Impact of Environmental Costs on Export Trade

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Abstract. With the rapid growth of trade, the problem of environmental protection has become increasingly prominent. In the export trade, environmental costs are highly valued and become one of the enterprises important considerations for production and export in China. This paper analyzes the impact of environmental cost internalization and environmental regulation on export trade based on the related literature on environmental cost and export trade; using China's one-time energy consumption data from 1997 to 2017 and 2001-2015 China's major industrial pollution discharge data. It simply calculated the environmental costs based on energy consumption. The research results show that the impact of environmental costs on export trade is mainly reflected in the impact on trade advantages and export product structure. Whether it is internalization of environmental costs or reasonable environmental regulation, it has a positive effect on the protection of pollutants from export enterprises and the protection of environmental resources within a certain scope, but excessive environmental costs or environmental regulations will increase the production cost of export products, which is ultimately not conducive to the growth of export trade. The government needs to further strengthen the coordinated development of environment and export trade to build an environment-friendly trade power.

Keywords: Environmental Costs, Export Trade, Energy Consumption, Industrial Sewage

1. Introduction
International trade plays a very important role in a country's economic growth, among which export is called one of the three carriages of economic growth. Since its accession to the WTO, China's export volume stood at US $266.1 billion in 2001 and reached US $2,263.4 billion in 2017. But with the rising power of China's international trade, the difficulties and barriers to trade in the world is growing, especially in recent years, the developed countries in their "environmental standard" on the grounds that the threshold of continuously improve our products to enter the international market, as a result, China's export trade is faced with more and more challenges and difficulties, environmental costs, China's export trade from the enterprise level or national level, has a rising trend.

So far, foreign scholars generally believe that environmental resources belong to non-exclusive natural resources, and pollution and other forms of environmental degradation are typical examples of externalities [1]. Environmental regulation has an important impact on trade flows, while trade has a lesser impact on the environment [2].
2. Analysis of the Current Situation of Environmental Cost and Export Trade in China

2.1. A Statistical Description of China's Export Trade

Table 1. China's import and export volume from 1997 to 2017 (unit: 100 million YUAN)

| Year | Total import and export | Total exports | Total imports | The difference | Exports as a share of GDP |
|------|-------------------------|---------------|---------------|---------------|--------------------------|
| 1997 | 26967.2                 | 15160.7       | 11806.5       | 3354.2        | 0.190                    |
| 1998 | 26849.7                 | 15223.5       | 11626.2       | 3597.3        | 0.179                    |
| 1999 | 29896.2                 | 16159.8       | 13736.4       | 2423.4        | 0.178                    |
| 2000 | 39273.3                 | 20634.4       | 18638.9       | 1995.5        | 0.206                    |
| 2001 | 42183.6                 | 22024.4       | 20159.2       | 1865.2        | 0.199                    |
| 2002 | 51378.2                 | 26947.9       | 24430.3       | 2517.6        | 0.221                    |
| 2003 | 70483.5                 | 36287.9       | 34195.6       | 2092.3        | 0.264                    |
| 2004 | 95539.1                 | 49103.3       | 46435.8       | 2667.5        | 0.303                    |
| 2005 | 116921.8                | 62648.1       | 54273.7       | 8374.4        | 0.334                    |
| 2006 | 140974.7                | 77597.9       | 63376.8       | 14221.1       | 0.354                    |
| 2007 | 166924.1                | 93627.1       | 73297.0       | 20330.1       | 0.347                    |
| 2008 | 179921.5                | 100394.9      | 79526.6       | 20868.3       | 0.314                    |
| 2009 | 150648.1                | 82029.7       | 68618.4       | 13411.3       | 0.235                    |
| 2010 | 201722.3                | 107022.8      | 94699.5       | 12323.3       | 0.260                    |
| 2011 | 236402.0                | 123240.6      | 113161.4      | 10079.2       | 0.253                    |
| 2012 | 244160.2                | 129359.3      | 114800.9      | 14558.4       | 0.240                    |
| 2013 | 258168.9                | 137131.4      | 121037.5      | 16093.9       | 0.231                    |
| 2014 | 264241.8                | 143883.8      | 120358.0      | 23525.8       | 0.224                    |
| 2015 | 245502.9                | 141166.8      | 104336.1      | 36830.7       | 0.206                    |
| 2016 | 243386.5                | 138419.3      | 104967.2      | 33452.1       | 0.187                    |
| 2017 | 278101.0                | 153311.2      | 124789.8      | 28521.4       | 0.187                    |

Since China joined the WTO in 2001, its export trade has been increasing. In order to study the total amount of China's export trade and its changes in the past 20 years, the total import and export trade...
data and GDP data of China Statistical Yearbook (1998-2018) of the National Bureau of Statistics are used as shown in Table 1.

