving the coordination of China's international business and ecosystem, although it is an extension of previous study. Various industries should upgrade in different directions according to the nature of their industries and their positions in the supply chain, and take measures to improve the ecological level. In the global supply chain of export trade, the level of international business development is low, and the terms of trade are deteriorating, so it should be upgraded to research and development, design and other import trade. In the global supply chain of import trade, China's trade development level fluctuates greatly, and its ecosystem development level is high. Measures must be taken to improve the trade structure and enhance China's position in the global supply chain.

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