Analysis of Development Status and Topological Characters of Textile Industry Along with the “Belt and Road”

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Abstract—Textile trade is a traditional trade commodity circulating on the ancient Silk Road and the Maritime Silk Road. It is also the starting point and main trade object of the "Belt and Road" initiative. As one of the five leading industries in China's manufacturing industry, the textile industry is also the main source of China’s export income. This article will first explore the status quo of the textile trade development of the Belt and Road countries. Next, with the help of social network research methods, the topological characters of the textile industry trade network, and the status of each country in the network will be analyzed. At the same time, the textile industry trade volume is decomposed from the perspective of value-added trade, to further explore the structural similarities and differences of different types of value-added trade networks at a deeper level. The author found that the overall development of the belt and road textile trade can be concluded as three stages, and the "core-semi-peripheral-peripheral" structure of the trade network is distinct. In addition, the value-added trade has become more prominent, but it is still dominated by final products.

Keywords-the “Belt and Road” Initiative; topological character; textile industry; network;

1 INTRODUCTION

Textile is a traditional trade commodity circulating on the ancient Silk Road and the Maritime Silk Road. It is also the starting point and main trade object of the "Belt and Road" Initiative. Modern textile industry plays an important role not only in the construction of the national economy, but also in prospering markets, expanding exports and absorbing employment. The output of China's textile industry now accounts for more than half of the world's total output and more than one third of the international market share [1]. However, with rising labor costs and downward pressure from the global economy, the situation of China's textile industry is not optimistic. The proposal of the Belt and Road Initiative is of great significance for the revitalization of the textile industry. In the past five years, China’s textile industry's total investment along the "Belt and Road" has accounted for more than 80% of the total global textile investment in the same period.

Xu [2] is one of the first researchers who introduce network analysis to the Belt and Road study. Ecept macro network, specific subdivided fields are focused on by more and more scholars. [3]-[5] However, researches on textile trade are scattered. The current research on textile trade issues mostly focuses on the competitiveness of a single country and bilateral trade relations

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[6][7], which does not reflect the macro characteristics of the trade network. This article will use social network research methods to discuss the development status of textile trade in countries along the "Belt and Road", the topological characteristics of textile trade networks, and the status of countries in the network. At the same time, the author will analyze the textile trade volume from the perspective of value-added trade, and further explore the structural similarities and differences of the types of value-added trade networks.

2 THE DEVELOPMENT STATUS ANALYSIS OF “BELT AND ROAD" TEXTILE INDUSTRY TRADE

2.1 Data Description

This article uses the input-output data of 189 countries around the world published by the EORA database from 1990 to 2015, and selects and extracts 61 countries in the “Belt and Road” based on the division of the “Belt and Road” countries (regions) by the Ministry of Commerce.

In the input data provided by EORA MEIO, the intermediate input (output) of a certain industry (sector) of a country to the industry (sector) of other countries is added to the final input, and then the total export of the country in the industry can be obtained. After preliminary extraction, sorting and calculation of the data, this article obtains the overall statistics of the textile industry's trade exports of countries along the "Belt and Road" region from 1990 to 2015. At the same time, this article will also separately extract the statistics of China's trade exports to all other countries in the industry during this time frame for comparison.

2.2 The overall development of textile industry trade along the “Belt and Road”

Figure 1 shows the overall development of the textile trade in 61 the “Belt and Road” countries from 1990 to 2015. From the perspective of the development trend of the entire Belt and Road region, it can be roughly divided into three development stages: the first is the slow rising stage from 1990 to 2002, during which the overall textile trade volume has risen from USD 11million to USD 22 million. The second is the rapid development stage from 2002 to 2008. With China’s accession to the WTO in 2001, it drove the rapid development of textile trade in the entire Belt and Road region, which rose to USD 80 million in 2008. The last stage is the recovery and redevelopment stage. After the recovery from global financial crisis in 2008 and 2009, the trade volume quickly increased to USD 115 million in 2012. However, affected by the wave of anti-globalization and the rise of trade protectionism in recent years, the period from 2013 to 2015 showed a relatively flat development. The overall trend of China's textile trade volume with other 60 R&B countries is the same as the overall regional development.

