Thesis for the Degree of Master of Arts

Analysis of Trade Structure and the Impact of Exchange Rate Volatility on Exports from Mongolia to China

무역 구조 분석 및 환율 변동이 몽골에서 중국으로의 수출에 미치는 영향

By

GUODING XU

Department of International and Area Studies,

The Graduate School

Pukyong National University, South Korea

August, 2020

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Advisor: Prof. Dr. Utai Uprasen

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A thesis submitted in partial fulfillment of the requirements for the degree of Master of Arts

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A dissertation

by

GUODING XU

Approved by:

Prof. Dr. Jonh-Hwan Ko (고종환 교수님)

_____

(Chairman)

Prof. Bub-Mo Jung (정법모 교수님)

_____

(Member)

Prof. Utai Uprasen (우프라센 우타이 교수님)

_____

(Member)

August, 2020

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GUODING XU

Department of International and Area Studies

The Graduate School of Humanities and Social Sciences

Pukyong National University

Abstract

Mongolia-China economic and trade relations have experienced different stages of development along with changes in international political and economic relations. China has become Mongolia's largest trading partner and largest investor for more than a decade. Mongolia is rich in natural resources. Since 1996, it has attracted a large amount of foreign capital investment and a large number of raw material exports. Tugrik has depreciated faster. Therefore, the exchange rate has fluctuated significantly. China is Mongolia ’s largest trading partner, 90 percent of Mongolia ’s exports of raw materials go to China, and China mainly exports manufacturing products such as consumer goods and machinery goods go to Mongolia. The commodity structure of bilateral trade is relatively single. The exchange rate volatility will undoubtedly affect the bilateral trade between Mongolia and China. Therefore, studying the trade structure and the impact of bilateral exchange rate volatility between

Mongolia and China will further promote economic cooperation between the two sides. Based on the previous research literature, the author analyzes at the industry level, making the bilateral trade structure and impact of exchange rate volatility more specific to product classification. The panel data from 1997 – 2017 and the top 20 industries ranked in total trade will be applied in the research. At the end of the paper, policy recommendations are contributed to the bilateral trade development between Mongolia and China.

Keywords: Bilateral Trade, RCA Index, TCI Index, Exchange Rate Volatility, Industry Level Analysis, China – Mongolia

무역 구조 분석 및 환율 변동이 몽골에서 중국으로의 수출에 미치는 영향

GUODING XU

부 경 대 학 교　대 학 원　국제지역학 학과

한글 요약

국제 정치 경제 관계의 변화에 따라 중국 – 몽골경제 무역 관계는 다른 발전 단계를 거쳤다. 십여 년 동안 중국은 이미 몽골의 가장 큰 무역 파트너이자 가장 큰 투자국이 되었다. 몽골은 천연 자원이 풍부하며 1996 년 이후 많은 외국 자본 투자와 많은 원자재 수출을 유치했다. 중국은 몽골의 최대 무역 파트너이며 몽골 원료의 90 퍼센트가 중국으로 수출되는 반면, 몽골에 대한 중국의 주요 수출은 소비재 및 기계 제품과 같은 제조업 제품이고 양자 무역의 상품 구조는 비교적 단일하다. 각국의 통화 정책 개혁에 따라 환율 변동이 국제무역에 큰 영향을 미치고 있고 환율 변동이 중-몽 양자 무역에도 영향을 미칠 것이라는 점은 의심의 여지가 없다. 이에 따라 중-몽 양자간 무역 구조 및 환율 변동의 영향에 대한 연구는 양측의 경제 협력을 더욱 촉진할 것으로. 보인다. 선인 연구 문헌을 바탕으로 업종별로 분석해 양자 간 무역 구조와 환율 변동의 영향을 제품 분류까지 구체화했다. 연구에서는 1997-2017 년의 패널 데이터와 무역 총액 상위 20 개 업종을 응용할 것이다. 논문의 마지막에 중몽 양자 무역 발전에 기여하는 정책을 건의한다.

