Research Based on the Python Networkx Toolbox Analysis of the Trade Network Structure from an Information Flow Perspective

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Abstract. Based on the python networkx toolbox analysis of the trade network structure from an information flow perspective, studies show that China's import and export trade with some areas along the "The Belt and Road Initiative" has declined, but overall, whether it is both import demand and export demand are rising year by year, which shows that China and the various regions along the "The Belt and Road Initiative" line have become closer in terms of trade and international trade trends have become more apparent.

1. Introduction
Since China proposed the idea of "The Belt and Road Initiative" in 2013, China's trade with countries along the "The Belt and Road Initiative" has deepened. In 2017, China's investment in countries along the "The Belt and Road Initiative" reached US $ 20.17 billion, an increase of 31.5% year-on-year, accounting for 12.7% of China's total foreign investment. From this, we can see that China's trade with countries along the route has grown rapidly, with great development potential and space.

The total population of the 64 countries along the "The Belt and Road Initiative" line accounts for 63% of the world's population. However, the total economy of these 64 countries accounts for only 29% of the world's total. It can be seen that although the population, There are many countries, but because most countries are developing countries, their economic development lags behind developed countries. Therefore, their trade environment is also relatively backward, which has led to relatively insufficient economic output. Therefore, in order to promote China's cooperation with the "The Belt and Road Initiative" line, cooperation between various countries promotes the economic development of various countries along the route. It is particularly important to study how to better trade with various countries along the route based on "The Belt and Road Initiative".

2. Literature Review
Research on China's trade with the "The Belt and Road Initiative" is rich. Scholars carry out research mainly from the perspective of the status quo, impact quantification, and countermeasures. For example, Qing Chunli constructed an evaluation of the trade along the "The Belt and Road Initiative" countries based on relevant data from 2012 to 2017. The index system of facilitation points out that the focus should be on improving the level of facilitation from the aspects of infrastructure and financial investment [1]. Wang Weiwei and Tan Yonglin used the principal component analysis method to
measure the "The Belt and Road Initiative" trade level and found that the level of trade facilitation has a significant impact on bilateral trade. The impact is far greater than the total economic volume and regional integration organizations [2]. Based on the XTC1 background, Han Yangyang studied the impact of the "The Belt and Road Initiative" construction on the economies and trade of the countries along the route [3]. Liu Qian expounded XTC1 based on the data analysis of 201X Significance and status quo of the development of economic and trade cooperation in the countries along the route, analyze the problems faced in the current stage of economic and trade cooperation, and propose countermeasures [4] to further promote the development of economic and trade cooperation in the countries along the "The Belt and Road Initiative" [4]. The gravity model of trade has carried out the overall effect, sub-regional effect and sub-measure on the impact of the level of trade facilitation of "The Belt and Road Initiative" countries on China's export trade Analysis of three aspects such as effects, and research on the impact on China's trade [5]. Gao Yunlong, Zhang Xiaoning, and Meng Pingli applied the Boston matrix model to the analysis of 73 countries' trade data with China. There are large differences in trade relations [6]. In recent years, about 70% of the trade with China along the route has been concentrated in more than 10 countries. Trade costs, institutional levels, and trade structures have the greatest impact on the development of trade between China and the countries along the route. In the future, policies should be formulated based on the above three aspects. Wang Juanjuan combed and analyzed the economic development data proposed by XTC1 over the past five years, and found that China's investment momentum in the countries along the line is improving, the complementarity of economic structures is becoming increasingly prominent, and the endowment of shared advantages has become a major trend. " Many countries along the "The Belt and Road Initiative" line have become China's important trading partners [7]. Chen Jiyong and Liu Yishuang have used two measurement methods, principal component analysis and trade gravity model, to estimate the impact of the promotion of trade facilitation levels on the trade potential of the countries along the line [8]. Studies show that the level of trade facilitation in 65 countries along the "The Belt and Road Initiative" line shows a "double U-shaped" effect in time and space, improving Facilitation level could lead to major trade flows to China, and bring a different effect of different levels of different indicators of trade facilitation will enhance the area.