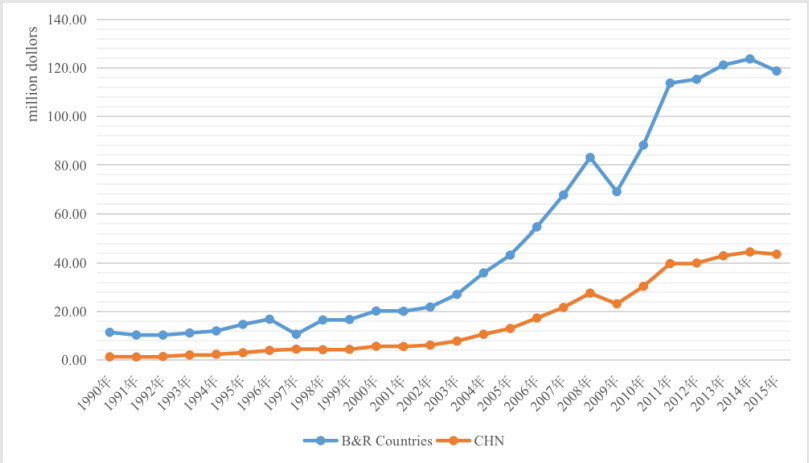


Figure1. The overall development trend of textile trade in B&R countries from 1990 to 2015

2.3 Decomposition and comparative analysis of added value of textile industry trade

Compared with the traditional method which only takes the total trade as the index, the WWZ decomposition calculation method [8] eliminates the double calculation caused by the global flow of factors. Therefore, based on the statistics of the total export volume of B&R textile industry, this paper decomposes the total trade volume from the perspective of value chain, and then makes a more accurate study on the trade pattern.

Though WWZ decomposition calculation method, a country's export value is decomposed into four value-added components, each of which has different economic meanings: domestic value added, foreign value added, returned domestic value added, and pure double counting. The main balance obtained by decomposing the trade export value of a country at the country (or sector) level.

$$\mathrm{TEX} = \underbrace{\mathrm{DVA_{FIN}} + \mathrm{DVA_{INT}} + \mathrm{DVA_{INTREX}}}_{\mathrm{DVA}} + \underbrace{\mathrm{MVA} + \mathrm{OVA}}_{\mathrm{FVA}} + \underbrace{\mathrm{DDV} + \mathrm{FDC}}_{\mathrm{PDC}} + \mathrm{RDV} \qquad (1)$$

Based on the perspective of value-added trade, the overall trade volume of the textile industry of the R&B countries is decomposed and the corresponding four types of value-added trade are obtained. Among them, DVA domestic value-added trade is the main form of trade. DVA can be further broken down into three parts, namely DVAfin (final export domestic value added), DVAint (intermediate export absorbed by direct importing countries) and DVAintrex (intermediate exports absorbed by the direct importing country and then exported to the third country).

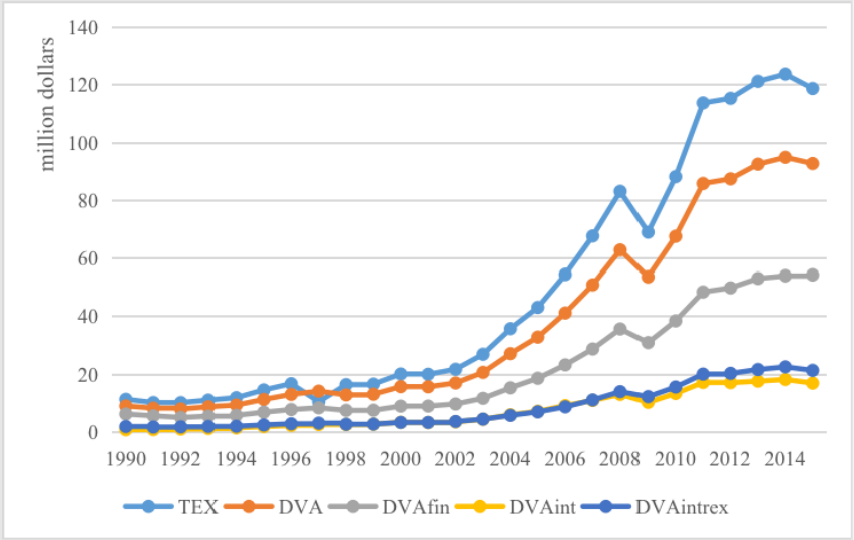


Figure 2. Development of value-added trade of R&B textile industry

Figure 2 shows that in the overall trade of the textile industry in the Belt and Road region from 1990 to 2015, the growth of various types of domestic value-added trade is similar to the previous total trade volume, showing the same trend development characteristics. In terms of detailed part of DVA, DVAfin has the highest proportion, accounting for at least 60% of the statistical results over the years, followed by DVAint, and DVAintrex is relatively small.