키워드: 중-몽 양자 무역, RCA 지수, TCI 지수, 환율변동, 산업 차원 분석, 중국 – 몽골

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Contents

Acronyms

ASEAN	Association of South East Asia
EU	European Union
FE	Fixed Effect
IMF	International Monetary Fund
MNT	Tugrik
RE	Random Effect
RMB	Renminbi
SITC	Standard International Trade Classification
UN Comtrade	United Nations Commercial Trade
USD	United States Dollar
WB	World Bank
WITS	World Integrated Trade Solution

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Chapter I INTRODUCTION

1.1 Background of Mongolia – China bilateral trade

The borderline between Mongolia and China is 4,710 kilometers long, which is the country with the longest borderline with China. It has become one of the China's important neighbors. August 21, 2014, Chinese President Xi Jinping visited Mongolia and held talks with Mongolian President Elbegdorj, promoting bilateral relations to a comprehensive strategic partnership, while the two countries signed 26 cooperation documents, The content covers various fields, such as railway, education, economy, trade, justice, energy, and the strengthening of bilateral political relations further promoted the development of Mongolia- China economy and trade[1]. Mongolia- China economic and trade relations with the changes in international political and economic relations have undergone different stages of development. China has been Mongolia's largest trading partner and largest investor for more than a decade. Mongolia, as an important neighbor of China, has abundant mineral resources and has become a major import source of such products in China. Mongolia- China economic and trade relations with the changes in international political and economic relations have undergone different stages of development, from active cooperation in the 1950s to the breakdown of Sino-Soviet relations in the 1960s. The relationship between Mongolia- China was stagnant, and it gradually recovered in the mid-to-late 1980s until the prosperity of the

[1] The State Council of China http://www.gov.cn/.

1990s. China has been Mongolia's largest trading partner and largest investor for more than a decade. Mongolia, as an important neighbor of China, has abundant mineral resources and has become a major import source of such products in China. In 1998, the bilateral trade volume between Mongolia and China was only 243 million US dollars. In 2008, it reached 2.43 billion US dollars, of which Mongolia- China exports increased from 63.4 million US dollars to 908 million US dollars during 2013-2017, the total foreign trade volume of Mongolia was 48.88 billion US dollars[2]. Among them, Mongolia- China trade totaled 29 billion US dollars, accounting for 59.3 percent. In the same period, Mongolia's total GDP was about 59.23 billion US dollars, and the contribution rate of bilateral trade between Mongolia and China to Mongolia's economic development was as high as nearly 50 percent.

It is a period of the rapid development of bilateral trade between China and Mongolia. Since 1999, China has surpassed Russia to become the first exporting partner of Mongolia[3]. In 2017, Mongolia's exports to China account for 85 percent of Mongolia's total export trade, and imports and exports accounted for 54 percent of the total. However, China's export to Mongolia accounted for less than 1 percent of China's total exports, and Mongolia ranked only in number 102 among Chinese export partners, and for total trade volume, Mongolia ranked in number 64, <Table 1.1-1> and <Table 1.1-2 >.

[2] UN Comtrade data base. Retrieved from http://comtrade.un.org/data/

[3] Embassy of the People's Republic of China in Mongolia. Retrieved from http://mn.china-embassy.org/eng/

Table 1.1-1 China’s major trade partners (2017)

