Analysis on Regional Imbalance of China's Foreign Trade and Its Dynamic Evolution Based on Big Data Technology

Yiming Zhao[1]

[1]Business School East China University of Political Science and Law Shanghai, China

Abstract—Foreign trade promotes the development of regional economy, and the imbalance of foreign trade will inevitably lead to economic in-coordination among regions, thus affecting China's overall development. This paper introduces big data technology, constructs an imbalanced index of foreign trade imbalance, and uses WebCrawler technology to obtain data from 2000 to 2019 to empirically study the imbalance and dynamic evolution of foreign trade in the three major regions of East, Central and West. The results show that our country does have an imbalance in foreign trade between regions, but the overall degree of external dependence has declined, and the imbalanced index of China's foreign trade has dropped from 1.39 in 2000 to 1.15 in 2019, and its dynamic evolution process has gradually improved, indicating that China's attention to the balanced development of foreign trade has been effective.

1 Introduction

Since the 19th National Congress of the Communist Party of China, China's foreign trade development has entered a 'new era' of the conversion of old and new momentum, showing the characteristics of more coordinated regional development of foreign trade, higher quality of export products, and innovative methods. Obviously, foreign trade is one of the important forces that promote the economic development of a country, and the high growth rate of income makes Chinese exporters choose to save a large part of their trade income, which leads to a large accumulation of China's foreign exchange reserves[1]. However, China's long-term surplus has led to the imbalances of China's foreign trade, and the discussion of the causes of the foreign trade imbalances has always been the focus of research. For example, Paul N. Courant and Alan V. Deardorff (1992) believed that the decisive factor affecting regional trade differences is the uneven geographical distribution of factors[2]. Yin Zhang and Guanghua Wan (2008) suggested that the real shock largely determines the changes in China's trade balance, and changes in the exchange rate have little impact on the trade balance, thus, currency measures are not enough to correct China's trade 'imbalance'[3].

At the same time, the development of foreign trade will also have an impact on the environment. Studies have shown that foreign trade has a negatively impact on CO_2 emissions[4]. Other than that, 10.03–26.54% of China's annual CO_2 emissions are produced in the manufacturing process of export products sent to foreign consumers, while the CO_2 emissions reflected in China's imports accounted for only 4.40% in 1997 and 9.05% in 2007[5].

Nevertheless, foreign trade still occupies an important part of the national economy and cannot be ignored. Studies have also shown that there is a positive feedback between the textile industry's foreign trade and energy efficiency, and the impact of imports on energy efficiency is greater than the impact of exports on energy efficiency[6]. Moreover, most scholars hold a positive attitude in the study of the impact of foreign trade on national income, national economy and regional economic development differences. EM Pernia and PF Quising (2003) analyzed the reasons for the huge differences in the regional economic development of Philippines based on the panel data of the Philippines, and found that foreign trade is an important factor that causes such differences[7]. Roberto Ezcurra and Andrés Rodríguez-Pose (2014) suggested that changes in international trade have led to the expansion of regional development differences in developing countries. The lower the level of economic development, the greater the degree of integration with the world economy, and the more significant difference in internal regional development[8].

Therefore, foreign trade is a double-edged sword, and the sustainable development of foreign trade requires the joint efforts and mutual promotion of all regions of one country to achieve better and faster high-quality development, which makes the research on the balanced development of foreign trade among regions more meaningful. Based on the above considerations, this study constructed an imbalanced index and used the data from 2000 to 2019 to study the regional imbalances in China's foreign trade process during the past 20 years, and has also conducted research on the dynamic development of this imbalances. The data obtained by WebCrawler technology between 2000 to 2019 used in this study contains 31 provinces and is divided into three regions based on

1308290522@qq.com

geographical characteristics: eastern (Beijing, Tianjin, Hebei, Liaoning, Shanghai, Jiangsu, Zhejiang, Fujian, Shandong, Guangdong and Hainan), central (Shanxi, Jilin, Heilongjiang, Anhui, Jiangxi, Henan and Hubei, Hunan) and western region (Inner Mongolia, Guangxi, Chongqing, Sichuan, Guizhou, Yunnan, Xizang, Shananxi, Gansu, Qinghai, Ningxia and Xinjiang).

