

Industry Competitiveness and Complementarity between China and Eurasian Economic Union Countries under the Background of Strategic Docking between Silk Road Economic Belt and the Union

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The implementation of strategic docking between Silk Road Economic Belt and the Eurasian Economic Union (the Union) is of great significance to facilitate the stable expansion of bilateral trade volume, diversification in major areas of trade, and the continual improvement of technical content level of trade products. This paper first uses the revealed comparative advantage index to study the competitiveness of industries with different technical levels for China and the Union member countries. Then, the trade complementarity and trade integration between China the Union member countries are studied by using the trade complementarity index and trade intensity index. Based on these results, the paper gives some advice on expanding and deepening the bilateral economic and trade cooperation.

Keywords: comparative advantage, trade complementarity, trade integration, technological difference, asymmetry

1. Introduction

The Eurasian Economic Union (the Union), established by Russia, Belarus, and Kazakhstan on January 1st in 2015, was evolved from the customs union founded in 2010. The Union conducted the first round of enlargement shortly after founding. Armenia and Kyrgyzstan officially announced to join in the Union on January 2nd and August 12th in 2015, respectively. The Union was formed under the leading of Russia, and the ultimate goal is to build the regional economic integration organization similar to European Union (EU). At present, the Union is a unified large market with a population of 180 million and gross domestic product of over USD 1,480 billion.¹

The establishment of the Union has attracted the attention from experts and

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¹ The data came from World Bank.

scholars in different fields worldwide. In terms of political strategy, the Union can be the institutional mechanism of leadership expansion of Russia in Eurasia (especially in Central Asia) (Kirkham, 2016). And it can also protect the internal market of member countries from invasion of economic forces outside the region (Yesevi, 2014). Although the realization of the inclusive and sustainable growth of economy are the major goals for establishment of the Union, such mandatory and fast institutional changes fail to generate the expected effect of trade diversification and trade creation. At the same time, the relationship among the union members is relatively loose and vulnerable due to internal causes such as huge difference in economic development level and serious industrial homogenization between member countries (Li and Li *et al.*, 2015). In addition, the great differences in the fundamental interest demand of joining in the union (Kassenova, 2012; Maria and Kirsten, 2016) and the severe economic sanctions imposed on Russia by the Western countries make the Union still confronted with many realistic obstacles on the road to replicate the success of EU and turn into an influential integration organization in the world (Roberts and Moshes, 2016).

The internal inherent defects of the Union and the unfavorable international environment restrict the economic growth space of member states, so the Union needs to pay attention to the economic cooperation which focuses on the construction of free trade area and the strategy docking with non-union countries, such as putting the docking with Silk Road Economic Belt in prominent place. In 2015, China and Russia jointly published *Joint Statement on Cooperation on the Construction of the Joint Eurasian Economic Union and the Silk Road Economic Belt Projects*. Silk Road Economic Belt and the Union belong to two different economic cooperation forms. The former abides by the cooperation concept of the equality and voluntariness and the mutual benefit, while the latter pursues the all-round integration of political and economic fields (Li, 2015). However, both of them are committed to the underlying strategic goal of striving for the stability and prosperity of Eurasia (Zhang, 2016). Therefore, such difference is not necessarily the obstacle of bilateral strategic cooperation, on the contrary, the difference provides the cooperation space and potential (Zhan, 2017). Due to the common energy market construction of the Union and China's enormous overseas energy demands, cooperation in energy can be the key to drive the cooperation in other fields such as finance, infrastructure construction, etc. (Wu and Zhu, 2015; Fu, 2016).

The expansion of cooperation scope and improvement of technical content level in trade products between China and the Union countries will play a vital role in facilitating the docking between Silk Road Economic Belt and the Union. However, the scholars rarely research the trade competitiveness, complementarity, and trade integration between China and the Union countries from perspective of trade product classification in accordance with different technical content levels. The reason why

the role of technology content is emphasized in trade product classification is mainly based on the following two points. Firstly, the analysis of the competitiveness and complementarity among industries with different technical levels of both parties can define the specific industry cooperation space in the future and provide the basis for the government to formulate the strategic industry policy. Secondly, analyzing the comparative advantage of industries with different technical content levels for both parties can contribute to concentrating efforts on propelling the cooperation in the industries (especially industries with medium technology and high technology), which is of great significance for promoting the optimization and adjustment of bilateral industrial structure and participating in global value chains deeply.

In view of this, this paper aims to answer the following research questions. First, what is the competitiveness level of industries with different technology levels of China and the Union countries in international product market? Second, what is the bilateral trade complementarity degree of industries with different technical levels? Third, does the industry with strong bilateral complementarity belong to the comparative advantage industry of exporting country? Fourth, do the main products of bilateral trade belong to the industries with comparative advantage and strong complementarity between countries at present? Through analyses on the above problems, some scientific and reasonable advice on effective docking between Silk Road Economic Belt and the Union to facilitate the inclusive economic growth in the region.

