An Analysis on the Structural Optimization of China's Foreign Trade from the Perspective of Energy and Environment

Xiandong Guo

School of Economics and Management, Beihang University, Beijing100083, China

Xiandong_guo@126.com

Abstract

Due to decades of development, China's society and economy have entered a stage of rapid growth, but we have long been suffering the model of developing economy at the cost of energy and environment resources. As we intensify efforts to protect energy and environment while promoting the sustainable development strategy, we need to timely adjust the economic structure, especially the foreign trade structure, in order to meet the national target of energy conservation, emission reduction, low-carbon and environmental protection. This will truly facilitate a long-term stable development of foreign trade and the overall economy. Therefore, in line with the actual situation of China's foreign trade structure, this paper will analyze how to optimize China's foreign trade structure from the perspective of energy and environment.

Keywords

Energy and environment, foreign trade structure, optimization measures.

1. Introduction

As one of the most critical driving forces of economic growth, foreign trade has always played a vital role in our economic development. China has gained closer relations with foreign countries in the process of globalization, providing a sound opportunity for foreign trade development. However, we have encountered massive energy consumption, environmental damage and other issues while restructuring the foreign trade, which is detrimental to the sustainable development of foreign trade. In this context, taking energy and environment into consideration, this paper puts forward several points about how to effectively optimize the current foreign trade structure, hoping these referential opinions could help strike a balance between foreign trade as well as energy and environment.

2. The Current Foreign Trade Structure

2.1 Import Trade Structure

With the further deepening of reform and opening up, China's foreign trade development has reached a new peak. Since the financial crisis in 2009, our import trade has shown a trend of steady growth. According to the latest statistics, China's trade volume of general import merchandise amounted to roughly $ 73 billion last year. What's worth mention, the trade volume of import food has been increasing year by year. From 2006 to 2016, our trade volume of imported food increased as much as four times with an average annual growth rate of over 17%. But on the whole, playing a major role in the import trade structure, primary products have obtained an increasing percentage, while the proportion of import manufactured goods has been dropping for several years. This change also means that we are transforming the current import trade structure by exporting more high-end products rather than low-end ones, so as to maximize the added value and achieve the stable development of import trade [1].

2.2 Export Trade Structure

In the past decade, China has increased support for new industries involving mechanical, electrical and high-tech products, as well as soybeans, corn and other agricultural commodities. As for the total export trade structure, the proportion of food and fossil fuel-based primary products, in particular, is gradually decreasing, while industrial products, represented by chemicals, machinery and other products are on the increase. Relevant data shows that the export growth of coal, natural gas, raw fur, textile fiber and other products has basically maintained at around 25%. Under strict management, China's import and export trade is gradually moving towards a path of balanced development.

3. A Study on the Structural Optimization of China's Foreign Trade from the Perspective of Energy and Environment

3.1 Input-Output Analysis

3.1.1 Basic connotations

The input-output analysis refers to the use of the "empirical form" to analyze production links in a comprehensive manner, taking advantage of observed data to establish a relevant model for identifying links among social production activities at the economic and technical level, so as to effectively analyze the number of overall production activities as well as their connections with economy, technology and other types of activities.

3.1.2 Model establishment

If there are n product sectors in the national economy, with X denoting the total economic output, AX the middle input and Y the social final product, and A the value direct consumption coefficient matrix,

$$A = \begin{cases} a_{11}a_{12}\cdots a_{1n} \\ a_{21}a_{22}\cdots a_{2n} \\ \cdots\cdots\cdots\cdots\cdots \\ a_{n1}a_{n2}\cdots a_{nn} \end{cases}$$

then comes the mathematical model of X = AX + Y. In this model, the final demand Y involves the consumer spending of residents and government, net exports, inventory increases and so on. The relation between the total output X and the demand Y can be defined as $X=(I-A)^{-1}Y$, and $(I-A)^{-1}$ represents the Lyndon inverse matrix, where the element α_{ij} means the amount of products fully put into i industry in producing per unit of output in j industry.

If EFP and EFC represent the total resource and environmental loss of domestic production and consumption products respectively, EFE and EFI denote the total resource and environmental loss of export and import products respectively, and EFB represents the difference between domestic production and consumption total loss, then the model EFB = EFE-EFI = EFP-EFC can be established. And if the EFB calculated by substituting relevant values is positive, the domestic consumption cannot completely digest domestic products. Therefore, as a net exporter of resource and environment loss, the country is an importer of trade pollution. On the contrary, if the calculated EFB value is negative, then the country is a net exporter of resources and environmental loss as well as an exporter of trade pollution.

