Article

Analysis of China’s Iron Trade Flow: Quantity, Value and Regional Pattern

Xinxi Chen 1, Jiansu Mao 2,* and Hezhong Tian 2

1 School of Environment, Beijing Normal University, Beijing 100875, China; chenxx426@foxmail.com
2 State Key Joint Laboratory of Environmental Simulation & Pollution Control, School of Environment, Beijing Normal University, Beijing 100875, China; hztian@bnu.edu.cn

* Correspondence: maojs@bnu.edu.cn

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Abstract: Iron is an important metal material that supports the development of society and national economies. Due to the uneven distribution of resources, there is frequent trade around the world. Therefore, mastering the global flow path and trade pattern provides an essential basis for the sustainable utilization of iron and related products. Based on the artificial flow of iron in international trade, this study used the material flow analysis method to investigate this flow. Based on the data of China’s international iron trade from China Customs and the United Nations trade administration, this study systematically analyzed the structure, type, quantity, and value of iron-containing commodities in 2018. The results were as follows: (1) China was a net importer of iron and formed a trade structure of “import raw materials and export products.” (2) There was a large trade surplus in China’s iron international trade. The quality of iron exported by China was high, and the price is relatively low; therefore, countries around the world have a great dependence on the iron imported from China. (3) Compared with developed countries, China is in urgent need of high-end technologies and can only import high-tech iron products from abroad. Therefore, the value of China’s exports of iron-containing commodities is relatively low, while that of its imports is relatively high.

Keywords: international trade; iron; material flow analysis; trade flow; value flow

1. Introduction

Iron is an important metal material that supports social and economic development. With the rapid development of the world economy, the consumption and demand for iron have also increased rapidly. It is an urgent task to allocate and use iron scientifically and rationally and to ensure its sustainable utilization. Due to the uneven distribution of global iron resources and unbalanced industrial development, countries have carried out frequent trades to exchange resources [1]. As a major producer and consumer of iron and metal, China has the international responsibility and obligation to promote global environmental protection and development that is commensurate with its own level of development. Therefore, it is vital to master the flow path of China’s iron in international trade for its efficient utilization, the scientific management of iron resources, the improvement of the international trade pattern of iron metal, and the provision of a basis for policy management.

Import and export trade plays a more and more important role in China’s iron supply and demand. It has become an inevitable trend to carry out international trade of iron metals. International trade is the main form of mutual connection among countries (or regions) on the basis of the international division of labor, reflecting the economic interdependence of countries (or regions) in the world. The trade of iron-bearing commodities between countries has formed a global trade system [2]. International logistics is produced and developed with the development of international trade. It can not only speed up the development of international trade but also provides indispensable support and help for
international trade. The development of international logistics has greatly improved the environment of international trade and provided various convenient conditions for international trade, which is the premise of the steady development of a national economy. The rapid growth of international trade is inseparable from the development of international logistics. International logistics is an important carrier of iron metal flow in the world and international trade is an important factor to promote the global flow of iron and metal [3].

As one of the most important basic methods for resource management and environmental system analysis, material flow analysis (MFA) can be used to quantitatively analyze the stock and flow changes of several commodities or a class of commodities in international trade in time and space [4]. So far, many scholars have made extensive use of material flow analysis methods to study the material flow of metal resources [5]. Qiangfeng and other scholars have studied the iron trade flows between China and the rest of the world [6]; Nakajima and others analyzed and calculated the global iron trade flow [7]. These previous studies have promoted the progress of MFA and provide new ideas for follow-up research. Though there were limitations, MFA can now be directly used to study the flow of various metals in regions and across regions.

Previous studies on iron flow can be divided into two categories: The first category mainly focuses on the enterprise and national levels throughout the life cycle or the stages of production, consumption, and resource recovery [8–18]. The second category mainly focuses on the analysis of iron material flow between countries and regions [19,20]. In the second category, there are few studies on the cross-regional flow of iron, especially international trade. However, it is important to understand the international trade of iron to master the pattern and comprehensively manage the related policies.

MFA was previously used to study iron trade flow in a certain country or region, and many kinds of iron-containing end products were ignored [6]. However, they account for a large proportion of China’s annual iron export. Therefore, it is crucial to analyze the trade flow of all kinds of iron-containing commodities to accurately analyze the iron trade flow in China.