2. Model and Data

2.1. Model

The model for researching the international product competitiveness of countries at the earliest is the revealed comparative advantage index proposed by an American economist Balassa (1965). Then, on this basis, some scholars put forward the international market share, revealed technological advantage index, and revealed comparative competitiveness index to study the product competitiveness of countries. Considering that the main purpose of this paper is to measure the comparative advantage of some kind of industry of the country in the international product market, and the revealed comparative advantage index can eliminate the influence of fluctuation in gross volume of national exports and gross volume of world export, we use the revealed comparative advantage index to measure the industrial competitiveness. The formula is shown as follows:

$$RCA_{xij} = \frac{EX_{ij}}{EX_{it}} \bigg/ \frac{WEX_j}{WEX_t} \quad (1)$$

In equation (1), RCA_{xij} represents the revealed comparative advantage index of industry j of country i . EX_{ij} represents the gross export of product j of country i in the world market. EX_i represents the gross export of all products of country i in the world market. WEX_j represents the gross export of product j of all countries in the world. WEX_i represents the total volume of commodity trade in the world. Based on the judgment standard proposed by JERTO, when RCA is less than 0.8, it indicates that the competitiveness of the product is low and at the comparative disadvantage. When RCA is between 0.8 and 1.25, it indicates that the commodity has medium international competitiveness. When RCA is between 1.25 and 2.5, it indicates that such commodity has strong international competitiveness. When RCA is more than 2.5, it indicates that such a product has extremely strong competitiveness.

Trade complementarity index can be used to measure the matching degree between exported products with comparative advantage of one country and imported products with comparative disadvantage of the other country. In general, if the trade complementarity index between two economies is more than 1, it is deemed as strong economic complementarity. The data adopted by trade complementarity index is only the gross export or gross import of the product of the country, rather than reflecting the destination country of export and the country of origin of imported product. For example, for country A and country B with international trade, product g of country A has the comparative advantage in the international market, while product g of country B has comparative disadvantage with large foreign demand. Now if product g of country B is mainly imported from country A , it indicates that the trade relation between country A and country B is close. If the import of product g of country B is mainly from other countries of the world rather than country A , it indicates that the trade between two countries has great room for improvement. The mathematical expression for trade complementarity index of the industry between two countries is shown as follows:

$$C_j = RCA_{xij} \times RCA_{mij} \quad (2)$$

In equation (2), C_j represents trade complementarity index of commodity j between two countries. The larger the value of C_j is, the stronger the trade complementarity is. RCA_{xij} is the revealed comparative advantage index, and the calculation method is described as above. RCA_{mij} is the comparative disadvantage of country i in commodity j measured by imports. The calculation formula is shown as follows:

$$RCA_{mkj} = \frac{IM_{kj}}{WIM_j} \bigg/ \frac{IM_{kt}}{WIM_t} \quad (3)$$

In equation (3), IM_{kj} represents the gross import of product j of country k . WIM_j represents the gross import of product j of all countries in the world. IM_{kt} shows the

gross import of all commodities of country k . WIM_i shows the gross import of all products in the world.

Trade complementarity index C_j only measures the complementary relation of both trade parties in the product, and it can not comprehensively reflect the trade complementarity intensity of the two countries. The composite trade complementarity index can be adopted to achieve this goal. The composite trade complementarity index is the weighted average of trade complementarity index of all categories of products, and the weighted coefficient is the trade proportion of various products in the world trade. The calculation formula is shown as follows:

$$C_{ik} = \sum_j C_j \frac{W_j}{W_i} \quad (4)$$

In equation (4), C_{ik} is the composite trade complementarity index between two countries measured with country i as exporting country and country k as importing country. C_j is the trade complementarity index mentioned as above. W_j is total trade volume of product j in the world. W_i is total trade volume of all products in the world. The larger the value of C_{ik} is, the higher the matching degree between exports of one country and imports of another country is, and the stronger the trade complementarity is.

Trade integration index is the theoretical concept firstly proposed by the economist Brown, and is perfected by the research of Kiyoshi Kojima, and also its significance in economics is defined. Trade integration index is generally regarded as the science indicator of measuring the closeness of bilateral trade relation in the international trade research. Its mathematical expression is:

$$TI_{ij} = \frac{X_{ij} / X_i}{M_j / (M_w - M_i)} \quad (5)$$

In equation (5), TI_{ij} is the trade integration index between country i and country j calculated by exporting of country i . X_{ij} represents the export of country i to country j . X_i is the export of country i to the world. M_j represents gross import of country j . $M_w - M_i$ is a numerical value which can be got by the gross import of the world minus the gross import of country i . If $TI_{ij} > 1$, it means that the actual export of country i to country j is more than the expected export, and the bilateral trade relation is close. On the contrary, it indicates the bilateral trade relation is relatively loose.

2.2. Data

United Nations Comtrade database is the most authoritative database in the

international trade statistics field in the world at present, and contains 99% of commodity transactions globally. All data utilized in this paper are from this database, and classified in accordance with Standard International Trade Classification 2 (SITC2). SITC2 divides all trade products into 10 categories. Such method classifies all trade products in accordance with the product attribute well, but it fails to reflect the technology content of products accurately. It leads to the mixed classification of resource-based products, products with medium technology content, and products with high technology contents, and easily underestimates or overestimates the comparative advantages of products with certain class of technology contents.