Existing research has analyzed the trade situation between China and "The Belt and Road Initiative" from different angles, and carried out a series of useful explorations. However, a common problem is that most of its basic data comes from 2017, which is not novel enough. In fact, with the start of the Sino-U.S. Trade war in 2018 and the tremendous changes in the global trading environment, it is necessary to use the latest trade data to conduct research and analysis. Based on this, this article is based on 2013-2018 trade data. The analysis and research of The Belt and Road Initiative's trade development can provide basic data support for other future research on the one hand, and also provide the latest trade progress introduction for related parties.

3. The General Idea and Basic Data Analysis
This article is based on the trade data of China and the countries along the "The Belt and Road Initiative" in the UN COMTRADE database from 2013 to 2018. Through analysis of the trade data of various countries along the line, the overall import and export trade between China and the "The Belt and Road Initiative" along with China and "The Belt and Road Initiative" Import and export trade in various regions along the line has been carried out in two aspects. Based on the traditional classification method, the geographical classification results of countries along the "One Belt and One Road" by traditional continents and sub-regions are shown in table 1.
Table 1. Countries along "The Belt and Road Initiative".

| Region                      | Countries                                                                 |
|-----------------------------|---------------------------------------------------------------------------|
| East Asia                   | Mongolia                                                                   |
| Southeast Asia              | Singapore, Thailand, Vietnam, Malaysia, Indonesia, Philippines, Myanmar, Cambodia, Brunei, Laos |
| South Asia                  | India, Pakistan, Bangladesh, Afghanistan, Sri Lanka, Maldives, Nepal, Bhutan |
| Central Asia                | Kazakhstan, Uzbekistan, Turkmenistan, Tajikistan, Kyrgyzstan               |
| West Asia and North Africa  | Iran, Iraq, Turkey, Syria, Jordan, Lebanon, Israel, Saudi Arabia, Yemen, Oman, UAE, Qatar, Kuwait, Bahrain, Georgia, Azerbaijan, Armenia, Egypt |
| Eastern Europe              | Russia, Ukraine, Belarus, Moldova, Poland, Lithuania, Estonia, Latvia, Czech Republic, Slovakia, Hungary, Slovenia, Croatia, Bosnia and Herzegovina, Montenegro, Serbia, Albania, Romania, Bulgaria, Macedonia |

There are a total of 64 countries along the route. Due to the serious lack of data on East Timor (Southeast Asia) and Palestine (West Asia and North Africa), they are not included in the analysis.

3.1 Analysis of the Overall Import and Export Trade Between China and "The Belt and Road Initiative"

Based on the UN COMTRADE database of trade data between China and the countries along the "The Belt and Road Initiative" from 2013 to 2018, the total value and proportion of China's import and export trade with the above countries are shown in Table 2.

Table 2. China and "The Belt and Road Initiative" countries along the total number of imports and exports and total trade volume and proportion.

| Year | China from "The Belt and Road Initiative" country | China's trade surplus with "The Belt and Road Initiative" countries |
|------|--------------------------------------------------|---------------------------------------------------------------|
|      | import   | Proportion | Export   | Proportion | Trading | Proportion |                             |
| 2013 | 4714.28  | 24.18%     | 5688.91  | 25.75%     | 10403.18 | 25.01%     | 974.63                       |
| 2014 | 4834.41  | 24.68%     | 6368.67  | 27.19%     | 11203.08 | 26.04%     | 1534.25                      |
| 2015 | 3880.88  | 23.11%     | 6141.02  | 27.01%     | 10021.90 | 25.35%     | 2260.14                      |
| 2016 | 3662.49  | 23.06%     | 5815.65  | 27.72%     | 9478.14  | 25.72%     | 2153.16                      |
| 2017 | 4543.63  | 24.64%     | 6353.61  | 28.07%     | 10897.23 | 26.53%     | 1809.98                      |
| 2018 | 5632.53  | 26.38%     | 7068.42  | 28.34%     | 12700.95 | 27.44%     | 1435.89                      |