China's major trade partners (2017)											
Export				Import				Total			
NO	Country	Value(ten million USD)	%	NO	Country	Value(ten million USD)	%	NO	Country	Value(ten milion USD)	%
1	United States	43,032.8	19.00%	1	Korea, Rep.	17,755.3	10.40%	1	United States	58,477.0	14.70%
2	Hong Kong, China	27,921.1	12.30%	2	Japan	16,579.4	9.70%	2	Japan	30,305.3	7.60%
3	Japan	13,725.9	6.10%	3	United States	15,444.2	9.00%	3	Hong Kong, China	28,652.8	7.20%
4	Korea, Rep.	10,270.4	4.50%	4	Germany	9,694.0	5.70%	4	Korea, Rep.	28,025.7	7.10%
5	Vietnam	7,161.7	3.20%	5	Australia	9,500.9	5.60%	5	Germany	16,807.5	4.20%
6	Germany	7,113.4	3.10%	6	Brazil	5,885.7	3.40%	6	Australia	13,644.7	3.40%
7	India	6,804.2	3.00%	7	Malaysia	5,442.6	3.20%	7	Vietnam	12,199.2	3.10%
8	Netherlands	6,713.2	3.00%	8	Vietnam	5,037.5	2.90%	8	Malaysia	9,613.8	2.40%
9	United Kingdom	5,671.4	2.50%	9	Thailand	4,159.6	2.40%	9	Brazil	8,780.8	2.20%
10	Singapore	4,501.9	2.00%	10	Russia	4,139.0	2.40%	10	India	8,438.8	2.10%
Top10		132,916	58.70%	Top10		93,638.3	54.70%	Top10		214,945.5	54.10%
102	Mongolia	123.6	0.50%	43	Mongolia	516.7	0.30%	61	Mongolia	640.3	0.20%
ROW		93,297.5	40.80%	ROW		76,987.4	45.00%	ROW		181,893.6	45.80%
World		226,337.1	100.00%	World		171,142.4	100.00%	World		397,479.4	100.00%

Source: Calculated by author using data from World Integrated Trade Solution

Table 1.1-2 Mongolia's major trade partners (2017)

Mongolia's major trade partners (2017)											
Export				Import				Total			
NO	Country	Value (million USD)	%	NO	Country	Value (million USD)	%	NO	Country	Value (million USD)	%
1	China	5,266.7	85.30%	1	China	1,411.5	32.60%	1	China	36,407.8	53.90%
2	United Kingdom	658.6	10.70%	2	Russian	1,219.1	28.10%	2	Russian	10,614.3	15.70%
3	Russian	61.1	1.00%	3	Japan	360.1	8.30%	3	United Kingdom	3,034.4	4.50%
4	Italy	43.3	0.70%	4	United States	208.5	4.80%	4	Japan	2,799.2	4.10%
5	Singapore	21.9	0.40%	5	Korea, Rep.	197.5	4.60%	5	United States	2,748.8	4.10%
6	Japan	14.8	0.20%	6	Germany	128.3	3.00%	6	Korea, Rep.	2,450.3	3.60%
7	Korea, Rep.	11.4	0.20%	7	Poland	48.3	1.10%	7	Germany	1,323.5	2.00%
8	Hong Kong, China	9.9	0.20%	8	Italy	45.3	1.00%	8	Canada	862.1	1.30%
9	Germany	9.9	0.20%	9	Malaysia	40	0.90%	9	Italy	748	1.10%
10	Iran	8.3	0.10%	10	Vietnam	39.8	0.90%	10	Singapore	500.7	0.70%
Top10		6,105.7	98.90%	Top10		3,698.6	85.40%	Top10		61,489.1	91.10%
ROW		66.5	1.10%	ROW		633.7	14.60%	ROW		6,002.1	8.90%
World		6,172.2	100.00%	World		4,332.2	100.00%	World		67,491.2	100.00%

Source: Calculated by author using data from World Integrated Trade Solution

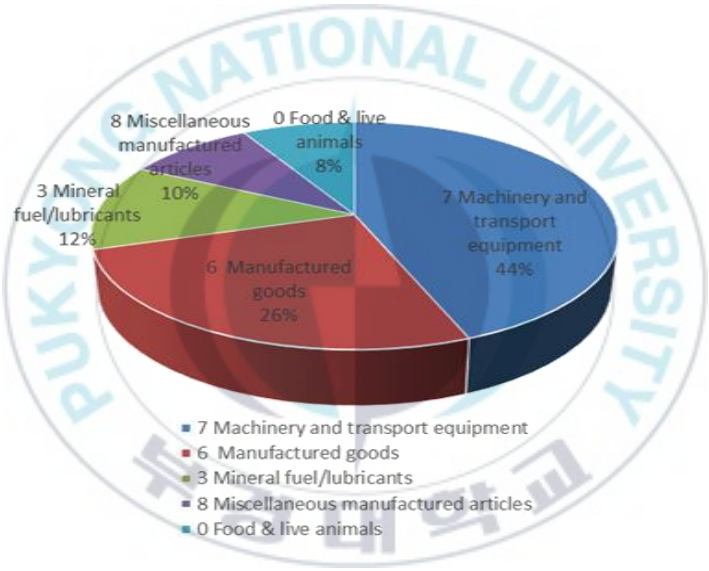
In 2017, Mongolia's exports to China total flows achieved 516,731 million US dollars[4], of which the main export commodities were concentrated in SITC 3, SITC 2, and SITC 0, which accounted for 50 percent, 46 percent and 3 percent. They account for 85 percent of the total exports of Mongolia, see <Figure 1.1-1 > and <Figure 1.1-2>. The products of the SITC 3 and SITC 2 are all mineral products, indicating that Mongolia is abundant in natural resources which has exported a large number of