In view of this, referring to the method of Lall (2000), we divide all manufactured products of international trade into four classes, i.e. resource-based manufactured products (RB), manufactured products with low technology content (LT), manufactured products with medium technology content (MT), and manufactured products with high technology content (HT), based on SITC2 three-digit encoding classification. Also we conduct the detailed classification of products in each class of technology content according to the product attribute, involving classifying the resource-based manufactured products into two classes of RB1 and RB2, and classifying the manufactured products with low technology content into two classes of LT1 and LT2. The detailed classification is shown in Table 1.

Table 1. Trade Products Classified by Technical Level

Class	Main products
Primary product (pp)	Fresh fruit, meat, rice, coffee, tea, timber, coal, crude oil, natural gas, silver, copper, nickel, aluminum, lead, zinc, and tin, etc.
Manufactured products:	
Resource-based manufactured products Agricultural / forestry products (RB1)	Prepared meat and fruit, beverage, wood products, and vegetable oil, etc.
Other resource-based products (RB2)	Ore concentrate, petroleum / rubber products, cement, cutting gems, and glass, etc.
Manufactured products with low technology content Textile / clothing (LT1)	Textile fabric, clothing, hat, shoes, leather products, and travel goods, etc.
Other manufactured products with low technology content (LT2)	Pottery, simple metal parts / structure, furniture, jewelry, toy, and plastic products, etc.
Manufactured products with medium technology content Automation equipment (MT1)	Passenger vehicles and parts, commercial vehicles, motorcycle and parts
Manufactured products with medium technology processing (MT2)	Synthetic fiber, chemicals and coating products, fertilizer, plastics, pig iron and iron alloy, and steel pipe, etc.
Manufactured products with medium technology engineering (MT3)	Engine, motor, industrial machinery, pump, switchgear, ship, and watch, etc.

Class	Main products
Manufactured products with high technology content	Office / data processing / telecommunication equipment, television, transistor, turbine, and power generating equipment, etc.
Electronic and electrical products (HT1)	
Other products with high technology content (HT2)	Pharmacy, aerospace, optical / measuring instrument, and camera, etc.
Other transactions	Electric power, movie, printing materials, gold, art, coin, and pets, etc.

In the classification of primary products, it is mainly considered that such products are some natural substances and mineral resources without processing or only simple processing. The comparative advantage of such products is mainly from the resource endowment, such as land and mineral products. The resource-based manufactured products always belong to the labor intensive products with low technology processing, such as food and leather products after simple processing, but some products such as petroleum refining are capital intensive. Such products gain the comparative advantage relying more on the abundant resource endowment, and have low dependence on technology. The production technology of products with low technology content does not have the monopoly effect, and generally has good diffusibility. These technologies are mainly reflected in the production equipment, and do not have very high requirements for the production skills of labor participants, which means low barriers to entry. Many products can be considered to be homogeneous with relatively strong substitutability. The size of competitiveness is mainly reflected in the price.

The products with medium technology content are the core of industrial activity in the mature economy, and generally they need a large amount of scale intensive technologies as the support. Besides, they are inclined to possessing the complex production technology and higher level of technical research and development ability in need for longer learning time. They can be divided into three classes. The first class is automation equipment (MT1), mainly including some vehicles, motorcycles and other automation vehicles and their parts. The second class is manufactured products with medium technology processing (MT2). The production of such products needs substantial investment for factory construction and capital facility purchasing, and subsequently needs a lot of investment involving physical capital and human capital in equipment improvement and production process optimization. The third class is manufactured products with medium technology engineering (MT3). The core production processes of such products are the product design, research and development, which need a large number of production and installation workshops and relatively mature and well-developed upstream industry supply network. Therefore, the entry threshold of these industries is high, and only the countries with strong economic strength and scientific research strength can produce these products. The manufactured products with high technology content often need highly advanced science and

technology, perfect design team and R&D team, and substantial investment in research. In most cases, these advanced science and technology and design concepts need the mature science and technology infrastructure, high level professional skills, close communication and cooperation between enterprise and university. The products with high technology content can be divided into two classes, i.e. electronic and electrical products (HT1), and other products with high technology content (HT2).

3. Results and Analysis

3.1. Analysis on Industry Competitiveness between China and Eurasian Economic Union Countries

According to the classification principle of technology content, *RCA* indexes for China and member countries of the Union are respectively calculated, and are shown in Appendix A. Based on the judgment standard proposed by JERTO, we present the international competitiveness of of China and the Union member countries in Table 2. When determining the *RCA* index of certain industry of a country, we comprehensively consider the international competitiveness in accordance with the majority principle (i.e. Among the years studied, which level of competitiveness appeared the most.) and tendency principle (i.e. the tendency occurring in recent years), rather than only taking the average value of data simply. It is because that we should consider the influence of world business cycle on export so as to make the *RCA* value fluctuate remarkably, and also we should consider the evolution tendency of *RCA*, since we are more concerned with the future rather than the past. Some important discoveries can be found from Table 2.