3.1.3 Data Selections

This paper is based on the analysis of 15 sectors including mining, metal products manufacturing, machinery and equipment manufacturing, the other services (except public administration) sector, and the construction sector. The total output, final demand and total export are represented by X, Y and Z respectively. The calculation of input-output data, including direct consumption coefficient matrix, direct consumption coefficient matrix of imported intermediate inputs, imported intermediate inputs used for domestic processing, and final consumption product, can be completed by using the relation between X and Y in the input-output model. Combined with relevant data on carbon emission, this paper has completed the calculation of direct loss coefficient and complete loss coefficient of various sectors in 2010, 2012, 2014, 2015 and 2016.

3.2 Calculation of the Embedded Carbon

3.2.1 The General Situation of Emission

EE, EI and EB are used to represent the embodied carbon in exported products, the embodied carbon in imported products, and the net balance of carbon emissions embodied in trade respectively. Figure

1 shows a gradual increase in embodied carbon emission in imported products during the past five years, but the figure had been decreasing during 2015 and 2016. The embodied carbon emission in exported products also shows a year-on-year increase, with its maximum reaching to 157.14 million ton. It can be seen that the embodied carbon emissions in exported and imported products have been growing continuously. As a former net exporter of embodied carbon emission, China has now changed into an importer of carbon pollution.

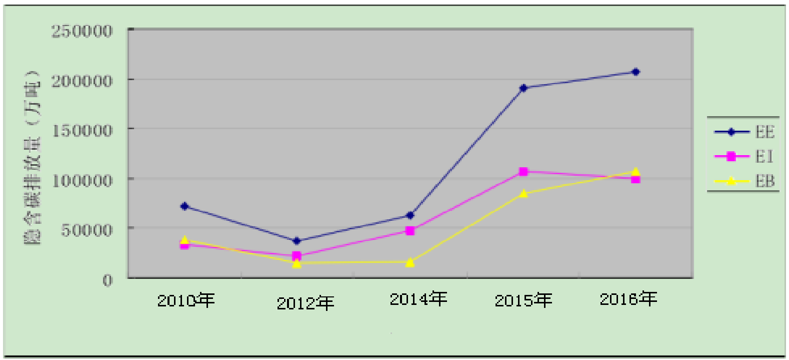

Figure 1. Changing Trend of EE, EI and EB between 2010 and 2016

3.2.2 Trade Structure

Based on the above-mentioned environmental input-output model, it is evident that the embedded carbon emission “outsourced” by other countries to China goes up with the increase of favorable trade surplus, which can be proven by the net balance of embedded carbon emission in 15 sectors and foreign trades. According to relevant data, the trade surplus of China in 2012 reached 378.4 billion yuan while the net balance of embedded carbon emission of that year rose to 381.02 million ton. In 2014, these two figures increased to 909.6 billion yuan and 843.2 million ton respectively. By the end of the previous year, the total volume of trade surplus had added up to 2.152 trillion while the net balance of embedded carbon emission had exceeded 100 thousand ton. To be specific, the majority of the embedded carbon emission comes from manufacturing (including machinery and equipment, metal products and textiles), accommodation and catering industry, all of which feature small trade volume and substantial embedded carbon emission.

3.2.3 Structural Optimization

During the past 10 years, China has restructured its export trade in consideration of the high carbon emission. However, there is no obvious change or fluctuation but a slight adjustment in emission priority in industries featuring high carbon emission, including chemical industry, machinery and equipment manufacturing. During the past decade, embedded carbon emission of export trade has remained low in industries such as agriculture, forestry, fisheries and food processing, and recent two years have witnessed a small increase of embedded carbon emission in such export trades as petroleum processing and gas. The structure of import trade is largely unchanged. The largest embedded carbon emission can be found in manufacturing industries featuring unapparent fluctuation in situation and slight adjustment in emission priority. Meanwhile, industries characterized by low embedded carbon emission, including agriculture, forestry, fisheries, food processing, accommodation, and catering industry, are taking a growing proportion in import trade sectors, which is firm evidence of optimized and restructured export trade.