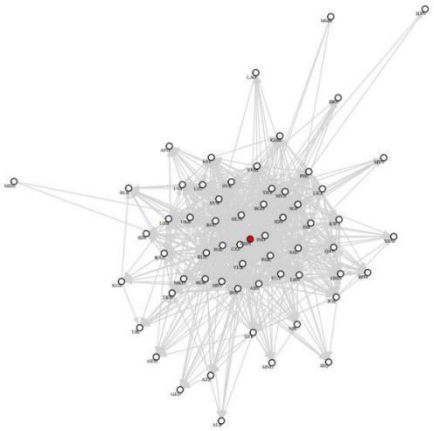
3 THE CONSTRUCTION AND STRUCTURAL CHARACTERISTICS OF THE R&B TEXTILE INDUSTRY TRADE NETWORK

3.1 Network construction and method description

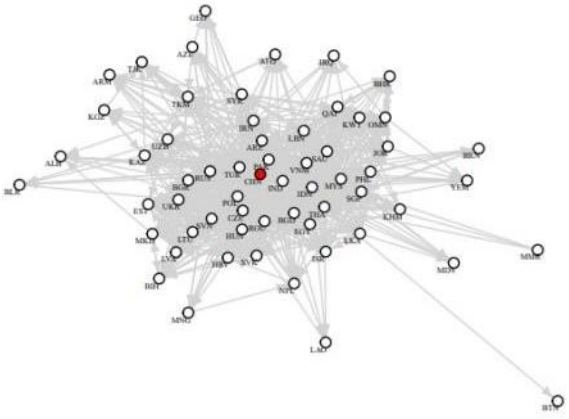
According to Wu's research, the composition of a network usually includes three elements: nodes(N), edges(M), and weights(W). At the same time, in this article, because only the mutual export relationship between countries at the textile trade level is considered, there is no self-loop in the network (that is, a country does not trade with itself). The initially obtained R&B textile industry trade network is a complete network that contains all the information. Due to the high density of the complete network, almost all nodes are connected. Therefore, the threshold screening method will be considered. In this way, only the connection relationship whose connection weight is more than one million US dollars will be retained.

In the TEX threshold network (Figure 3①), China, Russia, India, Turkey, Indonesia and other countries are at the core of the network system. In addition, most Southeast Asian countries are in a more critical position in the network system. The European countries among the countries are basically at the half edge of the network system. Compared with the TEX network, the core-peripheral-semi-periphery structure of the DVA threshold network (figure 3②） is less