Based on the artificial flow of iron in international trade, this study took the material flow and value flow in China’s international trade of iron as the research object and selected the MFA method to investigate this flow. An analytical framework for the life cycle of iron trade flows was established, with special attention to the value flow process in trade flows.

By considering various types of iron-containing commodities, this study qualitatively and quantitatively analyzed the quality and value changes of the different types of iron-containing commodities in China from the global perspective, which improved the accuracy of the material flow analysis, the reliability of the conclusions, and the evaluation of the quality and value changes. These benefits will help to optimize the resource allocation of the iron product industrial chain, improve the utilization rate of iron, and promote the sustainable development of related industries when putting forward relevant policies in China. The remainder of this paper discusses the research from four aspects: methods, results, conclusions, and suggestions.

2. Materials and Methods

2.1. Framework of the Iron Trade Flow Analysis

The trade flow is the flow of material and value through the boundary of a region based on artificial flow, which coincides with the material flow analysis method. To analyze China’s iron trade flow, based on the material flow framework, we chose China’s mainland as the boundary, took the material and value flow of iron in international trade as the research object, used the material flow analysis method, and paid attention to the relevant parts of value flow in trade flow (Figure 1).
According to the principle of mass conservation, material flow analysis tracks the material and value flow of one or several substances in the production, processing, use, recycling, and waste aspects of the system [21]. This method obtains the data of the material and value circulation in each link through the analysis of the life cycle of the material and then analyzes the value benefit of the saving and the final stock in different rings in order to improve the efficiency of the resource utilization, reduce the waste discharge, and ensure the sustainable development of the economy and resources [22].

Through the material flow analysis method, combined with the value change of iron metal flow in international trade, we carried out an objective analysis of China’s iron and metal trade flow, identified the international trade pattern of China’s iron and metal, provided strong support for the sustainable utilization of iron and metal, and proposed relevant policies. In trade flow, the material exchange of existing ferrous metals will inevitably lead to the exchange of value, and the direction of material and value flow is the opposite. The exchange process of the two flows, namely, the iron and metal trade flow, as well as its region, is shown in Figure 1. A comprehensive analysis of the two flows can obtain the flow status and development trend of iron-containing commodities in international trade.

Because this study focused on the flow of iron across a region’s boundary, the iron trade between the Chinese mainland and other regions was selected as the research object. Therefore, iron trade flows can be classified according to life cycle stages (Table 1). The process of the artificial flow of iron crossing the regional boundary mainly includes import, export, re-import, and re-export. In the framework of iron trade flow analysis, net import and net export are used to represent the material and value flow of the international iron trade in the whole life cycle.

As shown in Figure 1, the boundary is indicated by dotted lines. Within the boundary, the flow of iron in the full life cycle is indicated by dotted-line arrows, and the processes and products in each life cycle are connected by solid lines. In the trade flow across regional boundaries, the net import and export material flow between various iron-containing commodities and other regions is indicated by a solid-line arrow, and value flow is indicated by a dotted arrow. The direction of the arrow is the overall flow direction of material and value.

The net import and export mass of each type of iron-containing commodity is its total export mass minus the total import mass. If it is positive, the iron-containing commodity is a net export commodity; if it is negative, the iron-containing commodity is a net import commodity. The net value of import and export is the total value of exports minus the total value of imports. If it is positive, there is a trade surplus in the international trade of this commodity. Otherwise, there is a trade deficit.

Figure 1. Analysis framework of iron trade flows between China and other regions.
Table 1. Classification and iron content coefficient of iron-containing commodities in the full life cycle.