Table 2. International Competitiveness of Industry at Different Technical Levels Divided by *RCA* Indexes

	Weak competitiveness $RCA < 0.8$	Medium international competitiveness $0.8 < RCA < 1.25$	Strong international competitiveness $1.25 < RCA < 2.5$	Extremely strong international competitiveness $2.5 < RCA$
China	PP RB1 RB2 MT1 MT2 HT2 RB1 LT1 LT2	MT3	LT2 HT1	LT1
Russia	MT1 MT3 HT1 HT2	MT2	RB2	PP
Belarus	PP LT1 MT1 MT3 HT1 HT2 RB1 LT1 LT2	LT2	RB1 MT2	RB2
Kazakhstan	MT1 MT2 MT3 HT1 HT2	RB2		PP
Armenia	LT1 LT2 MT1 MT3 HT1 HT2	PP MT2		RB1 RB2
Kyrgyzstan	PP RB1 LT2 MT1 MT2 MT3 HT1 HT2	RB2 LT1		

Firstly, Russia and Kazakhstan have very strong international competitiveness in the primary product field (PP), and Armenia has medium international competitiveness, while China, Belarus and Kyrgyzstan have low international competitiveness. To be specific, *RCA* in PP in Russia has been more than 3 in recent years, while that in Kazakhstan has been more than 4.5 for so long, and even up to 5.87 in 2016. The main exported products of Russia and Kazakhstan in PP field are quite similar, focusing on petroleum, coal, natural gas and metallic ore. Different from Russia and Kazakhstan, the export of Belarus in the primary product field mainly focuses on milk and cream, meat, vegetables, nuts and other farm and pasture products, while the proportion of mineral resources is small. The primary products mostly belong to the resource intensive products, and the comparative advantage is from the resource endowment. Russia and Kazakhstan are the countries with very rich natural resources, especially in oil gas, coal, various metallic ores, so these two countries show very strong international competitiveness in the primary product field.

Secondly, in the field of resource manufactured products, Armenia shows very strong international competitiveness whether it is in RB1 or RB2. As for Belarus, RB2 has extremely strong international competitiveness, and RB1 has strong international competitiveness. RB2 of Russia has strong international competitiveness. All other countries have unobvious comparative advantage or are at comparative disadvantage in the field of resource manufactured products. Specifically, *RCA* of RB1 in Armenia has always been more than 3 in recent years, while *RCA* of RB2 has always been more than 2.5 and has shown the trend of increasing year by year. The export of Armenia in RB1 field mainly focuses on tobacco products, beverages, cheese and fruit products, while the advantage products in RB2 field are mainly metal ore concentrate and its condensate, pearls, and gems and lime prefabricated building materials. The export of Belarus in RB2 mainly focuses on petroleum products, glass, mineral manufactured products and lime prefabricated building materials, while the exported products are mainly cheese and curd, butter, plywood, and timber and paperboard in RB1 field. By comparison with comparative advantage industry of Armenia in the field of resource-based manufactured products, it is found that, the main advantage products of Belarus in RB2 field mainly focus on the petroleum products and ore, while the main exported products of Armenia are mainly metal and ore. The advantage products of both countries mainly focus on a few classes of products, and the contact ratio of main product export is not high. The main exported products of two countries in RB1 field also have low contact ratio, and relative to Armenia, the comparative advantage products of Belarus in the field of RB1 show the diversity. RB2 of Russia has strong international competitiveness, but RB1 has weak competitiveness. The main exported products in RB2 are refined petroleum products, and only this item was 75.54% of RB2 gross export of Russia in 2016. Compared with Armenia and Belarus, the advantage products of Russia in RB2 field are more unitary. The performance of Kazakhstan and

Kyrgyzstan is slightly worse. Their RB2 has medium international competitiveness and RB1 has weak competitiveness. China is at comparative disadvantage fully in the field of resource-based manufactured products, regardless of RB1 or RB2.

Thirdly, in the field of manufactured products with low technology content, China performs better. LT1 has extremely strong international competitiveness, and LT2 has strong international competitiveness, but the international competitiveness of LT1 shows the significant falling trend year by year. *RCA* value declined from 3.91 in 2000 to 2.62 in 2015 and 2.68 in 2016. In LT1 field, the export of China mainly focuses on knitted outerwear, shoes, textile products and travel goods, and the export of main products shows the diversity advantages, rather than focusing on very few products. In LT2 field, the advantage products focus on furniture, toy, plastic products and rolled steel. The industry of manufactured products with low technology content mostly belongs to the labor intensive industry with low technology content and low added value. With rising of labor costs in China, implementation of industrial structure optimization and transformation and upgrading plan in the national macro-level in recent years, a large number of enterprises select to build the plants overseas, aiming at some countries with relatively backward development with lower labor costs and institutional costs. Thus, although China has shown very strong international competitiveness in this field, but the comparative advantage is falling. Moreover, the Union member countries entirely show weak international competitiveness in such products, and have very obvious comparative disadvantage. To be specific, only LT2 of Belarus and LT1 of Kyrgyzstan have medium international competitiveness, and all others show weak international competitiveness.