[4] The data source from China's National Bureau of Statistics

Retrieved from http://www.stats.gov.cn/tjsj/

primary products such as ore fuel. And the other major products are animal husbandry-related products. Mongolia is rich in mineral resources, but its industry development is backward. China's industry is more developed than Mongolia and is rich in industrial products. It can provide electromechanical processing, cloth and food processing products for Mongolia. In contrast, China's economy is developing at a high speed, but there is a large supply gap for mineral resources and animal husbandry.

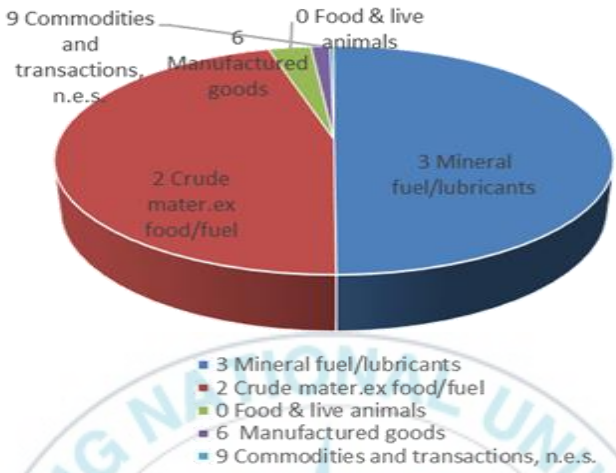
Figure 1.1-1 Structure of imported good of Mongolia from China[5] (2017)



Source: Calculated by author using data from World Integrated Trade Solution

[5] The data source from World Integrated Trade Solution. Retrieved from https://wits.worldbank.org/

Figure 1.1-2 Structure of exported goods of Mongolia to China (2017)



Source: Calculated by author using data from World Integrated Trade Solution

The inter-industry trade characteristics between Mongolia and China are remarkable, which also reflects the vertical division of trade between Mongolia and China, and the trade development between the two countries is still at a lower level[6].

With the economic development of Mongolia and China, the exchange rate policies of the two countries have also changed significantly. In 1973, Mongolian Tugrik was linked to the Soviet Ruble (Soviet Union currency) and depreciated by the same amount[7]. In March 1973, the Mongolian government began to adopt an appropriate management of an effective floating exchange rate system. After China

[6] Ding, Q.Y., (丁侨一), 2016, The trade complementarity analysis of Sino-Mongolia-Russia economic corridor (中蒙俄经济走廊的贸易互补性分析). *Economic Research Guide*, Vol 26, pp 140-142.

[7] Central Bank of Mongolia. Retrieved from https://www.mongolbank.mn/eng/

joined the WTO in 2001, it also reformed its exchange rate system in 2005[8]. With the economic globalization, trade communication between two countries is increasing, and the trade activities between Mongolia and China are becoming more frequent. As a medium of currency exchange between countries, exchange rate is also a bridge of national trade activities, which is very important in international trade.

Mongolia as a developing country, its export trade is dominated by natural resource-intensive products, while consumer goods and production capital depend on imports. From the perspective of its share of world trade, it belongs to a small trading country. China is a large manufacturing country, and there is a large demand for industrial raw materials. Therefore, primary products such as mineral resources and agricultural and sideline products are the commodities that Mongolia mainly exports to China, while imports from China are mainly commodities such as consumer goods and machinery. This relatively simple bilateral trade structure is susceptible to bilateral exchange rate volatility.