| Life Cycle                  | Category       | Subcategory      | Iron Content Coefficient |
|-----------------------------|----------------|------------------|--------------------------|
| Sintering and smelting      | Iron ore       | Sintered iron ore| 0.62                     |
|                             |                | Unsintered iron ore| 0.62                     |
|                             |                | Pig iron         | 0.95                     |
|                             |                | Iron alloy       | 0.9–0.95                 |
|                             |                | Ordinary steel   | 0.99                     |
|                             |                | Stainless steel  | 0.87                     |
|                             |                | Long strip steel | 0.98–0.99                |
|                             |                | Plate steel      | 0.98–0.99                |
| Steel production            | Ferroatloy      |                  |                          |
|                             |                | Narrow strip steel| 0.98–0.99                |
|                             |                | Tubular steel    | 0.98–0.99                |
|                             |                | Iron wire        | 0.9                      |
|                             |                | Land vehicles    | 0.53                     |
|                             |                | Marine transport | 0.45                     |
|                             |                | Air traffic equipment | 0.45                 |
|                             |                | Petrochemical supplies | 0.93                    |
| Product manufacturing      | Iron-containing end product | 0.35–0.45        |
|                             |                | Agricultural machinery | 0.52                   |
|                             |                | Metal forgings   | 0.65                     |
|                             |                | Household appliances | 0.58                    |
|                             |                | Engineering machinery | 0.65                    |
|                             |                | Other iron products | 0.45–0.9                |
| Scarping and recycling      | Ferriferous waste | Ferriferous waste | 0.15–0.5                |

2.2. Calculation Method Used for the Trade Flow

2.2.1. Calculation Method Used for the Material Flow

Iron-containing commodities in international trade contain not only iron but have a complex composition. Therefore, if we want to measure its material flow, we should first divide all kinds of iron-containing commodities in the global iron trade into 5 categories and 21 sub-categories according to the order of the full life cycle of iron (Table 1). Then, we can calculate them based on their actual iron content coefficient, combined with trade data. The calculation method is as follows:

\[ W_s = Q_s \cdot R_s \]  
\[ W = \sum_{s=1}^{n} W_s \]  

In (1), the physical meaning of \( Q_s \) is the quality of a certain sub-category of iron-containing commodities \( S \), with a unit of \( 10^4 \) tons. The data of iron-containing commodities’ quantity traded with other countries in 2018 were obtained from UN Comtrade [23] and China Customs. The physical meaning of \( R_s \) is the iron content coefficient of \( S \), which was obtained by referring to the weight, material composition, and other parameters of various iron-containing commodities of the China Iron and Steel Association (CISA), combined with the data of the China Non-ferrous Metal Industry Association. The specific data is shown in Table 1. \( W_s \) was calculated using (1). Its physical meaning is the iron content of \( S \), where the unit is \( 10^4 \) tons. In (2), the iron mass of each sub-category of iron-containing commodities obtained in (1) is added to obtain \( W \), which is the iron content of this category of imported iron-containing commodities, with the unit of \( 10^4 \) tons. The same is true for the calculation of the material flow of exported iron-containing commodities.

In Table 1, the iron content coefficient of some subcategories is a range rather than an exact number; therefore, a weighted average was applied to obtain the iron content coefficient \( R_s \) of each subcategory of iron-containing commodities, and then the material flow was calculated. Therefore, the mass of iron in this study was pure iron.
2.2.2. Calculation Method Used for the Value Flow

In the trade flow, since a material exchange of iron occurs, an exchange of value will inevitably occur, that is, the value flow of iron. Because the import and export trade volume and trade volume of all kinds of iron-containing commodities are not the same, the value flow was calculated according to the classification in the material flow calculation method to obtain the unit value of their iron content. The calculation method was as follows:

\[ P_s = \frac{V_s}{W_s} \]  \hspace{1cm} (3)

\[ P = \sum_{s=1}^{n} P_s \]  \hspace{1cm} (4)

Take the calculation of the value flow of imported iron-containing commodities as an example. In (3), the physical meaning of \( V_s \) is the total trade volume of a certain subcategory of iron-containing commodities, with a unit of \( 10^4 \) USD. The data of iron-containing commodities' value traded with other countries in 2018 were obtained from UN Comtrade and China Customs. However, in the calculation, only iron-containing commodities with a high iron content and value that was relatively dominated by iron were counted, excluding products with a low iron content but a high value (such as computers, mobile phones, and other electronic products). This was due to the low iron content of high-grade products in the processing process. The value was dominated by the high added value brought by the use of high tech and other precious metals, as well as other factors, rather than iron. The physical meaning of \( W_s \) is the iron content of the subcategory of the iron-containing commodity \( S \), with a unit of \( 10^4 \) tons, which was calculated in the material flow calculation. \( P_s \) was calculated using (3). Its physical meaning is the unit price of \( S \), given in USD/ton. In (4), the unit price of each subcategory of iron-containing commodities obtained in (3) is added to obtain \( P \), which is the unit price of the imported iron-containing commodities in this category, given in USD/ton. The same is true for calculating the value flow of the exported iron-containing commodities (Table 2).