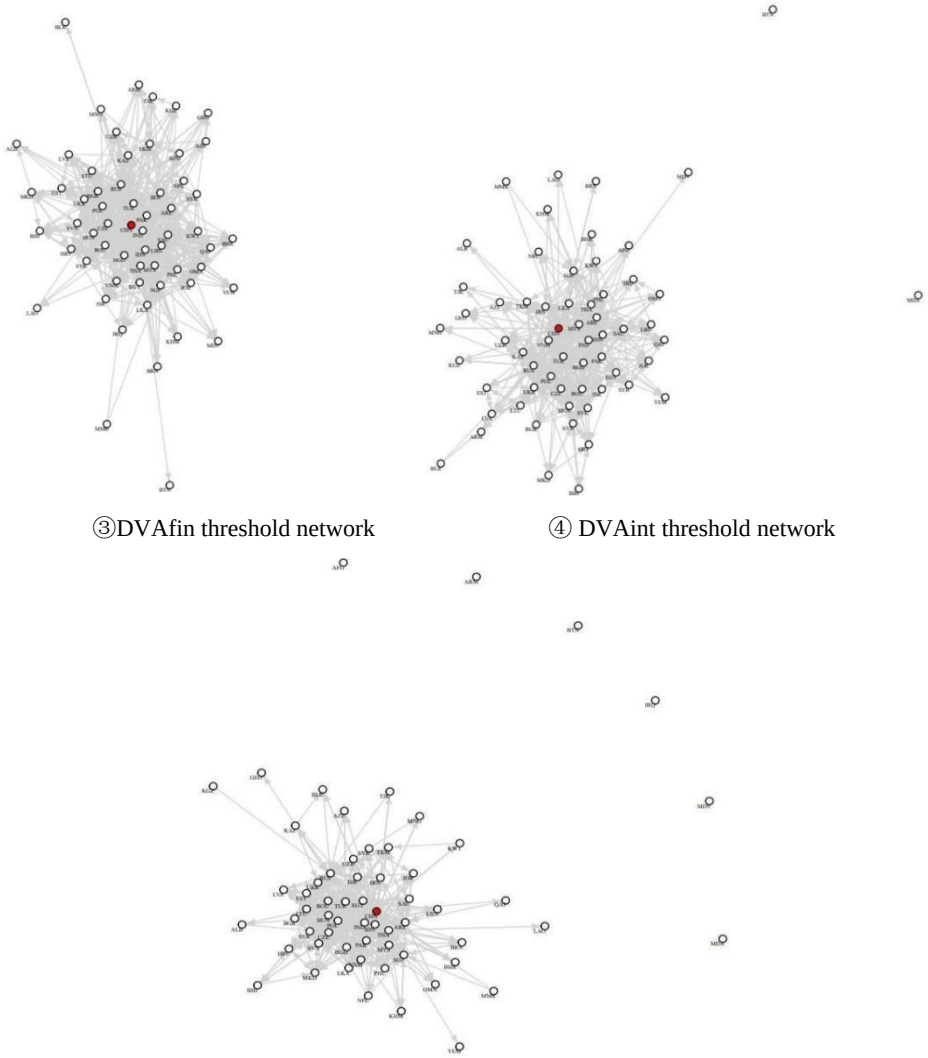
obvious. Moldova does not have DVA trade transactions of more than US$1 million with other countries. The structure of the DVAfin (figure 3③) threshold network is very similar to the DVA network, indicating that the domestic value-added trade of the textile industry is mainly in the form of direct exports. More isolated nodes have appeared in the DVAint (figure 3④) and DVAintrex (figure 3⑤) networks, indicating that there are more countries in these two forms that have not yet reached the million-dollar threshold.



① TEX threshold network



② DVA threshold network



③DVAfin threshold network ④ DVAint threshold network

⑤ DVA intrex threshold network

Figure 3

3.2 Analysis of the overall characteristics of the network

This article describes and analyzes the overall structural characteristics of the network by calculating the number of network nodes, edges, network density, average path length (APL), transitivity and reciprocity of the Belt and Road textile trade network and value-added trade network. Table 2 respectively reports the changes of the corresponding structural indicators from 1992 to 2015 (only the main years are selected due to the limitation of space). From the results in the table, the indicator changes of the DVA network are the closest to the TEX network, indicating that the textile trade of the Belt and Road is dominated by DVA. In terms of

network density and APL, from which the initial structural characteristics of the network are reflected, DVAfin network is the best among the three types of subdivided domestic value-added trade networks, followed by DVAint network. However, in terms of the transitivity and reciprocity indicators that reflect the deep-level characteristics of the network, DVAintrex network indicators have been significantly improved.

Table 1. Calculated results of the overall network characteristic index

	Year	***1992***	***1997***	***2002***	***2007***	***2012***	***2015***
TEX	Nodes	61	61	61	61	61	61
	Edges	543	680	752	944	1047	1043
	Density	0.148	0.186	0.205	0.258	0.286	0.285
	APL	2.236	1.999	1.946	1.844	1.776	1.771
	Transitivity	0.496	0.539	0.565	0.613	0.627	0.626
	Reciprocity	0.29	0.347	0.357	0.413	0.432	0.423
DVA	Nodes	61	61	61	61	61	61
	Edges	480	594	664	836	945	949
	Density	0.131	0.162	0.181	0.228	0.258	0.259
	APL	2.301	2.108	2.034	1.884	1.816	1.816
	Transitivity	0.471	0.502	0.522	0.585	0.598	0.601
	Reciprocity	0.253	0.338	0.336	0.382	0.415	0.419
DVAfin	Nodes	61	61	61	61	61	61
	Edges	381	494	533	696	782	797
	Density	0.104	0.135	0.146	0.19	0.214	0.218
	APL	2.891	2.312	2.207	2.014	1.975	1.964
	Transitivity	0.435	0.462	0.471	0.537	0.555	0.563
	Reciprocity	0.172	0.273	0.281	0.331	0.346	0.351
DVA	Nodes	61	61	61	61	61	61
	Edges	215	301	327	475	535	538
	Density	0.059	0.082	0.089	0.13	0.146	0.147
	APL	2.698	2.375	2.288	2.156	2.073	2.048
	Transitivity	0.382	0.456	0.463	0.471	0.479	0.475
	Reciprocity	0.162	0.254	0.258	0.346	0.348	0.352
DVAintrex	Nodes	61	61	61	61	61	61
	Edges	194	284	331	483	528	523
	Density	0.053	0.078	0.09	0.132	0.144	0.143
	APL	2.611	2.25	2.294	2.115	2.078	2.102
	Transitivity	0.495	0.522	0.524	0.545	0.537	0.544
	Reciprocity	0.244	0.309	0.308	0.364	0.368	0.369