1.2 Objectives of the research and research questions

Therefore, the objective of this paper is: 1. to further study the trade structure between Mongolia and China; 2. investigate the impact of exchange rate volatility on exports from Mongolia to China. First of all, the author will use the trade index calculation to analyze the trade structure between Mongolia and China. The trade index is studied by calculating the trade data and standardizing it to obtain different trade

[8] The People's Bank of China. Retrieved from http://www.pbc.gov.cn/

indices. To measure the bilateral trade structure between the two countries, this standardized analysis is easy to find a comparative analysis of trade characteristics and trade between the two countries. In this paper, the revealed comparative advantage index (RCA index) and trade complementarity index (TCI index) are used to analyze the comparative advantages between the two countries' products, and trade complementarity respectively. Then in order to study how the exchange rate volatility affects the export from Mongolia to China, the author follow Bahmani and Harvey (2017)[9], calculate exchange rate volatility as the standard deviation of the change for 12 monthly bilateral real exchange rates in the year. Then applied the gravity model to estimate the regression. In this part of the study, in order to further study the exchange rate affect exports on both overall export and specific industries, the author will use aggregate data and disaggregated data for estimation from 1997 to 2017.

1.3 Structure of study

This study includes six subsequent chapters. The first chapter introduces general information about Mongolia-China economic and trade relations and explains why these two countries were chosen for observation. In addition, information on the research objectives and research structure is also introduced.

[9] Bahmani Oskooee, M. and Harvey, H., 2017, "Exchange rate volatility and its impact on commodity trade flows between Singapore and Malaysia", *Journal of Economic Development*, Volume 42-1, pp.17-33.

The second chapter is dedicated to the Mongolian economy. Including the development process, the relationship between her and trading partners.

Chapter III outlines the bilateral political and economic relations between Mongolia and China. This includes the development of economic cooperation between the two sides, the bilateral trade structure of commodities, and the fluctuation of bilateral exchange rates.

In the following chapter IV is the analysis of trade structure, the main international trade theory been employing in the research. The author uses the RCA and TCI trade indexes to analyze the trade structure between Mongolia and China, which includes the trade theory and literature review for relative studies, and finally draws a conclusion for the trade structure analysis.

In chapter V, the author investigates whether the volatility of the Mongolia-China exchange rate affects the overall exports and the top 20 export products mainly use the trade gravity model and compare the results. Then, according to the literature review combined with the trade pattern between Mongolia and China, the results were analyzed and the conclusion of this chapter was given.

The final part of Chapter VI is the conclusion and policy recommendations. This chapter summarizes all findings and their brief explanations. On the basis of the conclusion, policy recommendations will be made to the two countries.

Chapter II MONGOLIA'S ECONOMY

2.1 Economic overview of Mongolia

Before the 1990s, Mongolia was influenced by the Soviet Union for a long time, and its economic development was highly dependent on the Soviet Union. Since 1991, Mongolia has transitioned from a planned economy to a market economy[10]. The economy has experienced rapid development. The average annual growth rate from 2001 to 2004 was about 6.3 percent. In 2004, the economic growth rate was as high as 10.6 percent, the highest value since 1990. Since then, this high-speed growth trend has continued. From 2005 to 2008, the average annual growth rate was about 8.2 percent. In 2008, the financial crisis that spread to all of the world has hit the Mongolian economy. Since the fourth quarter of 2008, due to the financial crisis, the Mongolian economy has experienced a sharp decrease in foreign trade, high inflation rates, and turbulence in the foreign exchange market. In 2008, the inflation rate was as high as 22.1 percent. This has caused a serious impact on the resource-export-oriented Mongolian economy. Statistics from the Mongolian Statistics Bureau show that in 2009 Mongolia 's GDP was approximately 6.7 billion US dollars, and a per capita GDP of approximately 1,537 US dollars[11], the growth rate was negative[12]. By the end of 2009,

[10] Ding G.W, 2016, "中蒙俄贸易现状及其潜力分析" [Analysis on the trade determinants between China-Russia-Mongolia], *Siberian Studies*, Vol.43-5 pp. 45-53.