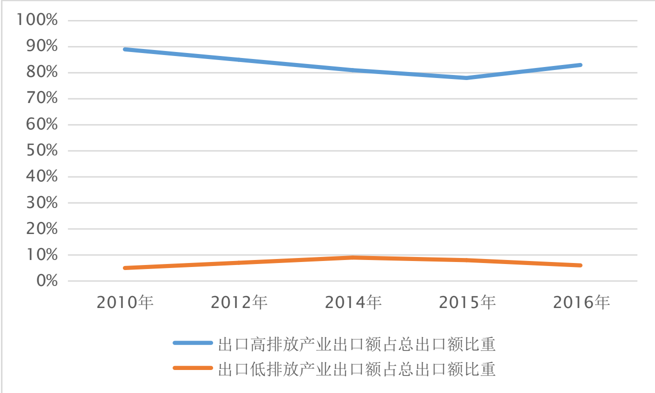

Figure 2. Structural Change in China’s Export Trade between 2010 and 2016

3.3 The Calculation of Embedded Energy

3.3.1 The General Situation of Energy Consumption

The energy embodied in import trade and export trades, as well as the net balance of embodied energy in export trade, are represented by EEI, EEE and EEB respectively. If EEB is negative, it means that our country is a net exporter of energy; if EEB is positive, it means that our country is a net importer of energy. Figure 3 shows the changing trend of EEI, EEE and EEB from 2010 to 2016.

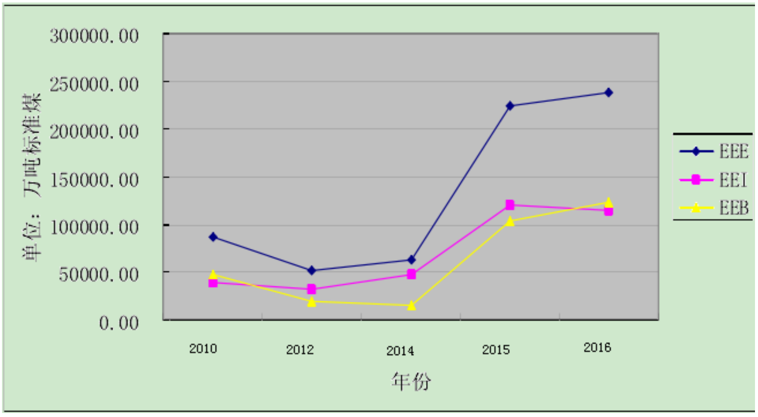

Figure 3. Changing Trend of EEI, EEE and EEB from 2010 to 2016

Based on the analysis of the figure above, it can be seen that the total volume of imported embodied energy is on a rise with the continuous development of import trade. The standard coal had soared from 388.8 million ton in 2012 to 1.29801 billion ton in the last year, which is more than three times the volume of standard coal. The volume of imported embodied energy fell slightly during 2015 and 2016. Through the calculation of net balance of embodied energy consumption, it can be seen that the net balance of embodied energy of the past five years shows a significant decline compared with that of the first decade of the 21th century, and the total volume of indirect energy output brought by export trade also showed a general decline.

3.3.2 Structural Characteristics of Trade

As embodied energy import industries of trade, petroleum processing, coking industry, mining industry and agriculture and forestry industry etc, are the typical representatives of China's trade deficit industry. In order to achieve the target of import substitution energy consumption, these industries should be vigorously encouraged and supported. While construction and accommodation, catering and other industries also belong to the industry of trade surplus, but the trade surplus of the former is in the medium level and its energy consumption is relatively low, and the trade surplus of the latter is at a high level and its energy consumption is relatively high. However, whether it is construction or catering or accommodation industry, it will, to some extent, promotes the long-term socioeconomic development of our, and is conducive to optimizing the energy environment. Therefore, for this kind of industries, China needs to give appropriate support and guidance. Although equipment manufacturing industry such as metal products and machinery and other manufacturing industries are all of high energy consumption, high surplus, they can help China to achieve maximized economic benefits to a large extent. Nevertheless, these industries have a greater negative impact on the optimization of energy environment. Therefore, the development of these industries should be restricted in china. Furthermore, for industries like the chemical industry, they have not only relatively low economic benefits but also consume a lot of energy and their destruction upon the ecological environment is relatively large. Thus it is necessary to have strict control on the development of these industries in China.