Table 2. The iron unit value of iron traded between China and other regions in 2018 (units: USD/ton).

| Trade Type          | Category               | North America | Oceania | Africa | South America | Europe | Asia | Percent (%) |
|---------------------|------------------------|---------------|---------|--------|---------------|--------|------|-------------|
| Import from other regions | Iron ore              | 151.7         | 197.1   | 121.9  | 125.8          | 156.3  | 114.7 | 11.39       |
|                     | Ferroalloy             | 3862.2        | 4778.5  | 1423.0 | 11804.5        | 3657.2 | 1702.1 | 2.67        |
|                     | Ferrous material       | 3057.0        | 1655.0  | 501.5  | 472.7          | 1319.6 | 762.9 | 1.05        |
|                     | Iron-containing end products | 29206.4       | 27573.7 | 25536.1| 27515.9        | 28583.3| 26801.8| 84.77       |
|                     | Ferriferous waste      | 1324.5        | 1447.0  | 911.1  | 1812.5         | 2006.6 | 1933.4| 12         |
| Export to other regions | Iron ore              | 663.6         | 283.75  | 113.0  | 96.8           | 754.5  | 115.3 | 0.10        |
|                     | Ferroalloy             | 1043.88       | 1088.2  | 772.6  | 768.6          | 1519.1 | 813.7 | 3.46        |
|                     | Ferrous material       | 776.1         | 944.2   | 821.3  | 734.9          | 756.3  | 730.6 | 2.46        |
|                     | Iron-containing end products | 5942.2       | 6002.4  | 5801.7 | 6045.4         | 5936.8 | 5891.1| 93.96       |
|                     | Ferriferous waste      | 3104.9        | 0       | 509.3  | 513.9          | 2449.0 | 442.1 | 0.02        |

2.3. Analysis of the Regional Pattern of Trade Flows

For the calculations of the material flow, we obtained the import and export data of iron-containing commodities with all countries that trade with China. We selected the main trading countries of each type of iron-containing commodities’ imports and exports and calculated the proportion of these countries’ trade volume and total trade volume.

Using the continental data of all trade areas in UN Comtrade, the trade volume of each major category of iron-containing commodities in all regions was screened. The trade volume of iron-containing commodities in each link of China’s international trade in 2018 was summed up in terms of the continent. Regional trade constitutes a global trade chain, where the regional division of labor is different. A region has a comparative advantage in exporting a product if its price (measured by other products) is lower than that in other regions. Trade patterns could be improved based on this. If conditions permit, the regions with lower prices of iron-containing commodities substitute for the ones with higher prices to be traded with.
Using the proportion of China’s major iron-trading countries’ trade volume and its flow in global trade in 2018, an analysis of the trade status between China and its major iron trading countries revealed the pattern of China’s iron international trade, where the pattern of China’s international iron trade was visually represented. This can improve the pattern of China’s international iron trade and provide a basis for policy management in accordance with local conditions.

3. Analysis of the Results of the Iron Trade Flow

3.1. Iron Trade Flow

According to the calculation results of the trade flow, a specific analysis of China’s iron metal trade flow in 2018 was carried out. The calculation results showed that China was a large net importer of iron and was highly dependent on foreign resources. In 2018, China imported 698 million tons of iron and exported 183 million tons of iron, which was less than one-third of the import volume. However, China’s total import iron trade was valued at 658.59 billion USD and the total export trade was valued at 759.66 billion USD. The trade surplus was 101.1 billion USD (Figure 2). It can be seen that although China’s iron trade is in a state of net imports, China is a country with a trade surplus in the iron trade. Countries around the world have a greater dependence on the trade of iron imported from China.