Fourthly, in the field of manufactured products with medium technology content, China and five countries of the Union underperform. Only MT2 of Belarus shows strong international competitiveness, and MT2 of Armenia and Russia has medium international competitiveness, while MT3 of China has medium international competitiveness. The manufactured products with medium technology content mainly include vehicles (MT1), heavy chemical industry (MT2), and electromechanical and equipment manufacturing (MT3), which belongs to the capital intensive industry having requirements for high technology and product design ability that means high entry threshold. The developed countries and newly industrialized countries enter this field earlier, and possess abundant capital, advanced technology, brand advantage, perfect upstream and downstream industry chain, and mature world market, thus they have the absolute advantage for a long term. The developing countries can hardly stand out in these industries. China has accumulated a great deal of capital in some industries in this field and has achieved good results in the electromechanical and large equipment manufacturing after reform and opening up for many years, but such products are still in the medium competition level in the world market due to failing to overcome the technical barriers in some core parts fields which depend on importing

from abroad.

Fifthly, in the products with high technology content, only HT1 products of China have strong international competitiveness in the international market. HT1 and HT2 of the Union member countries are with weak international competitiveness. HT2 of China also shows comparative disadvantage. Relative to products with medium technology content level, HT products need much higher technology content and scientific strength which needs powerful basic science as the support. In recent years, China has made rapid progress in the fields of communication equipment, data processing equipment, transistor and power generating equipment, and all of the production has strong international competitiveness. The exports of HT1 in China mainly focus on telecommunication equipment, automatic data processor, hot electron, microcircuit, transistor, valve, and electrical machinery and equipment, and such four classes of products account for 80.55% of MT1 general export of China in 2016.

In a word, the products with comparative advantage of China are less similar to the products with comparative advantage of the Union member countries. The industries with high international competitiveness in China are mainly labor intensive LT1 and LT2, capital intensive MT3 and technology intensive HT1. However, the products with strong international competitiveness in the Union member countries mainly concentrate on resource intensive industry PP, RB1 and RB2, and capital intensive industry MT2. Relatively speaking, the competitive products of China have higher technology content, while the advantage of the Union member countries is mainly embodied in the domestic abundant natural resources. Both parties mainly show the complementary relation rather than competitive relation in the international product market, which means the greater possibility of expanding the economic cooperation further.

3.2. Analysis on Trade Complementarity between China and Eurasian Economic Union Countries

In this section, we use the trade complementarity that can measure the matching degree between one country's export and another country's import to depict the trade complementarity. In order to research the possibility and potential of bilateral trade cooperation comprehensively, we have calculated two types of trade complementarity, one of which is based on China's imports and the Union member countries' exports, and the other on the basis of the Union member countries' imports and China's exports. The results are shown in Appendix B. According to the principle that if trade complementarity index is more than 1, it indicates strong bilateral economic complementarity; and if it is less than 1, then it indicates weak economic complementarity, the trade complementarity relations between China and the Union countries are summarized in Table 3 and Table 4. Some important discoveries can be gained by analysis.

Table 3. Economic Complementarity of Industry between China and Eurasian
Economic Union Countries Calculated by China's Imports

	Russia	Belarus	Kazakhstan	Armenia	Kyrgyzstan
Strong complementarity $C > 1$	PP RB2 MT2	PP RB1 RB2 MT2	PP RB2	PP RB1 RB2	RB2
Weak complementarity $C < 1$	RB1 LT1 LT2 MT1 MT3 HT1 HT2	LT1 LT2 MT1 MT3 HT1 HT2	RB1 LT1 LT2 MT1 MT2 MT3 HT1 HT2	LT1 LT2 MT1 MT2 MT3 HT1 HT2	PP RB1 LT1 LT2 MT1 MT2 MT3 HT1 HT2

Table 4. Economic Complementarity of Industry between China and Eurasian
Economic Union Countries Calculated by the Union Member Countries' Imports

	Russia	Belarus	Kazakhstan	Armenia	Kyrgyzstan
Strong complementarity $C > 1$	LT1 LT2 MT3 HT1	LT1 LT2 MT2 MT3	LT1 LT2 MT2 MT3 HT1	RB1 LT1 LT2	RB1 LT1 LT2
Weak complementarity $C < 1$	PP RB1 RB2 MT1 MT2 HT2	PP RB1 RB2 MT1 HT1 HT2	PP RB1 RB2 MT1 HT2	PP RB2 MT1 MT2 MT3 HT1 HT2	PP RB2 MT1 MT2 MT3 HT1 HT2

Firstly, the trade complementarity index calculated by import of China and export of the Union member countries manifests that the industries with strong complementarity are PP and RB, and a few of products of MT. And the complementarity intensity shows great difference. To be specific, for China's imports and Russian's exports, the most complementary field is PP and its trade complementarity index in last two years are 4.79 and 4.31. In addition, they also show strong complementarity in RB2, and the trade complementarity index is increasing gradually from 1.85 in 2000 to 3.10 in 2016. However, although strong complementarity exists in MT2, the degree shows the falling trend from 2.18 in 2000 to 1.08 in 2016. The field with the strongest complementarity between China's imports and export of Belarus is RB2, followed by MT2, and then RB1. In PP field, it only shows strong complementarity in the last two years. However, from the above analysis, it is found that the *RCA* index of Belarus in PP is increasing distinctly, so we believe that they may maintain strong complementary relation continuously in this field. There are only two classes of industries with strong complementarity between China and Kazakhstan, i.e. PP and RB2, and the degree of complementarity has great difference. In PP field, the complementarity between China and Kazakhstan is even superior to the complementarity between China and Russia, because the trade complementarity index between China and Kazakhstan rose from 3.82 in 2000 to 7.20 in 2015 and 7.89 in 2016. But the performance in RB2 is ordinary, and the complementarity index is only more than 1. The industry with strong complementarity between China's imports and Armenia's exports is PP, RB1 and RB2.