![Figure 2](image.png)

**Figure 2.** 1997-2017 China's imports and exports as a proportion of GDP

As can be seen from Figure 2, China, as the largest developing country in the world, has witnessed a rapid growth in its foreign trade in recent years. Its export volume increased from 2202.44 billion yuan in 2001 to the peak of 1.5331.12 billion yuan in 2017, with an increase of 596.1%. At the same time, the ratio of export to GDP also grew rapidly during 2001-2007, and then declined due to the impact of the economic crisis. After 2011, it remained stable and declined slowly. Both GDP and exports are growing, but the share of exports is slowly falling, partly because of environmental concerns.

2.2. Analysis of the Current Situation of Environmental Cost in China

Environmental cost refers to the sum of the costs incurred in the mining, use, production, transportation and recovery of commodities to solve and compensate for the environmental pollution and ecological damage caused in the process. The composition of environmental cost includes the cost of normal use of environmental factors and the external cost of environmental pollution. The cost of normal use of environmental factors is affected by the endowment of environmental factors. The external cost that must be paid to pollute the environment is a cost that should be paid but cannot be paid, which is mainly affected by national environmental policies.

2.2.1. A measure of environmental costs. The first method is to measure the trade pollution content of export trade products as the environmental cost of trade. This concept was proposed by Lee&Roland Holst(1993) to represent the resources consumed by a country to produce export products. The second method is to life cycle cost (LCC), refers to the obtained from raw materials to products eventually abandoned the whole process of environmental cost, this method needs to be a specific product of each stage of life cycle cost of trade are measured out in detail, and the trade products is rich, practical difficulty is high. The third method is the input-output method. In the process of calculating the implied pollution emission of trade, it can be divided into single-region input-output table and multi-region input-output table. Depending on whether domestic and imported product inputs are distinguished, it can also be divided into competitive (import) input-output table and non-competitive (import) input-output table[3]. This method measures the emissions of implied
pollutants (such as carbon emissions and SO2 emissions) in traded products through input-output model, which is more reasonable and practical.

3. The Theoretical Mechanism of Environmental Cost Affecting Export Trade
The first thing to mention is the externality of environmental resources, which means that when organizations and individuals engage in economic activities, their costs and consequences are not entirely borne by the bank. External diseconomy means that the economic activities of an organization or an individual bring harm to others in society, but the person or the organization does not have to compensate for such damage [4]. Due to the public nature of environmental resources, environmental costs are not considered in the production and trading process of products, thus the impact of economic activities on the environment will be ignored. However, the environmental bearing capacity is limited. This is where trade growth and environmental pollution come in. At present, most researches believe that the main reason of environmental cost externality is the failure of government and market, and the most effective way to solve this problem is to implement environmental cost internalization [5].

In order to avoid the external effect of the environment, the most effective method is to implement the internalization of environmental cost[6], which is to treat environmental factors as production factors like labor, capital and other factors and add them into the production link, so that environmental cost becomes a part of the total cost of producers' production. Therefore, the price of the product can better reflect the total cost of all factors in the production and operation process, playing a direct role in eliminating the impact of environmental externalities.

3.1. The Impact of Internalization of Environmental Costs on International Trade
As for the impact on the structure of export products, when transnational corporations realize that they need to strengthen environmental regulation and implement environmental cost internalization, they may transfer the industry to the countries with more backward environmental regulation, and they will also become the importing country.

As for the impact of comparative advantage, internalization of environmental cost can enhance the competitiveness of industries with environmental advantages in the international market [7]. For industries with environmental externalities, it will increase the environmental cost in the short term and transform them to produce products with more environmental advantages in the long term [8].

4. Environmental Cost Measurement and Its Effect in China
Although our country has yet to give a clear definition of environmental costs, but at home and abroad on the study of environmental cost is very rich, measure of trade environment cost are two main the process of trade of the number of natural environment and resources; The second is to measure the emission of trade pollution [9], that is, how many pollutants are discharged. Therefore, this paper also measures the environmental cost of trade from these two aspects.