3.3 Analysis of the status of network nodes

The centrality index of each node in the network from 1992 to 2015 is calculated to reflect the status characteristics of different countries. This article mainly selects degree centrality, closeness centrality, betweeness centrality and eigenvector centrality as index.

Degree centrality is divided into in-degree and out-degree, which respectively reflect the number of edges pointing to a single node (import relationship) and the number of edges pointed out from a single node (export relationship). Closeness centrality reflects the extent to which a node can be independent of other nodes. Betweeness centrality reflects the importance of nodes in the process of network information transmission. Eigenvector centrality reflects how strong the node is to radiate and lead other nodes.

According to the calculation results, the author selects the top ten countries in each index in the past years, and draw the ranking map as shown in Figure 4①-4⑤.

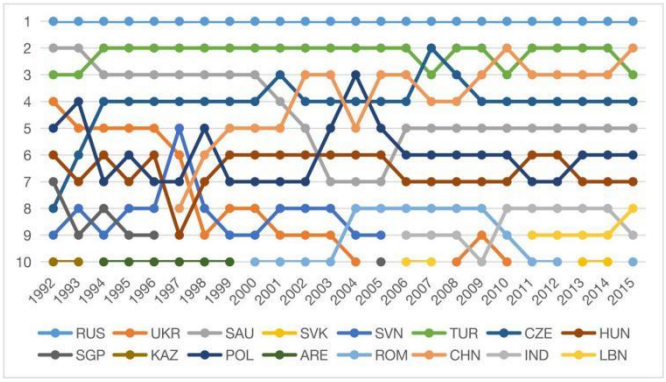


Figure 4 ① Changes of ranking in in-degree of TEX network

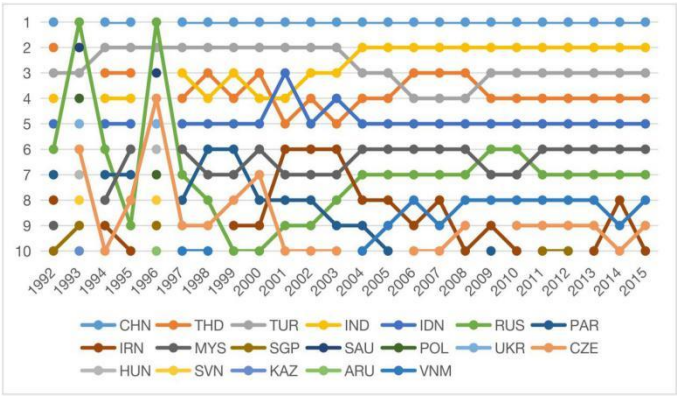


Figure 4 ② Changes of ranking in out-degree of TEX network

From the perspective of network in-degree, Russia has always been the country with the most import relationships in the Internet, and Turkey, Saudi Arabia, and the Czech Republic also

rank relatively high in most years. For most of the 1990s, China was only in the middle and late stages of the top ten countries, while it was often in the top three after 2010. In terms of network out-degree, China has basically always been the country with the largest number of export relationships. Turkey and India also have more export relationships. Russia only ranked first in 1993 and 1995, and then basically ranked 6-10.