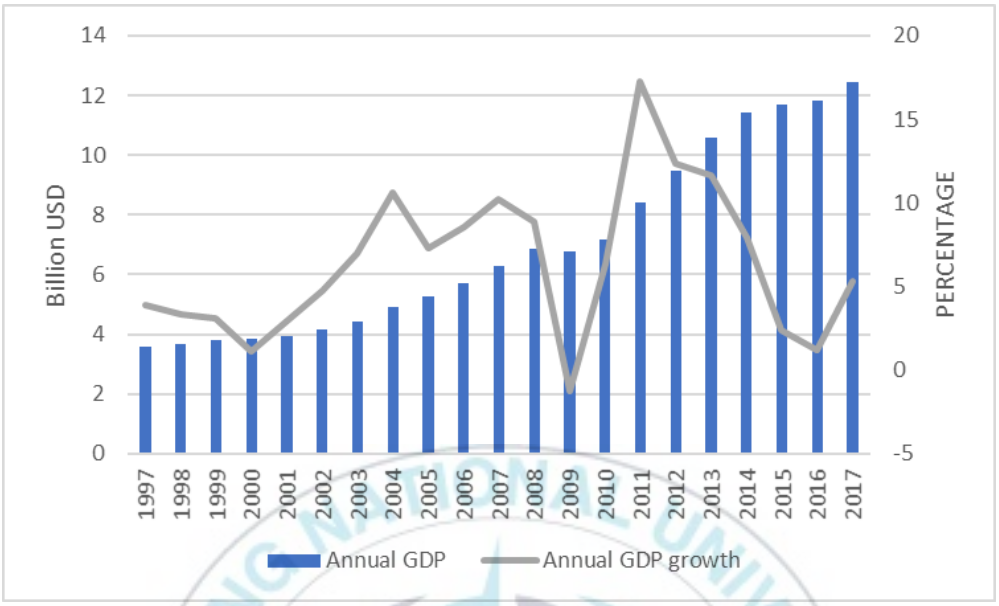
[11] The statistic from National Statistical Office of Mongolia. Retrieved from http://www.en.nso.mn/index

[12] Ding, Q.Y., 2016, "中蒙俄经济走廊的贸易互补性分析" [The trade complementarity analysis of Sino-Mongolia-Russia economic corridor] *Economic Research Guide*, Vol 26, pp. 140-142

the prices of copper, gold, coal, and other factors in the international market had gradually recovered, and the export volume of mineral products in Mongolia had begun to increase significantly, which overall drove its economic growth. In 2010, Mongolia's economic growth rate recovered to 6.4 percent. Since then, Mongolia's economy has entered a stage of rapid development. The GDP is 7.19 billion US dollars, and the GDP growth rate in 2011 was 17.2 percent, becoming one of the fastest-growing economies in the world. As showing <Figure 2.1-1>, however, since the end of 2012, due to the slowdown of China's economic growth and the continued downturn in the international commodity market, Mongolia's economic growth has been affected, and economic growth has slowed significantly[13]. Since 2014, Mongolia's economy has experienced a sharp decline and has fallen into a severe crisis. In particular, changes in international mineral resource prices and raw material prices. The Mongolian economy's economic growth entered a downward channel in 2014, and the annual economic GDP growth was only 7.8 percent. In 2015, the GDP growth rate was only 2.5 percent, a significant decrease of 5.3 percentage points. This data is far from the rapid growth in 2011 and 2012. In 2015, the Mongolian economy failed to continue the previous miracle. In 2016, Mongolia's economic growth was only 1.4 percent, and economic development fell into recession.

[13] Pan, Y.J., 2016, 中蒙双边贸易的实证分析及潜力测算--基于贸易引力模型 [Empirical Analysis and potential estimates on Sino-Mongolian bilateral trade on the Gravity Model of Trade], Dept. of Chinese Economy Studies, Jinan University.MA thesis.