3.3.3 Structural Optimization

In the past decade, there is no obvious change fluctuation showed in China's imports of high energy consuming industries. But some industries such as food manufacturing, non-metallic mineral products industry etc, originally belonging to the embodied energy highly consuming industries are gradually transformed into embodied energy lowly consuming industries. According to figure 4, in China's total imports from 2010 to 2016, the imports of embodied energy highly consuming industries shows a slight upward trend. During this period, China's total imports of embodied energy lowly consuming industries decline. Therefore, the development of import trade is mainly depends on high energy consuming industries. But it is helpful to decrease in general level energy consumption. As a result, China's import trade structure has been optimized. On the contrary, during this period in China's export trade, the highly concentration of embodied energy highly consuming industries have certain unfavorable effects on reducing the total level of energy consumption in China, and especially in the total export trade volume, the constant rising of high energy consuming industries obviously reflects that our country hasn't realized the optimization of the structure of export trade.

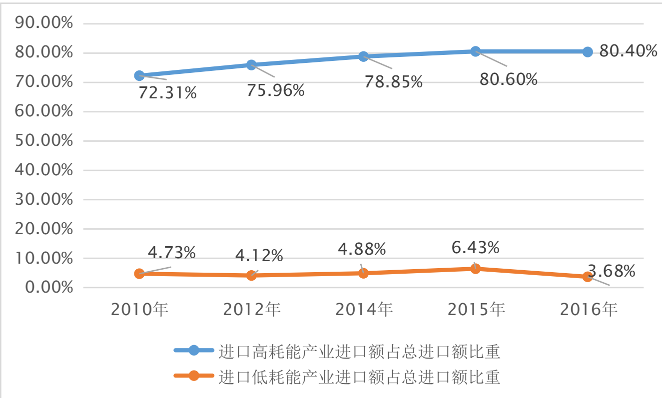

Figure 4. shows the change of import trade structure in China from 2010-2016

4. Optimizing China's foreign trade structure in the context of energy environment

4.1 Optimizing the Structure of Export Trade

According to above analyses, it is clear that in the context of energy environment, China's trade structure has been adjusted for some time. But resource intensive products are still the major elements in the import trade structure of China. Therefore, in the future, China still needs to reduce the export in this aspect as much as possible, and constantly improve the capital and technology intensive export products such as aerospace technology, life science products, computer products, and so on in order to effectively reduce the embodied Carbon and energy in its export trade to encourage low energy consuming industries.

4.2 Optimizing the Import Trade Structure

In the aspect of import trade structure, based on the perspective of energy and environment, China still needs to increase the imports of high-tech products and resource shortage products to effectively reduce the negative effect of its import trade on energy and environment as well as to meet the demand of domestic supplying market in China, laying a solid foundation for the continuous improvement of quality of the similar products. In addition, China also needs to learn the advanced science and technology and equipment of the western developed countries and regions as well as excellent management philosophy. On the basis of optimizing the import regulations of products, the import market can be more diversified to create a favorable environment for the continuous development of high-tech industry of low energy consumption and low emission in china.

4.3 The Need of Expanding Service Trade

In the process of optimizing foreign trade structure, China still needs to expand service trade, improve the participation of international outsourcing service trade, reasonably allocate trade in goods and services based on the completion of full use of foreign capital and domestic capital at the same time, and strive to attract more foreign capital through actively learning a series of measures of national trade environment law to achieve synchronous development of the trade in goods and services and to protect the stable development of China's foreign trade in the energy environment for a long time.

4.4 Reasonable Use of Tariff Adjustment

In addition, China needs to actively use tariffs, especially the import and export tariffs and export tax rebate policy to completely adjust China's foreign trade structure, for example, the development of a variety of preferential tariff policies to encourage industries including oil processing, coking industry, mining industry, as well as trade deficit industry such as agriculture, forestry and so on. As for the chemical industry, metal products and machinery and equipment manufacturing industry and other manufacturing industry which belong to industries of the high-energy consumption and high surplus, China needs to raise taxes, and improve measures to increase the tariff restrictions on the trade activities to effectively control the negative effect of these industries on China's energy environment.

5. Conclusion

In short, in the severe energy environment, China should optimize and adjust the foreign trade structure as soon as possible, with an aim to minimize the energy consumption and carbon emissions and to achieve sustainable development of foreign trade and economic growth. Therefore, China should develop specific trade policy according to the current situation of each industry and, based on expanding service trade, reasonably adopt various tariff policy to improve the level of foreign trade from the perspective of energy and environment.

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