![Figure 2. Trade flow of iron between China and other regions in 2018.](image)

In the structure of the international iron trade, iron ore is the main imported product. In 2018, China imported 660 million tons of iron ore, accounting for 94.5% of the total iron imports, where the import trade volume was 75 billion USD. However, in the same year, only 6.88 million tons of iron ore was exported, accounting for 3.76% of total iron exports. The trade volume was 793 million USD. This was because most of the iron ore in China is poor ore, with low quality, deep burial, and high mining and screening costs. Iron ore can only be imported from abroad. In addition, the recycling and reuse of iron-containing waste have also become a part of China’s international iron trade with the improvement of overall environmental protection awareness.

In contrast to the trade situation of iron ore and ferrous wastes, ferroalloys, ferrous materials, and iron-containing end products were the main components of China’s iron export trade. In 2018, China exported 176 million tons of ferroalloys, ferrous materials, and iron-containing end products, accounting for 96.18% of their iron exports. However, the total import volume of the three was only 38 million tons, accounting for 5.44% of the total import volume of iron. In 2018, the export trade volume of the three materials mentioned above was 758.8 billion USD, accounting for 99.88%
of the total export trade. The value of iron-containing commodities was mainly concentrated in ferrous materials and iron-containing end products. The trade surpluses of the two in 2018 were $11.8 billion and $155.7 billion, respectively. Importing ferrous materials and iron-containing end products from China has become the best choice for other countries worldwide. The above results show that China’s iron resources are relatively scarce, especially raw materials, such as iron ore. It is necessary for China to import a large amount of pre-range and mid-range iron-containing commodities from abroad to meet domestic production and consumption needs. This result shows that China lacks high-quality iron ore resources and relies heavily on importing foreign raw materials. On this basis, a large number of iron-containing products are processed and manufactured in China, and a large amount of iron-containing rear and end products are eventually exported. China is a veritable “world factory,” bearing heavy environmental discharge and pollution responsibilities for other countries around the world.

3.2. Regional Pattern of Iron Trade Flow

3.2.1. Iron Trade Flow Pattern of Major Countries

China is a major iron ore importer. In 2018, it imported 653 million tons of iron ore, mainly from Australia, Brazil, and South Africa. Iron ore from these regions accounted for 89% of China’s total iron ore imports. Australia is the largest source of China’s iron ore imports. In 2018, China’s iron ore imports from Australia accounted for 63.88% of its total imports. China has a large number of poor iron ore that is of low quality; therefore, it is not the main country that exports iron ore. In 2018, it exported 6.877 million tons of iron ore, most of which was exported to Japan (78%) and South Korea (9%), as shown in Figure 3.

The production of alloys has a high environmental cost and a relatively low value. During the process of alloy production, abundant pollutants are emitted and energy is consumed. Dealing with the native environmental problems costs a lot and the export price of alloys are quite low; therefore, the international trade of ferroalloy is not active. China’s related trade is mainly carried out in neighboring countries. In 2018, China imported 8.84 million tons of ferroalloys, mainly from Indonesia, South Africa, Japan, South Korea, India, and Malaysia, which together accounted for 58% of the total ferroalloy imports. Additionally, 30.25 million tons were exported, mainly to South Korea, Vietnam, and Indonesia, and 28% of the total export volume of ferroalloys was exported to South Korea and Vietnam.

With the rapid development of the economy, China has become a large exporter of ferrous materials and iron-containing end products worldwide. In 2018, China imported 29.15 million tons of ferrous materials and iron-containing end products, mainly from developed countries, such as Japan, South Korea, the United States, and Germany. These iron-containing commodities have higher requirements for science and technology, and China still needs to import from these countries with more developed manufacturing industries at present. China’s ferroalloys, ferrous materials, and iron-containing end products are the main exports. In the same year, a total of 146 million tons of iron-containing materials and iron products were exported, but these iron-containing commodities have low technical content. China has a large amount of iron resources but does not have high-quality iron resources. It can only import high-end iron-containing products from countries with a more developed manufacturing industry and export a large number of medium- and low-end iron products to more than 200 countries. It can be seen from the pattern of China’s iron trade flow that China imports the most iron ore from Australia, followed by Brazil and South Africa. Its primary exported iron-containing commodities are ferroalloys, ferrous materials, and iron-containing products, which are mainly exported to neighboring Asian countries, such as Japan, South Korea, Vietnam, and the Philippines. It is not difficult to see that the division of labor in the global iron industry chain is becoming deeper and more refined. Regions rich in mineral resources, such as Australia and Brazil, provide various types of high-quality iron ore. China imports and processes iron ore from these regions
and provides a variety of medium- and high-end products for all countries worldwide as a part of international trade.