The arrangement of this study are as follows: the first part is the introduction section; the second part introduces the principle of WebCrawler technology in big data technology; the third part introduces the development and structural characteristics of China's three major regions of foreign trade in the past 20 years; the fourth part is the design of model and the empirical analysis of the imbalanced index, the last section is the conclusions and policy recommendations.

2 WebCrawler technology

WebCrawler is an important part of search engine, and it is an indispensable link of information capture in the process of search engine providing service. Web crawler can efficiently grab web pages, which is essentially a set of automatic computer programs. It can search and grab the web page resources from the Internet continuously. It doesn't need to control the operation of the program manually. It can realize the uninterrupted unattended operation day and night. Web crawler uses the links in the web page to achieve page crawling. Usually, after crawling the start page, it parses the content in the start page, parses the links in the page, and then continues crawling through the resolved links, and so on until the stop condition of crawling is reached.

WebCrawler usually selects some pages with large number of links or high weight page links as the initial link for crawling, and the page crawling process takes this as the starting link for page crawling operation in network resources. Different pages contain different links, which constitute a complex link network. WebCrawler uses some search algorithms to traverse and grab the pages in the link network. By adding the parsed links to the queue of links to be fetched until the stop condition is reached, the pages captured through the links of each page are stored in the page library for users to search and access in the client. In this paper, we use web crawler to get the required data for further analysis

3 Basic characteristics of China's foreign trade

3.1 Foreign trade scale

Figure 1A shows the trends and differences in the total import and export value of the eastern, central and western regions from 2000 to 2019, indicating that there does exist significant regional imbalances in China's foreign trade. From the perspective of import and export trade value (Fig. 1A), the foreign trade of the eastern region increased from US$436.8 billion in 2000 to US$3795.5 billion in 2019, a nearly 10-fold increase, and the central and western

regions increased by about 20 times; From the perspective of the proportion (Fig. 1B), there are also huge differences in China's regional foreign trade. The eastern region accounts for the vast majority of the country's total foreign trade. Although its proportion has decreased compared with 2000, it still reaches more than 80%, while the proportion of the central and western regions are relatively small, rising from about 4% in 2000 to about 8% in 2019.

The reason is that in terms of foreign trade cooperation, the competitiveness of the eastern region mainly comes from the absorption, mastery and reuse of technological knowledge. In addition, the eastern region has the highest spatial concentration of export enterprises, especially the export of high-tech products, which brings the continuously accumulated competitive advantage. However, the status of the eastern region's foreign trade is based on the cost of transferring resources for economic development in the central and western regions. The central and western regions have always been in the position of providing raw materials in the country's regional division of labor system. In addition, a large amount of labor from the central and western regions flowed to the eastern region, thus supporting the trade competitiveness of labor-intensive industries in the eastern region. Therefore, there is a huge gap between the central and western regions and the eastern regions, forming the situation of 'one China, four worlds'.
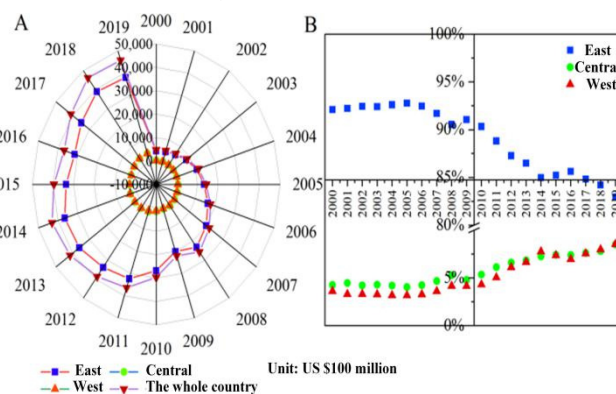

Fig 1. Structure of foreign trade in China. **A.**Total value of foreign trade in the east, central, west and the whole country. **B.** Regional structure of foreign trade in China.