The industry with strong complementarity between China and Kyrgyzstan is only RB2, which just meets the condition of strong trade complementarity relation and has obvious instability.

Secondly, the trade complementarity index calculated by China's exports and the Union member countries' imports reveals that complementary fields is mainly LT, and it has a small amount of MT and HT, and the complementarity intensity also shows great difference in all the fields. To be specific, the fields with strong complementarity between China and Russia are mainly LT1, LT2, MT3 and HT1, among which the trade complementarity index of LT1 is largest, followed by LT2, and then HT1 and MT3. The industries with strong complementarity between China and Belarus are mainly LT1, LT2, MT2 and MT3, and the complementarity intensity is slightly different, with a slim advantage in LT1 and LT2. The industries with strong complementarity between China and Kazakhstan are LT1, LT2, MT2, MT3 and HT1. They have shown strong complementarity in LT1 and HT1 in recent years, while they have always maintained strong complementarity in LT2, MT2 and MT3 fields for many years. The industries with strong complementarity between China and Armenia are mainly RB1, LT1 and LT2, with larger complementarity intensity in LT1 and LT2. The industries with strong trade complementarity between China and Kyrgyzstan are RB1, LT1 and LT2. The complementarity intensity of LT1 is the largest, followed by LT2, and then RB1.

Some important discoveries can be gained by above analysis. First, the fields at all technology content levels between China and the Union member countries have strong complementarity in different ranges and degrees. It means that both parties have the mutually beneficial and win-win cooperation space and the broad prospects for cooperation at all technical level fields. Second, the industries with strong trade complementarity calculated by China's exports have technology advantages, compared with the trade complementarity industries calculated by the Union countries' exports. Third, the quantity of fields with strong bilateral trade complementarity calculated by China's exports is generally larger than that calculated by the union countries' exports. So further market opening and trade facilitation can release all countries' potentials, and promote the economic growth from the breadth or depth of cooperation scope.

To further reflect the comprehensive economic complementarity between China and the Union countries, the comprehensive trade complementarity index is adopted to calculate the Union member countries' exports, and the results are as shown in Table 5. From Table 5, the comprehensive trade complementarity between China and Russia & Kazakhstan is strongest, followed by Belarus and Armenia, and then Kyrgyzstan. The statistical data of World Bank shows that gross domestic product (GDP) of Russia, Belarus, Kazakhstan, Armenia, and Kyrgyzstan in 2016 is respectively 1,283 billion dollars, 47.407 billion dollars, 137.278 billion dollars, 10.572 billion dollars, and 6.551 billion dollars.¹ Except for Kyrgyzstan, other four countries account for 99.56%

¹ The data is from World Bank.

of total GDP in all countries of the Union, so it is believed that the economic relation between China and the Union is mainly manifested as complementarity, so they have great potential for further cooperation.

Table 5. Comprehensive Trade Complementarity Index between China and Eurasian Economic Union Countries Calculated by Import of China

Data	Russia	Belarus	Kazakhstan	Armenia	Kyrgyzstan
2000	0.95	1.03	0.56	0.93	0.45
2001	0.87	1.03	0.94	0.90	0.38
2002	0.83	0.97	0.87	0.78	0.53
2003	0.82	0.95	0.88	0.88	0.39
2004	0.89	0.94	0.95	0.93	0.46
2005	0.88	0.95	0.92	1.02	0.55
2006	0.88	0.94	0.93	0.95	0.66
2007	0.93	0.97	0.98	1.04	0.76
2008	0.98	1.03	1.03	1.07	0.39
2009	1.01	1.06	1.07	1.06	0.31
2010	1.01	0.97	1.09	1.03	0.36
2011	1.00	0.98	1.09	0.96	0.38
2012	1.10	0.95	1.14	0.90	0.54
2013	1.08	0.91	1.13	0.89	0.51
2014	1.13	0.95	1.18	0.89	non
2015	1.12	0.93	1.20	0.86	0.42
2016	1.00	0.90	1.24	0.87	0.46

Note: non shows the data is missing for the corresponding year.

A large trade complementarity index only indicates that the import of country A for world market and the demand of country B for world product market have strong complementarity, but it is not deemed to have a close trade relation between countries in the industry, because the import of country B in the industry may be from other countries rather than country A. Therefore, it is necessary to research the commodity trade structure between China and the Union countries in details, and mainly inspect whether the main trade products of both parties are industries with strong trade complementarity. Thus, we measured the main trade product categories between China and the Union countries, and the results are as shown in Table 6. With the research results, it is found that most of products between China and the Union member countries belong to the industries with the advantage in international competitiveness and strong complementarity. Moreover, the further deepening of cooperation can enhance the division level of all countries, and then increase the bilateral trade benefits. However, it is noted that some industries with

strong international competitiveness and strong complementarity are not main trade products, so China and the Union countries should strengthen the cooperation in these industries and promote the expansion and deepening of bilateral trade in future.