Source: Compiled and calculated from UN COMTRADE data

From 2013 to 2018, after the total trade volume reached a peak in 2014, it continued to decline in 2015 and 2016, reaching a six-year low in 2016, and rebounded in 2017 and 2018. In 2017, China and the countries along the "The Belt and Road Initiative" line, the total trade volume of China was 108.973 billion U.S. dollars, an increase of 14.97% compared with 2016. In 2018, China's total trade with the countries along the "The Belt and Road Initiative" was 1.270 billion U.S. dollars, an increase of 16.55% compared with 2017. The trend of changes in export volume and export volume is consistent with the total trade volume, and the trend of total export volume is relatively gentle. The overall trend is stable and slightly rising. In 2018, the import value of China and the countries along the "The Belt and Road Initiative" was US $ 563.253 billion, and the export value was 706.842 billion US dollars, an increase of 23.97% and 11.25% over 2017.
From 2013 to 2018, in addition to the decline in 2015, the proportion of China's trade with the "The Belt and Road Initiative" countries in the total trade volume between China and the world showed an upward trend. In 2018, China's trade with the "The Belt and Road Initiative" countries The proportion of total trade in China's total global trade is 27.44%, an increase of 0.91 percentage point from 26.53% in 2017. In terms of imports, it has experienced a U-shaped trend over the past 6 years, and has fallen flatly at about 23% since 2015. The proportion in 2017 It rose to the level of 2014 and continued to rise in 2018; in terms of exports, except for a decrease of 0.18 percentage points in 2015, China's exports to countries along the "The Belt and Road Initiative" line accounted for an increase in the proportion of China's total global exports, and the growth trend has flattened. In 2018, it increased by 0.27 percentage points from the previous year.

3.2 Analysis the Trade Network of "The Belt and Road Initiative" Regions

The trade network of "The Belt and Road Initiative" Regions is illustrated based on the above data, as figure 1 shows. In the figure, it only shows that the trade value is more than 5 billion US dollars, and the thicker the line, the larger the trade value. The corresponding area of node code in the figure is shown in Table 2.

![Figure 1. Imports, exports, trade and trade surplus.](image)

Table 3. China and "The Belt and Road Initiative" countries along the total number of imports and exports and total trade volume and proportion.

| Region                  | Code |
|-------------------------|------|
| China                   | 1    |
| East Asia               | 2    |
| Southeast Asia          | 3    |
| South Asia              | 4    |
| Central Asia            | 5    |
| West Asia and North Africa | 6   |
| Eastern Europe          | 7    |
It can be seen from the figure that
(1) region 4 basically had no trade with other regions from 2013 to 2015, and initially established preliminary trade with region 1 in 2018, but the amount was small.
(2) Region 1 and region 2, region 1 and region 6, and the connection of region 5 and region 6 are very obvious in the trade network, but with the evolution of time, the trade of region 5 and region 6 has a downward trend;
(3) from the current situation, region 1 has always occupied the core of the whole trade network, but region 5 and region 6 pose a certain challenge to its status.

4. Conclusion
First, through research on overall trade, it is found that although the total trade volume is increasing, the balance of import and export trade is decreasing, which shows that the proportion of China's imports is increasing compared to the proportion of exports, and the demand for trade imports is even more important. Secondly, from the perspective of the trade situation of the various regions along the route, although the import volume of all regions is increasing, the increase is mainly concentrated in Southeast Asia and West Africa and North Asia, which not only has a significant increase, but also accounts for the overall import. It can be seen that not only has China always had high import demand with Southeast Asia and West Africa and North Asia, but this trend will become more and more obvious. In terms of exports, Southeast Asia is the largest exporter and the most obvious increase. The rest are along the line. Relatively small regional exports and a downward trend indicate that China's export trade is increasingly concentrated in Southeast Asia.

According to the above analysis, it can be seen that although the import and export trade in some regions has declined, overall, both import and export demand have been increasing year by year, which shows that China and the various regions along the "The Belt and Road Initiative" line have closer trade relations. China and the countries along the "The Belt and Road Initiative" line have also paid more attention to international trade, which has also made the international trade trend more obvious.

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