3.2 External dependence

The degree of external dependence is abbreviated as the degree of dependence on foreign trade, also known as the foreign trade coefficient (traditional foreign trade coefficient). The degree of external dependence is an index widely used by various countries to measure the degree of a country's economy's dependence on foreign countries. It is measured by the proportion of a country's total imports and exports to the country's gross national product or gross domestic product. Figure 2 reflects three major regions' external dependence in China since 2000. It should be noted that the unit of total foreign trade value is 100 million U.S. dollars, while output data (GDP) is 100 million RMB. Therefore, this study converts the unit of total foreign trade into a unit of 100 million RMB based on the exchange rate of RMB against the U.S. dollars of

that year, ensuring the accuracy of the calculation of the external dependence.

The eastern region has the highest degree of external dependence. Although it dropped from 62.99% in 2000 to 48.84% in 2019, the eastern region's external dependence is still much higher than the central and western regions, and even the national level. In addition, the central and western regions have basically the same degree of external dependence. That is to say, due to the restrictions on the level of opening up, the total foreign trade of the central and western regions does not account for a large proportion of the region's GDP, and there is huge potential for foreign trade. At the national level, our country's degree of external dependence has experienced a process of first increasing and then decreasing. On the whole, compared with 2000, the external dependence of 2019 has dropped to 32.04% in China.
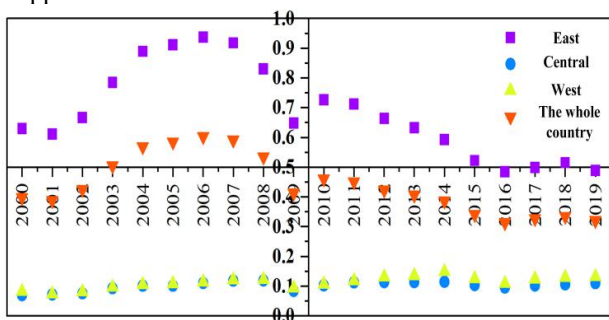

Fig 2. The degree of external dependence in China and three major regions during the period 2000-2019.

4 The Regional Imbalance of China's Foreign Trade and Its Dynamic Evolution

4.1 Imbalanced index of foreign trade

The imbalanced index of foreign trade is determined by the difference between each region and the general national level (the average value of the eastern, central and western regions), reflecting the degree of difference between a certain region and the national level, as shown in formula (1):

$$I(FT) = \sum_k \delta_k \left| FT_k - FT_N \right| \tag{1}$$

Where δ_k indicates the proportion of the total output value of the k-th region to the total output value of the country, and $\Sigma\delta_k=1$. FT_k and FT_N indicate the level of foreign trade in a certain region and the general level of foreign trade in the country respectively. It should be noted that, in order to facilitate calculation and comparison, this study quantifies the FT_N value from 2000 to 2019 as 1, thereby simplifying the calculation of the difference in foreign trade between each region and country numerically.

4.2 The dynamic evolution of foreign trade imbalances

The dynamic evolution of the foreign trade imbalanced index is derived from the difference between the imbalanced index of two adjacent periods, and represents the development of its imbalances, as shown in formula (2):

$$\Delta I(FT) = I(FT)^{t+1} - I(FT)^t \tag{2}$$

4.3 Empirical result

Through calculations, this study empirically studies the regional imbalances of China's foreign trade and its dynamic evolution, and finally finds that the degree of China's foreign trade imbalances has declined, and its dynamic evolution is also improving (Fig. 3). Specifically, in 2000, China's foreign trade imbalanced index was 1.39. After experiencing a steady decline, it fell to 1.15 in 2019, a record low (Fig. 3A). In addition, the dynamic evolution process of the imbalanced index also experienced a process of first growth, then a sharp decline, and finally a steady decline, which means the regional imbalances of foreign trade gradually improved (Fig. 3B).
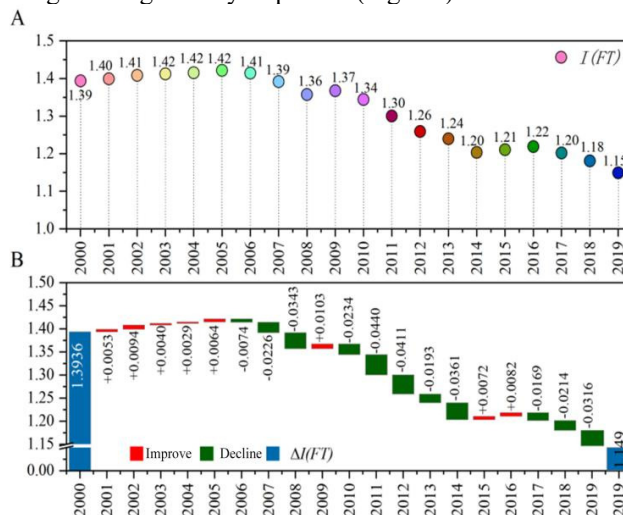

Fig.3. The regional imbalances of China's foreign trade and its dynamic evolution. **A.** The imbalanced index of China's foreign trade from 2000 to 2019. **B.** The dynamic evolution of the imbalanced index.

