

# China's economic and trade interdependencies with other BRIC countries - From a GVC Perspective

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## 1. Introduction

The fact that the economic relations of BRIC have been strengthened is manifested by the BRIC value added, which has been driven by the final demand of each country. In this context, certain commodity's producing process is considered under a global value added chain (GVC). This is no existing literature estimating the economic interdependencies of BRIC in terms of their trade relation. This paper tries to explore how their final demand drives the value added of BRIC countries. We calculate the international linkages and how much each country's final demand contribute to the value added among BRIC countries by using the WIOD through 2001-2011. We find that China's external trade with other BRIC countries both in Customs data and in value added is increased greatly through 2001 to 2011, but the structures between these two kinds of data are clearly different. The inter-industrial linkages between China and other BRIC are getting closer, at the same time the final demands contribute to sectoral value added for each country are also rising. It shows the economic interdependencies among BRIC are obviously getting greater. At the same time, there is a wide variety of manufacturing goods in China exports, while Russia

and Brazil agriculture and mining sector's value added are contributed largely by other BRIC final demand. The further strength of economic interdependencies among BRIC could be predicted, while the pattern should be improved and thus contribute to domestic economic development.

## 2. The Model and Data

This paper analyzes how the aggregate demand of BRIC increases each other's TiVA. Thus, the TiVA model assumes there are five countries, namely China, Russia, India, Brazil, and the rest of the world (ROW) except the BRIC.

The Input-Output model of the five countries can be expressed as the following matrix:

$$\begin{pmatrix} x_{chn} \\ x_{rus} \\ x_{ind} \\ x_{bra} \\ x_{row} \end{pmatrix} = \begin{pmatrix} \alpha_{chn-chn} & \alpha_{chn-rus} & \alpha_{chn-ind} & \alpha_{chn-bra} & \alpha_{chn-row} \\ \alpha_{rus-chn} & \alpha_{rus-rus} & \alpha_{rus-ind} & \alpha_{rus-bra} & \alpha_{rus-row} \\ \alpha_{ind-chn} & \alpha_{ind-rus} & \alpha_{ind-ind} & \alpha_{ind-bra} & \alpha_{ind-row} \\ \alpha_{bra-chn} & \alpha_{bra-rus} & \alpha_{bra-ind} & \alpha_{bra-bra} & \alpha_{bra-row} \\ \alpha_{row-chn} & \alpha_{row-rus} & \alpha_{row-ind} & \alpha_{row-bra} & \alpha_{row-row} \end{pmatrix} \begin{pmatrix} x_{chn} \\ x_{rus} \\ x_{ind} \\ x_{bra} \\ x_{row} \end{pmatrix} + \sum_k \begin{pmatrix} f_{chn-k} \\ f_{rus-k} \\ f_{ind-k} \\ f_{bra-k} \\ f_{row-k} \end{pmatrix} \quad (1)$$

$x_h$  is the output vector of country  $h$ , and  $f_{h-k}$  is the vector of aggregate demand from country  $k$  to country  $h$ .  $(f_{chn-k} f_{rus-k} f_{ind-k} f_{bra-k} f_{row-k})'$  is the aggregate demand of each country.  $\alpha_{h-k}$  is the input coefficient matrix from  $h$  to  $k$ .

$va_{h-k(j)}$ , the value added created by sector  $j$  in country  $h$  to meet the final demand of country  $k$ , equals value added rate of sector  $j$  in country  $h$  multiplying its output that is to meet the final demand of country  $k$ .

$$va_{h-k(j)} = v_{h(j)} x_{h-k(j)} = (1 - \sum_p \sum_i \alpha_{p-h}^{(i,j)}) x_{h-k(j)} \quad (2)$$

The data in this paper is from the World Input-Output Database (WIOD), which includes the intermediate and the final demand from 2001 to 2011 of the BRIC countries. WIOD covers 27 EU countries and 13 other major countries and regions (including Turkey, Canada, America, Mexico, Japan, Korea, Taiwan Province, Australia, Brazil, Russia, India, Indonesia and China). Since this paper focuses on the analysis of trade among BRIC, we adjusted the original data to categorize the other 36 countries other than BRIC to the other countries. This allows us to transform the original world input-output table, which includes 41 countries (with one ROW category), into a new table that contains only China, Russia, India, Brazil and the ROW. The WIOD, which covers 35 sectors, has also been integrated in this paper into 26 sectors. Among the sectors, Textiles and Textile Products, Leather and Footwear sector are integrated as Textile, leather and feather products industry. Chemicals and Chemical Products, and Rubber and Plastics are integrated as Chemical Industry. Sale, Maintenance and Repair of Motor Vehicles and Retail Sale of Fuel; Wholesale Trade and Commission Trade Except of Motor Vehicles; Retail Trade Except of Motor Vehicles; as well as Repair of Household Goods, are integrated as Wholesale and Retail Industry. Inland Transport, Water Transport, Air Transport, and Other Supporting and Auxiliary Transport Activities are integrated as Transportation and Warehousing. Health and Social Work; Other Community, Social and Personal Services; and Private Households with Employed Persons, are integrated as Health care and other social services. There are two methods to set price for the WIOD. One is in current prices, and the other is in previous year's prices. The data in this paper is based the WIOD of current prices.