![Graph of China's iron trade flow](image)

**Figure 3.** Major trading countries of China’s iron-containing commodities in 2018 and their proportions: (a) major trading countries of iron-containing commodities imported from China and their proportion in 2018; (b) major trading countries of iron-containing commodities exported to China and their proportion in 2018.

### 3.2.2. Global Flow Pattern of Iron Trade Flow

In 2018, China’s net import of iron ore reached 653 million tons, which was the largest trade flow among iron-containing commodities, as shown in Figure 4. Of these, 423 million tons came from Oceania (64.78%), 160 million tons from South America (24.49%), 33.1 million tons from Africa (5.07%), 24.2 million tons from Asia (3.7%), and the remaining 12.74 million tons from North America (0.81%) and Europe (1.14%). The flow directions of ferroalloys, ferrous materials, and iron-containing end products were similar, with 17.33 million tons (80.94%), 6.97 million tons (43%), and 34.26 million tons (34.16%) respectively, sent to Asia; 1.1 million tons (5.14%), 1.43 million tons (8.82%), and 31.06 million tons (30.97%) respectively, sent to North America; 1.01 million tons (4.71%), 2.38 million tons (14.68%), and 22.91 million tons (22.84%) respectively, sent to Europe; and the rest sent to Africa (3.32%, 20.73%, and 5.05%, respectively), South America (5.7%, 11.6%, and 4.1%, respectively), and Oceania (0.19%, 1.17%, and 2.88%, respectively). Overall, China’s exports of iron-containing goods mostly went to Asia, followed by North America and Europe.
3.3. Value of the Iron Trade Flow

To analyze the value of China’s iron in global trade flows, the unit prices of iron ore, ferroalloys, ferrous materials, iron-containing end products, and ferrous wastes were summed up by continent. The results are shown in Table 2.

The results show that the value of imported iron was mainly concentrated in iron ore (11.39%) and iron-containing end products (84.77%), while the exported value of iron was mainly concentrated in iron-containing end products (93.96%). The unit value of iron ore imported from Oceania was the lowest, and the unit value of iron ore imported from Europe was the highest, at 107.1 USD/ton and 156.3 USD/ton, respectively. However, most of the imported iron ore came from Oceania, South America, and Africa, and the unit value of iron ore from the latter two was 125.8 USD/ton and 121.9 USD/ton, which was 17.5% and 13.8% higher than that of the iron ore imported from Antarctica, respectively. Regarding the export of iron ore, the highest value was found for Europe, with a unit value of 754.5 USD/ton, and the lowest unit value was found for Africa, which was 113 USD/ton.

The unit value of ferroalloys imported from Africa was the lowest, followed by Asia, at 1423 USD/ton and 1702.1 USD/ton, respectively. In 2018, China’s imports of ferroalloys from Africa and Asia accounted for 16.62% and 69.34%, respectively, of the total ferroalloy imports. The value of ferroalloys exported to Europe was the highest, while that of ferroalloys exported to South America was the lowest, which were 1519.1 USD/ton and 768.6 USD/ton, respectively.

In the import trade of ferrous materials, the unit value imported from South America was the lowest at 472.7 USD/ton, while that imported from North America was 3057 USD/ton. In 2018, China’s imports of ferrous materials from Asia accounted for 96.16% of the total imports, and the unit value imported to Asia was 762.9 USD/ton. Regarding the export of ferrous materials and the import and export of iron-containing end products, the unit values varied little worldwide. The average unit value of ferrous materials export was 793.9 USD/ton, which was the closest to that of North America; the average unit value of iron-containing end products import was 27,536.2 USD/ton, which was the

Figure 4. Regional pattern of China’s iron-containing commodity trade in 2018 (unit: million tons). (Note: the arrow direction in the figure indicates the total flow direction of the iron-containing commodity mass, and the thickness of the arrow indicates the quantity of the mass. The thicker the arrow is, the more the mass is).
closest to that of South America; and the average unit value of export was 5936.6 USD/ton, which was closest to that of Europe.