Table 6. Main Trade Products between China and Eurasian Economic Union Countries under Ten Types of Products Divided by Technical Level

	Main imported products	Proportion in total import (average value)	Industry with high trade complementarity calculated by import of China	International competitiveness level of the Union countries in the products	Main exported products	Proportion in total export	Industry with high trade complementarity calculated by export of China	International competitiveness level of China in the products
Russia	PP	47.27%	PP RB2 MT2	E	LT1	30.02%	LT1	E
	RB1	17.53%		W	[LT2]	[11.12%]	LT2	S
	RB2	15.87%		S	MT3	15.49%	MT3	M
	(MT2)	(12.06%)		M	(HT1)	(18.24%)	HT1	S
Belarus	[RB2]	[11.18%]	PP RB1 RB2 MT2	E	MT3	24.14%	LT1 LT2	M
	MT2	64.51%		S	(HT1)	(31.50%)	MT2 MT3	S
Kazakhstan	PP	59.21%	PP RB2	E	LT1	38.42%	LT1	E
	RB2	16.00%		M	[LT2]	11.74%	LT2	S
					MT3	13.83%	MT2 MT3	M
					(HT1)	(12.17%)	HT1	S
Armenia			PP RB1 RB2		(LT1)	(11.85%)		E
	[RB2]	64.20%		E	LT2	15.43%	RB1	S
	(MT3)	(11.32%)		W	MT3	22.02%	LT1	M
					[HT1]	[17.32%]	LT2	S
Kyrgyzstan	PP	37.24%	RB2	W			RB1	E
	RB2	44.48%		M	[LT1]	[53.10%]	LT1	W
	LT1	16.55%		M	(MT2)	(20.96%)	LT2	

Notes: [.] represents that the proportion of trade volume has the significant rising trend in recent years, and (.) shows that the proportion of trade volume has the significant falling trend in recent years. W represents weak competitiveness; M represents medium international competitiveness; S represents strong international competitiveness; E represents extremely strong international competitiveness.

3.3. Analysis on Trade Integration between China and the Eurasian Economic Union Countries

China and the Union countries have strong complementarity relation, but the trade complementarity index can only measure the matching degree of one country's exports and another country's imports, and fails to reflect the true situation of bilateral trade integration, so further analysis with trade integration index is required. We calculate the bilateral trade integration index for the Union countries' exports

and China's exports respectively, and the results are as shown in Table 7 and Table 8 respectively. Two important discoveries can be gained from the tables.

Table 7. Bilateral Trade Integration Index Calculated by Export of the Union Member Countries

	Russia	Belarus	Kazakhstan	Armenia	Kyrgyzstan
2000	1.38	0.5	2.1	0.05	2.37
2001	1.34	0.46	1.83	0.00	0.98
2002	1.33	0.56	2.19	0.16	1.80
2003	1.05	0.28	2.18	0.12	0.68
2004	0.84	0.33	1.48	0.45	0.83
2005	0.78	0.39	1.25	0.14	0.57
2006	0.73	0.28	1.32	0.01	0.67
2007	0.57	0.26	1.56	0.09	0.72
2008	0.58	0.24	1.39	0.02	0.35
2009	0.62	0.09	1.53	0.29	0.18
2010	0.49	0.18	1.73	0.30	0.19
2011	0.63	0.14	1.72	0.11	0.20
2012	0.61	0.08	1.59	0.19	0.32
2013	0.58	0.11	1.45	0.40	0.19
2014	0.63	0.15	1.04	0.97	non
2015	0.71	0.25	1.03	0.96	0.21
2016	0.86	0.15	1.01	0.49	0.49

Note: non represents the data is missing for the corresponding year.

Table 8. Bilateral Trade Integration Index Calculated by Export of China

	Russia	Belarus	Kazakhstan	Armenia	Kyrgyzstan
2000	1.67	0.12	3.05	0.03	5.05
2001	1.47	0.02	1.19	0.06	3.75
2002	1.49	0.04	1.79	0.04	4.96
2003	1.77	0.05	3.18	0.06	5.81
2004	1.82	0.06	2.63	0.13	7.97
2005	1.77	0.06	3.00	0.18	10.45
2006	1.39	0.12	2.46	0.18	15.09
2007	1.57	0.09	2.54	0.19	16.93
2008	1.34	0.10	2.85	0.19	24.84
2009	1.03	0.10	2.78	0.28	17.94
2010	1.21	0.22	3.69	0.30	12.2
2011	1.18	0.15	2.38	0.31	10.85
2012	1.20	0.17	2.16	0.23	8.28
2013	1.30	0.17	2.16	0.24	7.15
2014	1.46	0.22	2.43	0.23	non
2015	1.33	0.18	1.96	0.24	7.47
2016	1.50	0.29	2.44	0.26	10.82

Note: non represents the data is missing for the corresponding year.

Firstly, the bilateral trade integration indexes calculated by the Union member countries' exports reveal that China has close trade relation only with Kazakhstan. The trade integration index between Russia and China had been strong in the first few years since 2000, and has always been in the trend of declining with fluctuation in recent years. From the above analysis, China and the Union have strong economic complementarity relation, but for the bilateral trade integration calculated by the Union countries' exports, they all show loose relations except for Kazakhstan. It gives us the important enlightenment, i.e. the Union member countries' exports (except for Kazakhstan) to China has enormous room for improvement. For the bilateral trade cooperation, the opportunity of a new round of opening to the outside world characterized by "increase imports" of China can be taken to increase exports to China, which will promote the rapid development of bilateral economic and trade relations.