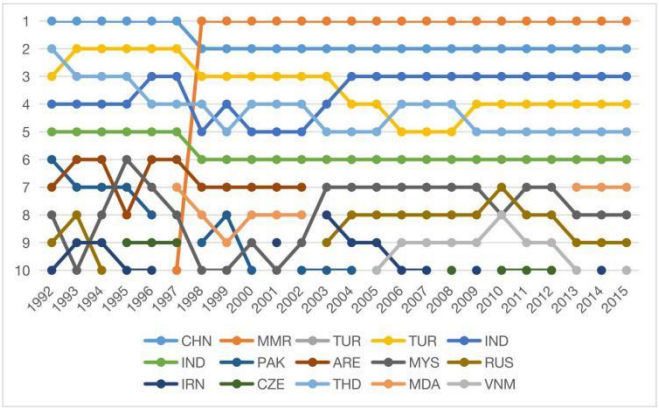


Figure 4 ③ Changes of ranking in closeness centrality of TEX network

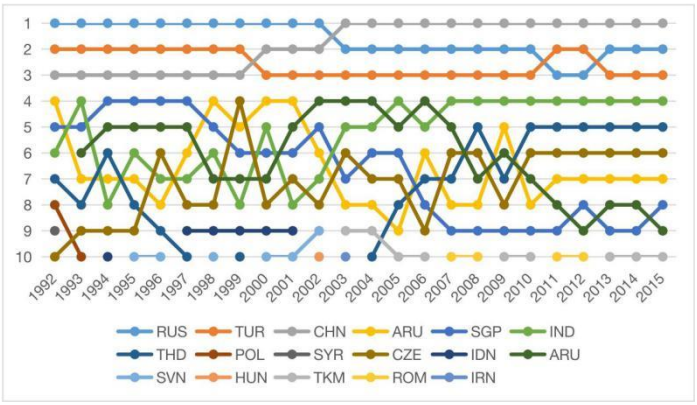


Figure 4 ④ Changes of ranking in betweeness centrality of TEX network

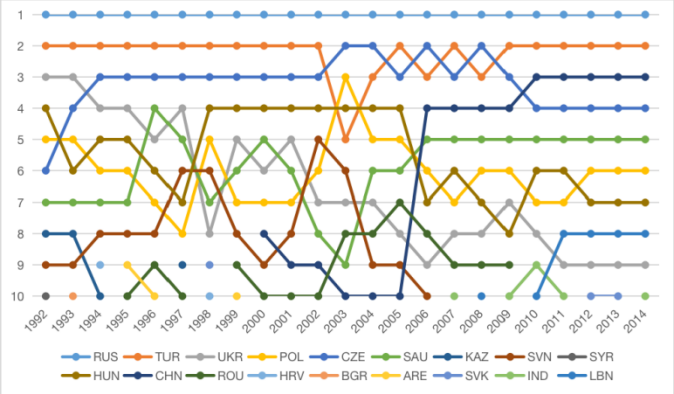


Figure 4 ⑤ Changes of ranking in eigenvector centrality of TEX network

From the perspective of betweeness centrality, Russia, China, and Turkey have taken the top three positions over the years, reflecting that they play a key pivotal role in the textile industry trade network of the Belt and Road Initiative. The results of Eigenvector centrality show that Russia, Turkey, the Czech Republic, and China have relatively greater influence and leading role in trade partners in the textile industry, and can fully promote the development of neighboring nodes through their own development, and the radiation effect is better.

4 CONCLUSION

Based on the above analysis content, the main conclusions obtained in this paper are as follows. First, no matter the entire B&R region or single major country in it, the textile trade development from 1990 to 2015 showed the similar three distinct stages as a whole: steady development stage (1990-2001), rapid growth stage(2002-2008), and recovery-adjustment stage(2009-2015). Second, Limited by the relatively single production link and simple production technology of textile products, the overall development of textile industry trade is still dominated by domestic value-added behavior, and the final product export form is the main source of value-added. However, with the development of technology and the continuous integration of the service industry into the production link of the manufacturing industry, it can be seen that the production chain in the textile trade is gradually becoming more complicated. Third, the "core-semi-periphery-periphery" structure of the textile trade network in the Belt and Road region is prominent. The core countries, mainly China, Russia, and Turkey, have obvious advantages in the network, which have large-scale textile trade with most other countries. However, there are still many isolated nodes in the trade network in the form of intermediate products as the source of value-added, which means that many countries in the B&R textile trade are still not involved in the production of intermediate goods. In the future, the author will use methods such as QAP or ERGM to discuss the factors that have mutual influence on the textile trade in the Belt and Road region.

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