### **3. The empirical findings**

#### **3.1 The structures of total value export and value added export between China and other BRIC countries are clearly different**

The total value export simply refers to the traditional trade statistics, in which the commodity export is based on the Customs data. While the value added export, which describes how much value added produced by one country embodied in the final demand of another country, is estimated based on the methodology discussed in section 3 in this paper.

Figure 1 and 2 present a rapid increase in China's export to other BRIC countries and China's import from other BRIC countries (other BRIC export to China) in the view of total value trade data. Meanwhile, the rapid increase also happens in value added trade as Figure 3 and 4 shown. In 2001, China's total value export to (import from) the other BRIC countries was about 7.62 (7.98) billion USD, and it reached to 172.81 (107.18) billion USD in 2011, the average annual growth rate was about 36.63% (29.67%) during this 10 years. In the view of value added trade, China's total export to (import from) other BRIC countries was about 6.98 (6.81) billion USD in 2001, while it reached to 140.72 (87.52) billion USD in 2011, the average annual growth rate was about 35.04% (29.08%) during this 10 years.

Figure 1

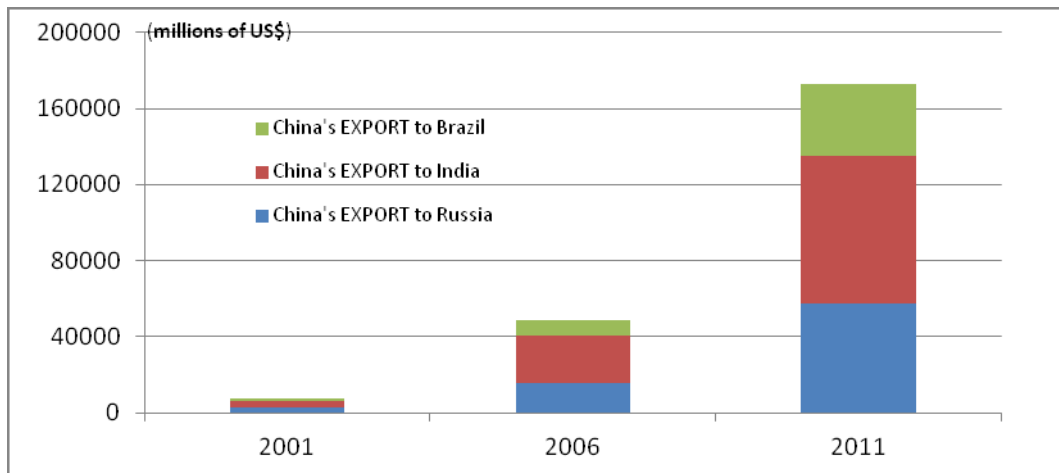


Figure 2

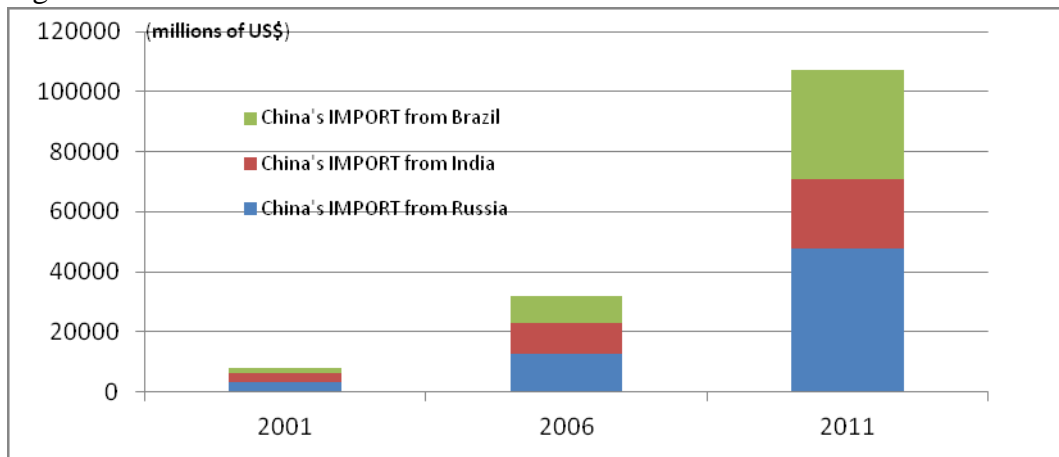


Figure 3

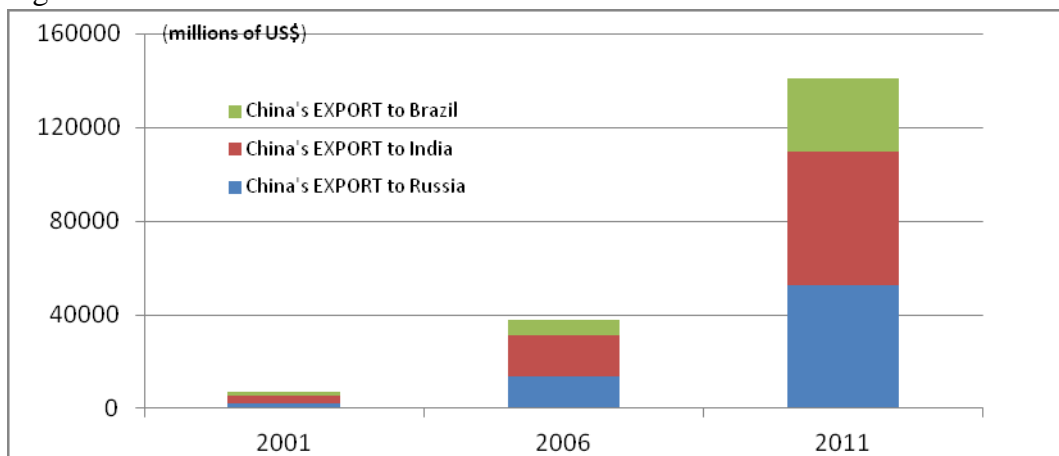


Figure 4

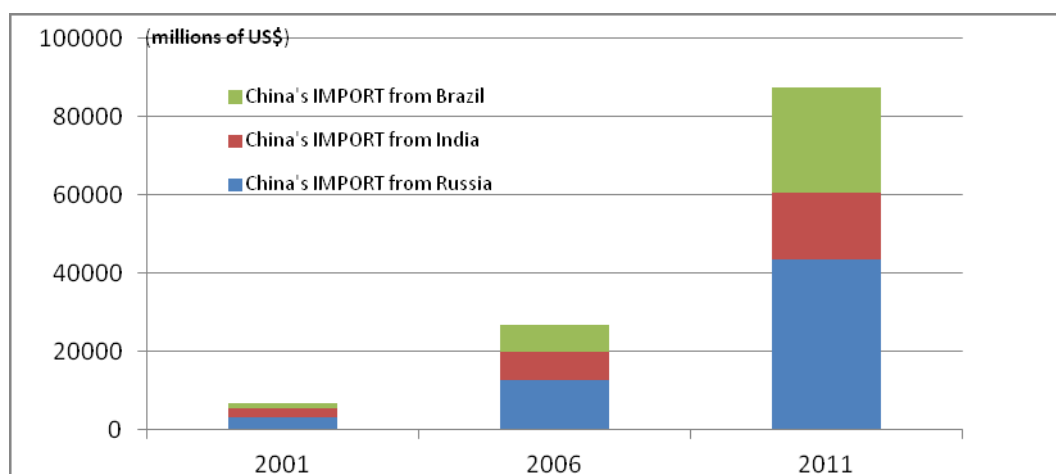
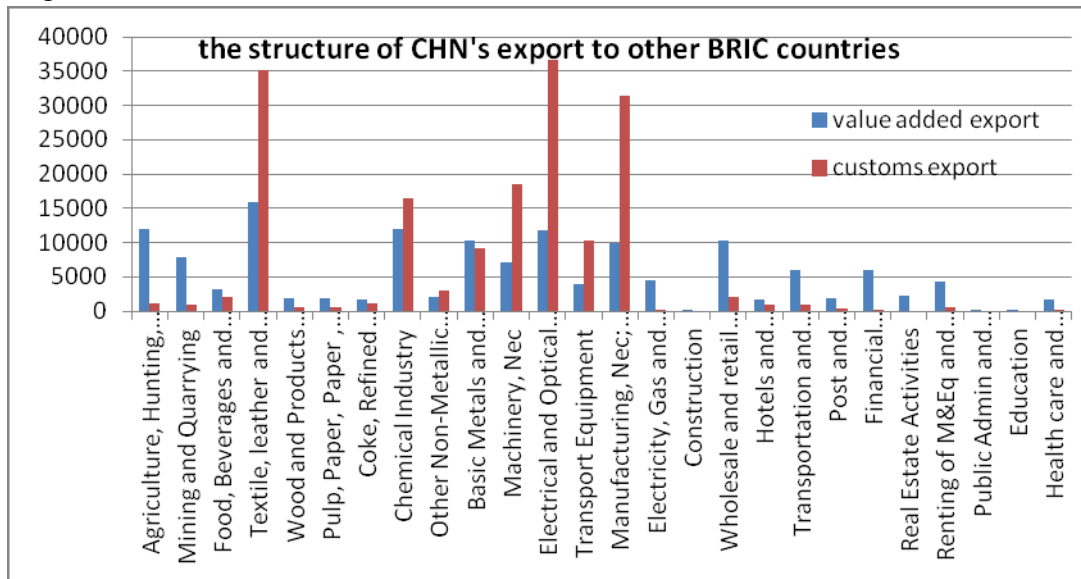


Figure 5 presents huge differences between the total value export and value added export in the structure of China's export to other BRIC countries in 2011 at 26-sector classification. China's exports to other BRIC countries in Textile, leather and feather products, Electrical and Optical Equipment, Manufacturing, Nec and Recycling, Machinery and Transport Equipment based on total value export are much larger than that of value added export. It means that these industries domestic value added in China's export are in small proportions. On the contrast, Agriculture, Mining and Quarrying, Wholesale and retail trade, Food, Beverages and Tobacco and services industries' value added exports are larger than that of total value export. The reason is that these industries supply a lot of inputs for other sectors to make products for export, which thus contain a certain part of value added origin from those inputs' industries under IO estimation in context of value added trade.