From the value analysis of China’s iron international trade, we can see that China should import iron ore from Oceania and Asia from an economic point of view. However, the mineral resources in Asia are relatively poor, and China has formed a stable and efficient industrial chain with Oceania, South America, and South Africa. Therefore, although Asia has geographical advantages and can save on transportation costs, it still cannot become the main body of China’s import iron ore trade. Similarly, China should export iron ore and ferroalloys, except for ferrous materials and iron-containing end products with a similar unit value, to Europe. However, China hardly exports iron ore. It even exported very little iron ore to its Asian neighbors with stable trade chains. This was because of the rapid development of China’s manufacturing industry led to a shortage of raw materials. The demand for pre-end and mid-end products in the iron industry chain has surged, and there are few surplus iron ore and ferroalloys for export. In addition, China mainly trades steel with neighboring Asian countries due to its geographical advantage.

China imports iron-containing end products at a very high unit price, but the average export unit price is only 21.56% of imports. This shows that China bought them at a high price but sold them to other regions at lower prices. This was because China lacks high-end science and technology, exports low-tech iron-containing commodities, and does not produce much added value that can be brought by high-end technology compared with developed countries. In addition, it is also related to the situation that large enterprises monopolize the international market. Although the products made in China sell well worldwide, some large enterprises occupy the international market and dominate the market share with similar products with extremely low prices, which leads to the low price of Chinese iron products such that they can compete in the market.

4. Conclusions

Based on the analysis of China’s iron trade flow in 2018, this study analyzed the scales, patterns, and unit values of iron-containing commodities traded in international trade and drew the following conclusions:

(1) China is a large iron metal importer. In 2018, it imported 698 million tons and exported 183 million tons of iron, which was less than one-third of the import volume. At the same time, there was a large trade surplus in China’s international iron trade. In the same year, the total import trade of iron was valued at 658.59 billion USD; the total export trade was valued at 759.66 billion USD. The trade surplus was 101.1 billion USD.

(2) China has formed a trade pattern of “import raw materials and export products.” This was due to a large amount of lean iron ore and poor iron quality in China, which requires a large number of imported raw materials from the pre-end and mid-end industrial chain. However, with the developed manufacturing industry, China produced a large amount of steel (ferroalloys, ferrous materials) and steel products, which were sent to more than 200 countries around the world. In 2018, China imported 660 million tons of iron ore, mainly from Australia, Brazil, and South Africa, which have formed a stable industrial chain with China because of their rich mineral resources with high quality. In the same year, China exported 176 million tons of steel and iron and steel products, mainly to neighboring Asian countries, such as Japan, South Korea, Vietnam, and Indonesia. Generally, regions that are rich in mineral resources provide the iron industry chain with a wide variety of high-quality raw materials. China imports iron ore and processes it, relying on its strong manufacturing industry to deliver abundant and high-quality iron products to countries around the world. The division of labor in the global industrial chain is becoming increasingly detailed and clear with the development of international trade.

(3) In addition, China currently imports iron products at high prices from abroad but exports iron products at low prices. The first reason for this situation is that China lacks innovation ability and high-end technology, and the iron products exported do not have the added value that is
possible using high-tech. The second reason is that large enterprises monopolize the international market. Although iron products made in China have ideal sales conditions around the world, the international market is occupied with similar low-priced products and dominate the market share. For example, large steel enterprises from Japan occupy 33% of the international steel market. Therefore, China can only lower prices to compete with them.

5. Recommendations and Policies

According to the results of this paper, the following suggestions are put forward for the international trade policy for iron-containing commodities and optimizing the resource allocation of the iron-containing products industry:

(1) China should optimize the structure of international trade and improve international competitiveness. China should expand the scope of international trade in iron resources and utilize more trading partners. In terms of imports, China should establish more sources of imported resources; in terms of exports, China should utilize more and wider export markets, thereby enhancing their international competitiveness.

(2) China should optimize its own trade structure and promote high-tech applications. To narrow the technological gap between China and developed countries, China must improve the level of technology and introduce advanced technology.

(3) China should change its international marketing strategy by creating its own brand. By opening up the international market by lowering the price of creating its own brand and sales channels, the goal of grabbing the international market share and opening up the international market could be achieved.

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