5 Conclusions and policy recommendations

China is now turning to a 'normal' foreign trade system that has become more closely integrated into the domestic economy[9]. The unbalanced regional development of foreign trade is one of the important reasons for the unbalanced regional economic development in China. Clarifying the regional imbalance of China's foreign trade in the past 20 years provides academic guidance for the current formulation of corresponding opening-up policies. The results of this study show that: (1) Since 2000, with the continuous deepening of opening-up development in China, China's foreign trade still has significant imbalances among three regions. In particular, the eastern region has long accounted for more than 80% of China's total foreign trade. (2) The eastern region is far more dependent on foreign countries than the central and western regions. In addition, the proportion of our country's foreign trade in GDP increased significantly and

then declined, and the overall degree of foreign dependence declined. (3) Compared with 2000, although China still has significant regional imbalances in foreign trade, this imbalance has declined at last (from 1.39 in 2000 to 1.15 in 2019). (4) The regional imbalances of China's foreign trade has a trend of positive development, which shows that China has achieved important results in balancing the economic development of the three major regions.

In response to the conclusions drawn in this study, the following suggestions are put forward: First, without damaging the current scale of foreign trade in the eastern region, we should gradually encourage the development of foreign trade in the central and western regions, such as issuing more favorable foreign trade policies. The second is to give play to the advantages of the eastern region in foreign trade, and drive the joint development of the central and western regions, thereby promoting the coordinated development of each region, and then promoting China's economic growth. That is to say, establish a new mechanism for coordinated development of regional foreign trade of 'competition, cooperation and mutual benefit'. Only by realizing a new pattern of mutual benefit and win-win situation in the division of labor in the foreign trade industry, can the imbalance in regional economic development be corrected. Third, continue to expand the transportation network platform centered on transportation node cities. The transportation network is like the value-added transmission chain in the value chain. By promoting industrial agglomeration, the transportation network can further promote the industry to achieve economies of scale, reduce costs, and increase profits, thereby driving the overall economic development of the country on the basis of promoting regional economic development.

Acknowledgment

References

1. Wen, Y. Explaining China's trade imbalance puzzle. Federal Reserve Bank of St. Louis Working Paper Series. 2011.

2. P N Couran., & A V Deardorff. International Trade with Lumpy Countries. Journal of Political Economy, vol. 100, pp. 198-210. 1992.

3. Zhang, Y., & Wan, G. Correcting China's trade imbalance: Monetary means will not suffice. Journal of Policy Modeling, vol. 30, pp. 505-521. 2008.

4. Chen, Y., Wang, Z., & Zhong, Z. CO_2 emissions, economic growth, renewable and non-renewable energy production and foreign trade in China. Renewable energy, vol. 131, pp. 208-216. 2019.

5. Yunfeng, Y., & Laike, Y, China's foreign trade and climate change: A case study of CO_2 emissions. Energy policy, vol. 38, pp. 350-356. 2020.

6. Zhao, H., & Lin, B. Impact of Foreign Trade on energy efficiency in China's textile industry. Journal of Cleaner Production, vol. 245, pp. 118878. 2020.

7. E M Pernia., & P F Quising. Trade Openness and Regional Development in a Developing Country. The Annals of Regional Science, vol. 37, pp. 391-406. 2003.

8. Roberto Ezcurra., & Andrés Rodríguez-Pose. Trade Openness and Spatial Inequality in Emerging countries. Spatial Economic Analysis, pp. 162-182. 2014.

9. Lemoine, F., & Unal, D. China's foreign trade: a "new normal". China & World Economy, vol. 25, pp. 1-21. 2017