Figure 5



### 3.2 The structures of China’s exports to other BRIC countries in value added trade

In this and next sub-section, we will analyze the trade linkage in value added between China and other BRIC countries. In one side, the value added export of China to other BRIC shows how other BRIC countries’ final demand contribute to China’s domestic value added creation at industrial level; from the other side, China’s value added import from other BRIC in fact contribute to other BRIC countries’ domestic value added, which is the other BRIC export to China.

Figure 6 to 11 shows 2011 China’s export to Russia, Brazil and India at 26-sector classification and their structure change through 2001 to 2011. In other word, these are the other BRIC countries’ final demand contributions to China each sector’s domestic value added. It shows that Russian final demand contributes the most to China’s domestic value added in textile, leather and feather products and agriculture, while in Electrical and Optical Equipment, Transport Equipment, Machinery and

Basic Metals and Fabricated Metal industries, their value added shares had been increased through 2001 to 2011.

On the other hand, Brazilian and Indian final demand contributions to China's domestic value added come from many manufacturing sectors. Although the total value are not so big comparing with corresponding industries value added induced by Russia, the manufacturing industries export shares, including Electrical and Optical Equipment, Chemical, Basic Metals and Fabricated Metal and Machinery to Brazil, Manufacturing, Nec and Recycling, Chemical, Basic Metals and Fabricated Metal, Electrical and Optical Equipment and Machinery to India, are quite large in the total value added exports of China to Brazil and India in 2011 respectively. In addition, the export structure to Brazil is quite stable through 2001 to 2011, except for a few sectors like Basic Metals and Fabricated Metal and Machinery increased gradually. But the export structure to India changed a lot. The shares of China's Mining and Quarrying, Textile, leather and feather products and Transportation and Warehousing sectors' export to India slightly decreased through 2001 to 2011, while Manufacturing, Nec and Recycling, Machinery, Electrical and Optical Equipment, Basic Metals and Fabricated Metal and Transport Equipment export shares gradually increased at different degree.

These results mean that although China's export to Russia is quite big among BRIC countries, the domestic value added is mainly from agriculture and few manufacturing industries, which are so called China's traditional large exporting sectors. In contrast, China's export to Brazil and India is more balanced and shifting towards concentrated



on capital intensive and high-tech manufacturing industries.