Secondly, the trade integration indexes between China and the Union member countries calculated by China's exports reveal that China has close trade relations with Russia, Kazakhstan and Kyrgyzstan. The trade integration index between China and Russia has always fluctuated between 1.03~1.82 for a long term, but with Kazakhstan, it has been more than 2 in recent years (except for 1.96 in 2015), which means that the real export of China to two countries exceeds the expected export value, and the bilateral trade relation is close. In addition, the data shows that the maximum trade integration index between China and Kyrgyzstan is 24.84, and the minimum one is 3.75, with larger fluctuation, which indicates that the economic and social development of Kyrgyzstan is highly dependent on imported products from China, thus it means there may be serious trade imbalance between China and Kyrgyzstan. The trade integration index between China and Belarus & Armenia calculated by China's exports is still less than 1, signifying the loose bilateral relations. The Chinese enterprises will have a brilliant future in exploiting the market of these two countries.

4. Conclusions and Policy Suggestions

In this paper, revealed comparative advantage index, trade complementarity index, and trade integration index are used to study the international competitiveness, the trade complementarity, and the trade integration between China and the Union member countries of the ten types of international trade products divided by technology contents respectively. And some important discoveries have been made.

Firstly, the products with high international competitiveness between China and the Union member countries are mainly primary products, resource-based manufactured products, and products with low technology content. All the countries are at the comparative disadvantage in the production of products with medium and high technology content except for few fields. As a whole, China and the Union member countries have strong trade complementarity relations, and China's exports have

higher technology content relative to the Union countries, which means that China has technical advantages. The difference of technical level means that the bilateral economic and trade cooperation is mainly inter-industry trade. The industry with medium technology content belongs to the capital intensive industry and has high requirements for science and technology, so such an industry is mainly controlled by a few developed countries and newly industrialized countries. China and the Union countries have low competitiveness in the field.

Secondly, the bilateral trade integration indexes calculated by China's exports and the Union member countries' exports respectively have significant difference. The closeness of trade relation between the Union member countries and China is mainly reflected in the Union countries' imports from China, while China's imports from the Union countries is generally lower than the expected value, which means that there is a huge potential for improvement. The Union member countries can promote the export to China by building more diversified industrial structures and developing products for market demand in China, which can effectively avoid the drastic fluctuation in the bilateral trade, and it also helps to alleviate the problem of trade imbalance.

Thirdly, the main trade products between China and the Union are mostly industries with high competitiveness in the international market and strong trade complementarity, which means that the bilateral trade cooperation is mutually beneficial and win-win, and it is beneficial for the improvement of social welfare in all countries. However, some industries that have the comparative advantage and strong trade complementarity have small proportion in the bilateral trade. In future, to accelerate more diversified development of bilateral trade, the cooperation in supply and demand must be deepened in these fields.

Referring to the above research results and considering the rapid construction of the Silk Road Economic Belt, in this paper, the author gives the following suggestions on how to facilitate the efficient docking between China and Eurasian Economic Union in the commodity trade field.

Firstly, it is necessary to consolidate and expand the main cooperative industries between China and the Union member countries actively, and also it is necessary to extend the industries with strong bilateral complementarity but in weak cooperation level at present actively. On this basis, the bilateral trade can be promoted to evolve toward high technology content. The economic development experience of some newly industrialized countries demonstrates that, the trade structure has the pulling effect on domestic industrial structure. The increase of gross export and diversification of exported products can enhance the total factor productivity by means of optimal allocation of resources, technology transfer and learning effect, and further promote the adjustment of industrial structure.

Secondly, China and the Union should promote the bilateral trade and investment facilitation actively, and the opportunity of expanding and deepening the economic

cooperation scope can be taken to build the regional value chain of Silk Road Economic Belt by virtue of technological advantages of China in the industry. At present, China is in the critical period of economic structural adjustment moving towards the phase of high quality economic development constantly, and it possesses the most complete manufacturing system in the world. Besides, China has the comparative advantage relative to the Union member countries. So both parties should keep sufficient interactions in the domestic industrial structural adjustment.

Thirdly, China and the Union member countries should promote the interconnection actively, and propel to establish multilateral and bilateral economic and trade cooperation agreement actively that can provide the institutional foundation for deepening and sustainability of cooperation. In the interconnection, policy communication should be emphasized so as to enhance the top-level design of trade relation and reduce the trade frictions and conflicts; the road connection shall be promoted so as to provide the convenience for cross-border trade; the tariff and non-tariff barriers hindering the trade development constantly shall be reduced so as to promote the trade facilitation; financing and trade settlement mechanism shall be innovated so as to enable the finance to serve the trade and investment better; all-round and multi-level social cultural exchange shall be promoted so as to reduce the communication barriers in the region. In addition, the multi-field economic and trade cooperation agreement should be signed to provide the institutional basis for bilateral cooperation.

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