4.1. Environmental Costs from the Perspective of Energy Consumption
Firstly, the trade environment cost is calculated from the perspective of energy consumption. Export is an important part of GDP, and the energy consumed by export is also a part of energy consumption in GDP. Therefore, the following calculation can be made:

\[
EC_c = \frac{\text{EXPORT}}{\text{GDP}} \times \text{ECONS} = \text{ratio} \times \text{ECONS}
\]

ECc represents the trade environment cost measured from the perspective of energy consumption, EXPORT represents the total amount of the country's exports, GDP represents GDP, and ECONS represents the total energy consumption of the country.

The data needed for this research mainly includes three aspects: one-off energy consumption data, GDP (gross domestic product) and China's total export trade. According to formula (1), the
environmental cost of China's export trade in the past 20 years can be calculated. The calculated results are shown in Table 2.

**Table 2.** China's environmental cost from 1997 to 2017 (unit: million tons)

| Year | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|------|------|------|------|------|------|------|------|
| Ton oil equivalent(toe) | 200.06 | 180.85 | 185.41 | 234.95 | 234.98 | 278.10 | 378.66 |
| Year | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
| Ton oil equivalent(toe) | 503.78 | 609.19 | 704.23 | 793.24 | 742.60 | 579.05 | 682.83 |
| Year | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
| Ton oil equivalent(toe) | 714.48 | 705.31 | 704.64 | 698.96 | 648.39 | 596.65 | 612.34 |

As can be seen from Table 2, the environmental cost of China's exports peaked at 7.9324 million tons of oil equivalent in 2007 from 2.06 million tons in 1997, with an increase of 296.5%. And in the two years from 2007 to 2009, environmental costs fell sharply, then rose slightly before peaking again, and remained stable after 2011. One-time energy consumption in the countries all over the world, including the United States, China, Russia, Japan and India are among the best, so as the export trade as a decline in the cost of environment, also cannot say that China is the developed countries or some developing countries "pollution haven", in contrast, the change of China's export trade, export proportion in 2006, is the high environmental cost of the previous year reached its maximum value, the proportion is as high as 35.4%[10], from 1997 to 2007, the total amount of export trade growth of 517.56%, This indicates that the growth rate of export trade volume is much faster than the increase rate of environmental cost of export. Through trade liberalization and global division of trade, China exports more and more "clean" products. Since 1997, China's energy consumption growth has also been slowing down. When analyzing the environmental effect of trade, it can be seen that scale effect increases the environmental cost of export, but technology effect has a positive effect on the reduction of environmental cost of export, reducing China's energy consumption [11].

5. Conclusion

This paper first uses the literature analysis method to summarize and analyze the current situation of China's environmental cost and export trade. At present, the measurement of environmental cost is mainly from the two perspectives of implied pollutant emission and energy consumption. At the same time, environmental cost affects China's export trade mainly by influencing the comparative advantage of trade and the structure of export commodities. Through the analysis of the environmental costs of China's export trade, inductive measurement method and results of environment cost, think the current measure of real costs of environment has not yet formed a set of perfect system, for enterprise to bear the environmental costs of it is not clear, can take advantage of the internalization of environment cost optimization of the structure of export products, thereby improving the environmental regulation system, promote enterprise technology innovation, improve product international competitiveness. By looking at nearly 20 years of trade data and one-time energy consumption data and the main industrial pollution emissions, try to calculate based on the perspective of environmental costs, energy consumption analysis of the environmental costs of export trade scale effect and technical effect, and compare the environmental costs and the change of the export trade, draw the conclusion: scale effect increases the environmental costs, but technical effect reduces the environmental costs; Export trade is basically in line with the trend of environmental costs from the perspective of energy consumption. Through a simple regression analysis of the relationship between pollutant discharge and environmental cost, it is found that there is a significant relationship between pollutant discharge and environmental control cost indirectly. Therefore, in order to reduce the impact of environmental costs on export trade, we can implement the internalization of environmental costs and reasonable environmental regulation intensity, promote the further optimization of China's export trade structure,
reduce export energy consumption and pollution content, make exports more "clean", and make contributions to the construction of China as an environment-friendly power.

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