Figure 6

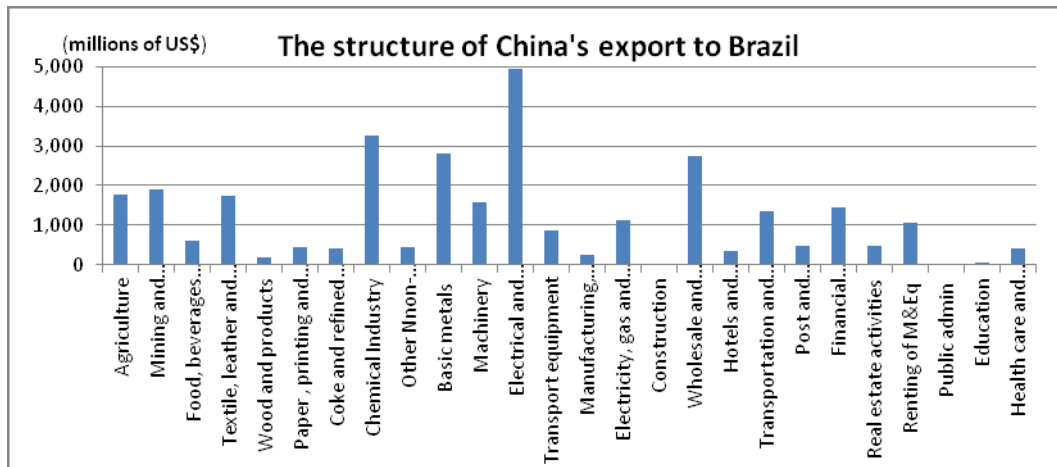


Figure 7

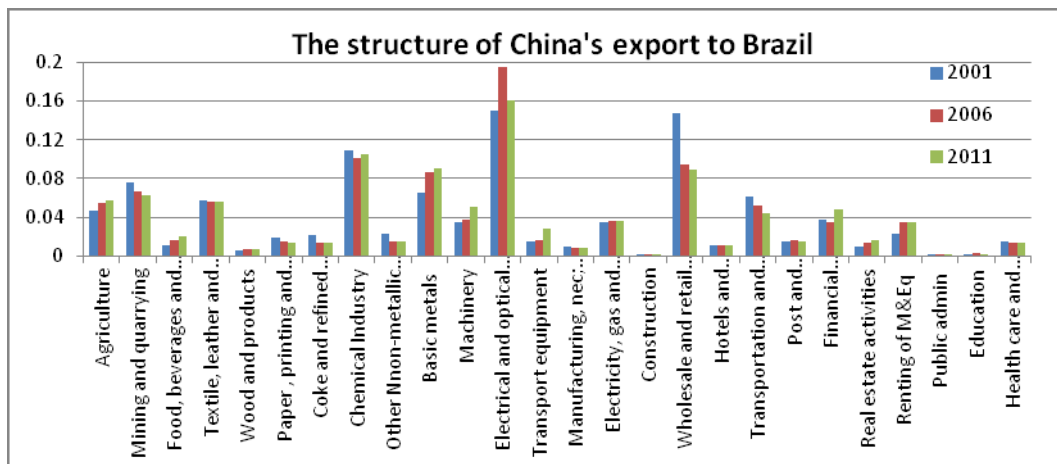


Figure 8

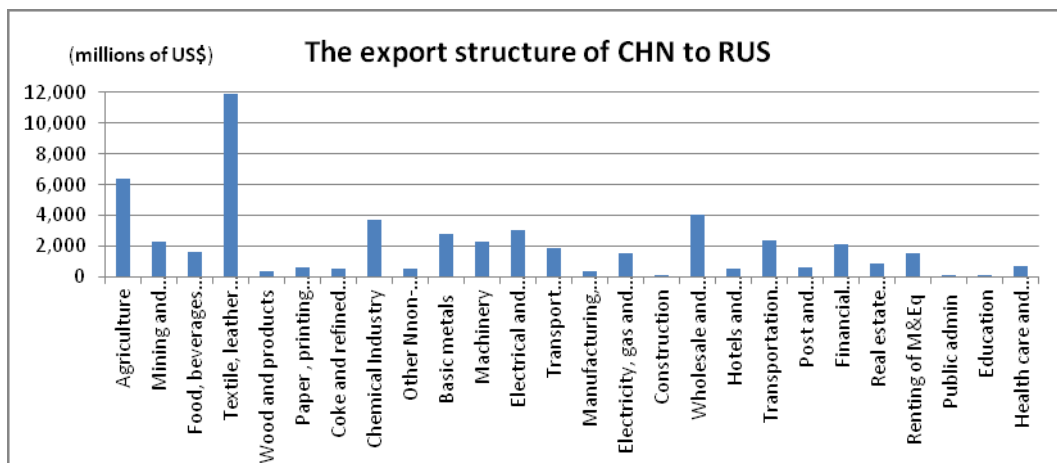


Figure 9

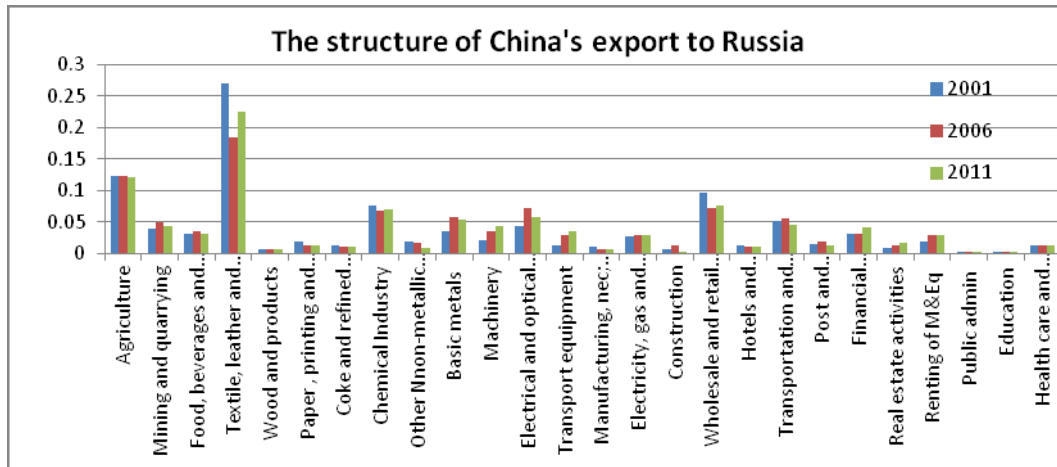


Figure 10

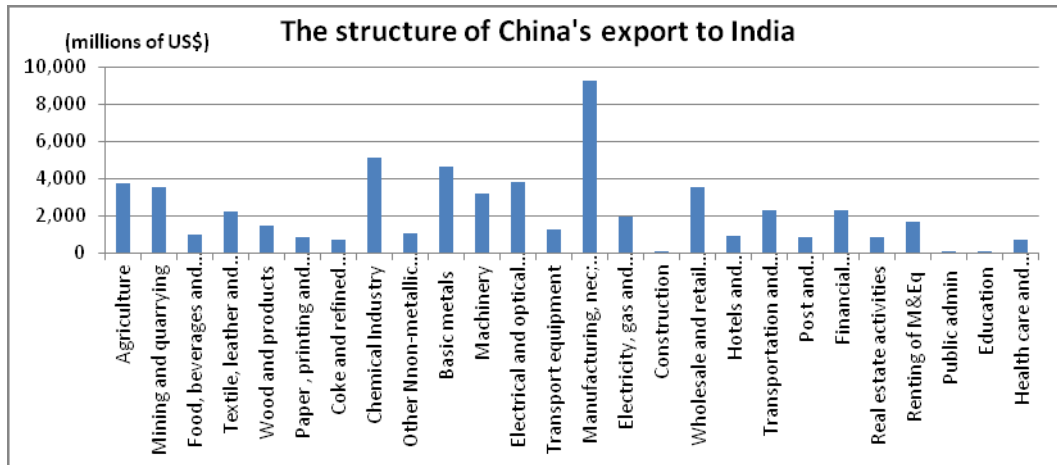
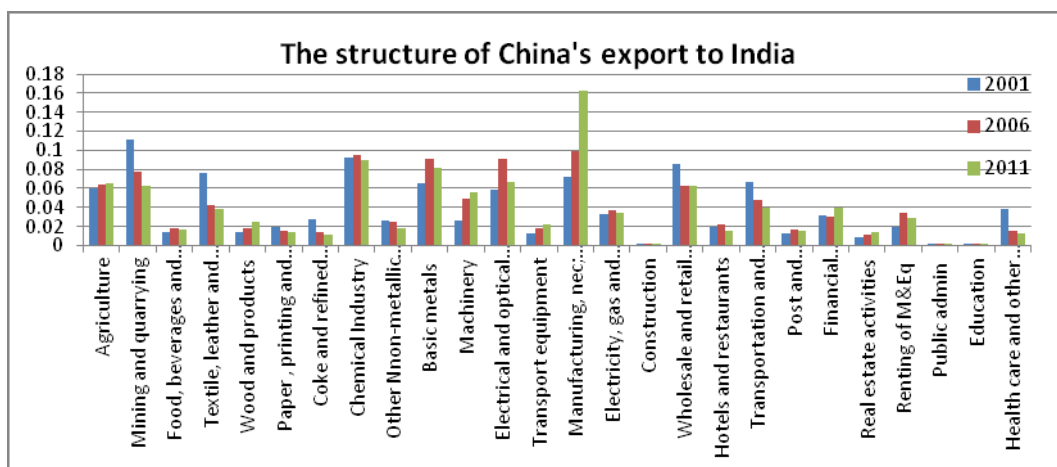


Figure 11



### **3.3 China's final demand contributes the most to Russian value added among BRIC**

Different from the value added export of China to other BRIC countries, China's import or final demand contributions to other BRIC countries are still concentrated on resource-based industries and thus heavily from Russia and Brazil.

Figure 12 to 17 shows 2011 China's import from Russia, Brazil and India at 26-sector classification and their structure change through 2001 to 2011. In other word, these are the China's final demand contributions to Russian, Brazilian and Indian each sector's domestic value added. The figures show that China's final demand contributes the most to Russia value added among BRIC and it mainly comes from the Mining and Quarrying sector which accounts for 37.8% of Russian value added export (16.51 billion USD) to China in 2011, which is increased from 10.5% in 2001. On the other hand, the shares of China's value added import from Russia of Basic Metals and Fabricated Metal, Agriculture and Chemical Industries was falling through 2001 to 2011.

In 2011, China's value added import from Brazil is about 27 billion USD, which is the second one after Russia and higher than China's value added export to Brazil. At the same time, the structure is also similar with that of Russia though the Mining and Quarrying sector share is smaller, the Agriculture is getting bigger even higher than that of Mining and Quarrying in 2006 and 2011. Comparing with structure with Russia and Brazil, though total value is smaller, China's value added import from India shows more diversified. The import shares of Mining and Quarrying and

Agriculture are still big, but some other industries like Chemical, Basic Metals and Fabricated Metal and Electrical and Optical Equipment could also have relative big shares with showing increasing trends for the last 2 industries. Another characteristic of China's import from India is that a big part is from services industries including Wholesale and retail trade, Financial Intermediation, Transportation and Warehousing and Renting of M&Eq and Other Business Activities.

Figure 12

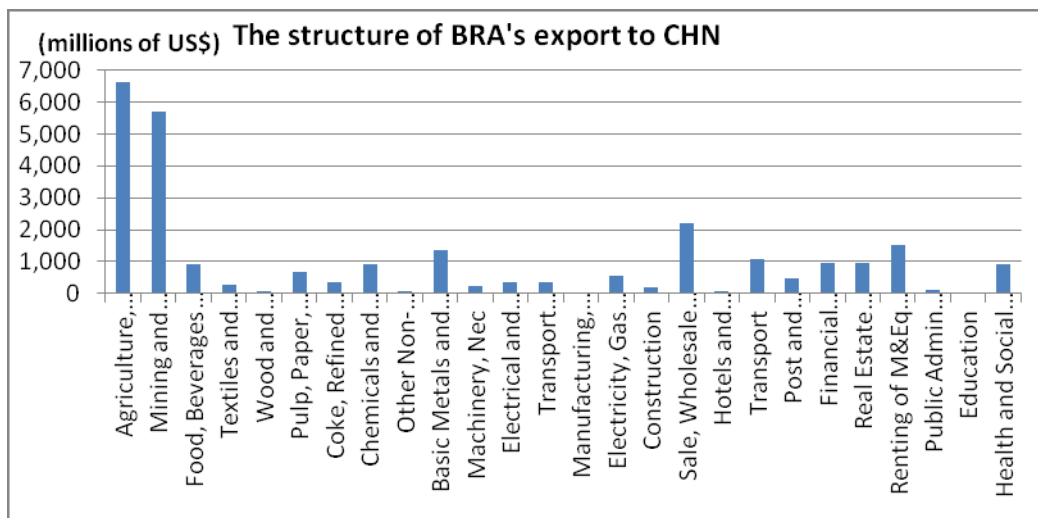


Figure 13

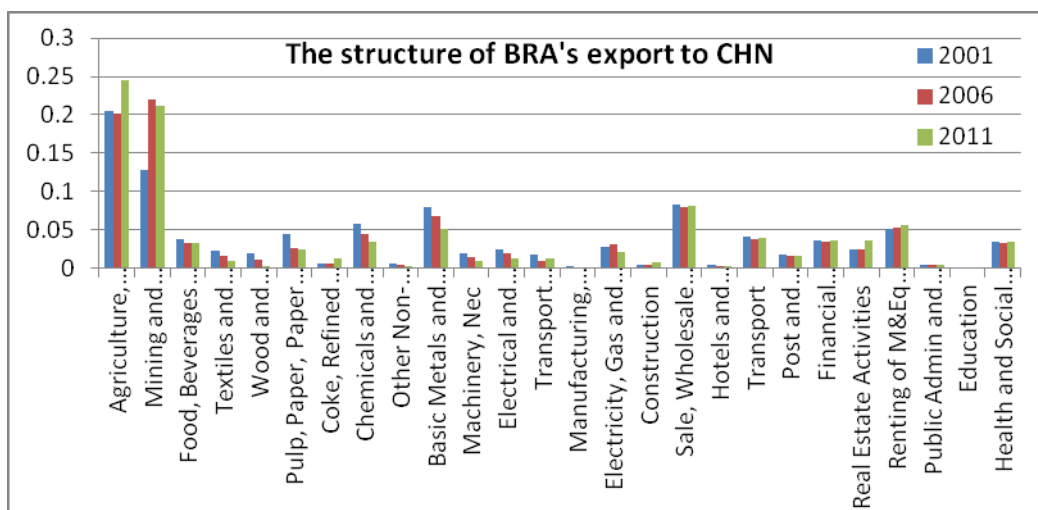


Figure 14

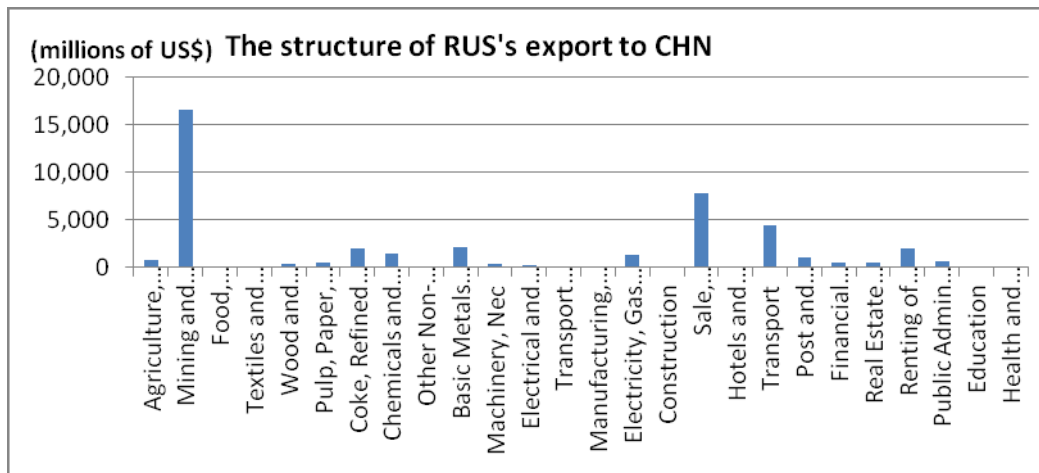


Figure 15

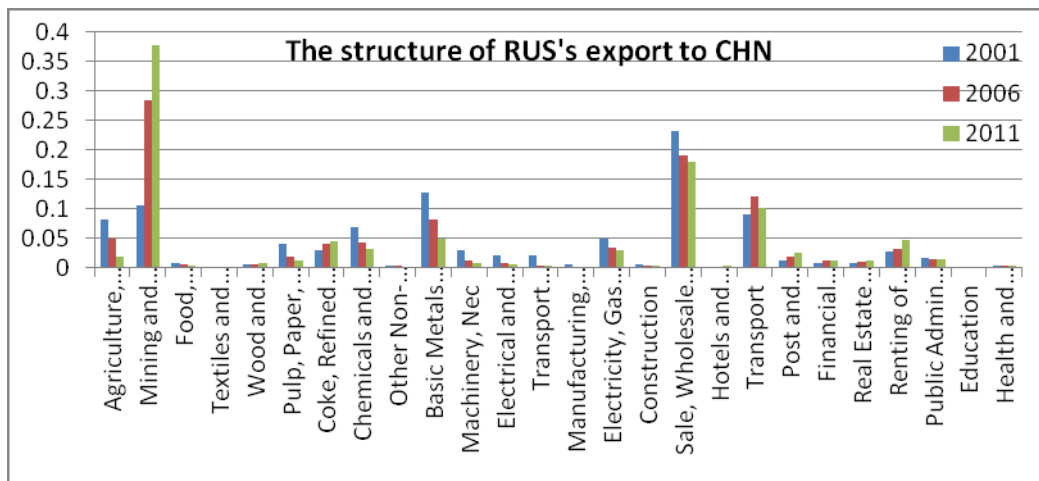


Figure 16

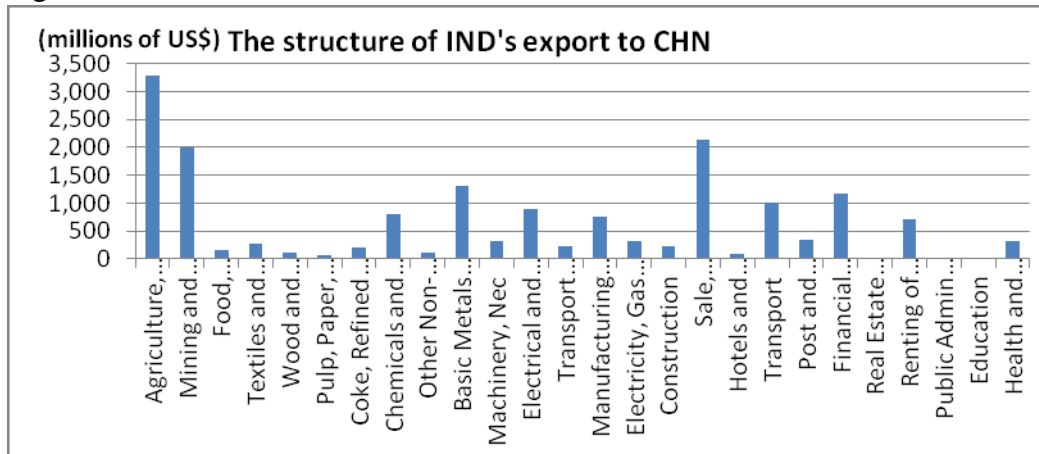
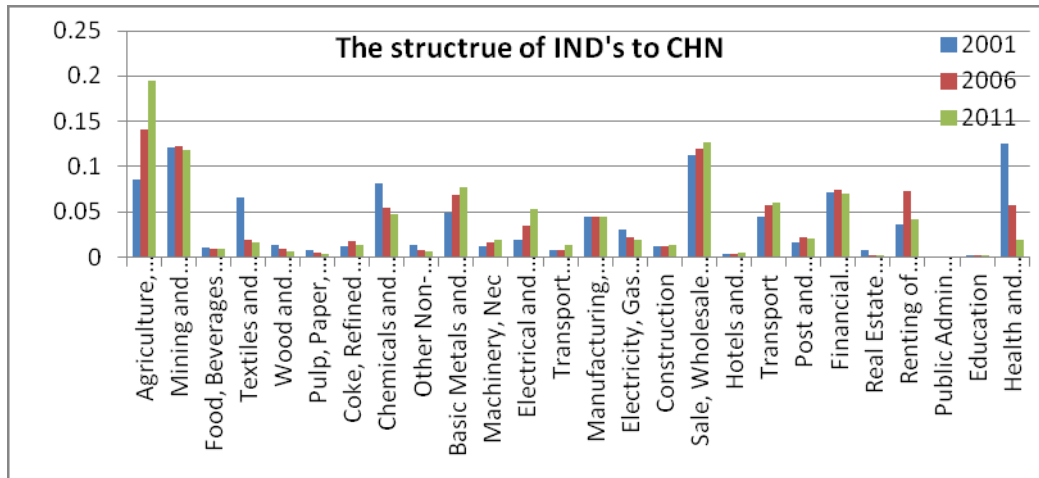


Figure 17



## 5. Conclusion

This paper estimates the economic relation and interdependency among BRIC countries, especially focusing on China with other BRIC members. We follow the GVC perspective, by using the WIOD through 2001-2011, to calculate the international correlation coefficients and how much each country's final demand contribute to the domestic value added among BRIC countries.

China's external trade value with other BRIC countries of both in Customs data and in value added had been increased greatly through 2001 to 2011, but the structures between these two kinds of data are distinguished different. The main China's exports to other BRIC countries are manufacturing products, while the imports are mostly the agriculture, mining, Chemicals and Chemical Products and Basic Metals and Fabricated Metal. Russian final demand contributes the most to China's domestic value added in textile, leather and feather products and agriculture, while Brazilian and Indian final demand contributions come from many manufacturing sectors, but the value are still small. At the same time, the export structure to India is changing from Mining and Quarrying, Textile and Transportation to other more manufacturing

industries.

Different from the value added export of China to other BRIC countries, China's import or final demand contributions to other BRIC countries are still concentrated on resource-based industries and thus heavily from Russia and Brazil. Though total value is smaller comparing with that from Russia and Brazil, China's value added import from India shows more diversified. At the same time, a big part of China's import from India is from the services industries.

The development of BRICs countries' economic and trade relation is not only important for themselves but also for the world. Though the geographical distances are not always close, as major developing economies, the BRICs economic inter-relations has been getting intensive and this trend will be certainly continued. In particular, the BRICs governments and enterprises should realize the importance and chance and try to promote this relation and cooperation. The further strength of the BRICs economic inter-dependency is an internal demand for each BRICs economies, China must try to enlarge the BRICs market by diversifying the export goods in manufacturing industries, that is shifting from so called traditional large exporting sectors to capital intensive and high-tech manufacturing industries. At the same time, China should try to enlarge the import from other BRICs, especially from India. With further strength of the energy and resource cooperation, China should consider how to use BRICs other endorsements like land, labor and other nature resource to promote the economic cooperation.

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