Figure 2.1-1 Annual GDP and GDP growth of Mongolia, 1997 – 2017 [14]



Source: World Bank Database

In the current economic development of Mongolia, foreign trade activities occupy a very important position. At the same time, the structure of Mongolia 's export products are characterized by a single concentration. Mongolia is rich in natural resources, which brings huge opportunities for Mongolia's economic development. The mineral resource export industry represented by raw coal and copper ore occupies a major position in Mongolia's export structure. For a long time, the reality is that the average income level of the public is not high and the budgetary income of the Mongolian government is low determines that Mongolia needs to rely on foreign exports to improve economic development. In the context of the sluggish domestic market, the weak consumption power of residents and the lack of government

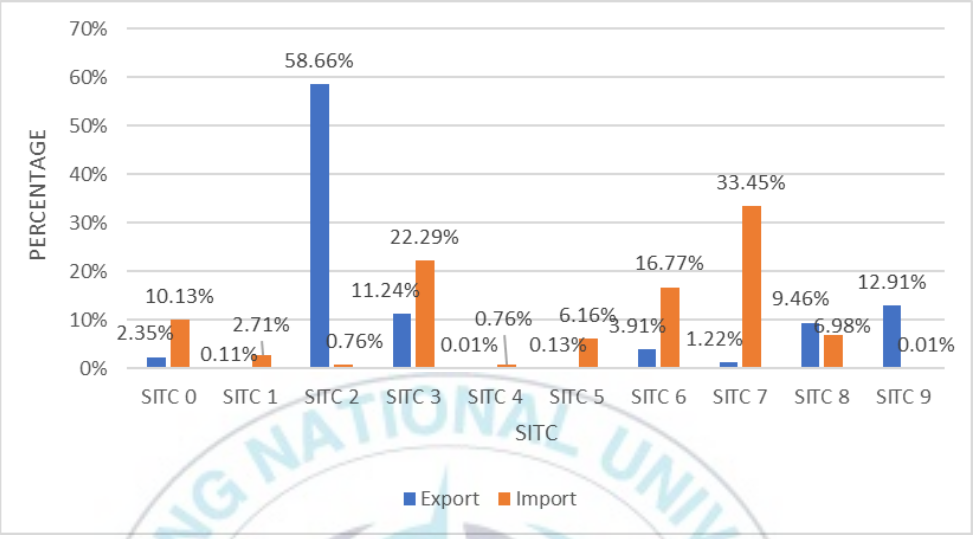
[14] World Bank database. Retrieved from http://worldbank.org/

purchasing power, the development of the national economy is even more dependent on exports[15]. Due to historical economic reasons and lack of labor, Mongolia's manufacturing industry is not developed, and it is difficult to rely on technology or cost advantages to export to obtain its own growth, < Figure 2.1-2> .

Therefore, the use of its rich reserves of coal, copper ore and other mineral resources, while exporting these resources while gaining foreign investment, has brought important impetus to the development of Mongolia's economy and has also become a path for Mongolia's export trade development. The status of industries based on natural resources, and animal husbandry in the national economy continues to increase, becoming the pillar industry of its economy, which has promoted Mongolia's economic development into a period of rapid growth. Between 1997 and 2017, the SITC 0, SITC 2 and SITC 3 total accounted for 72 percent of the total exports. Due to Mongolia's excessive dependence on foreign trade and its single industrial structure, which mainly depends on mineral resources and animal husbandry exports, its economy is very vulnerable to changes in the international economy.

[15] Zhou, M.F., Chen, X.X., Deng, H.Y., Hu, R.F., 2013, “Mongolia’s economy development and China-Mongolia relationship”, *财经理论研究*, pp 96-105.

Figure 2.1-2 The average ratio of SITC classification to the Mongolian total export and import (1997-2017)



Source: Calculated by author using data from World Integrated Trade Solution

Since 2013, copper prices in the international market have declined. In 2013, copper prices fell to the lowest prices since the financial crisis. The export volume and prices of copper mines have "fallen together", which limited the increase in total foreign trade in 2013[16]. In 2014, due to the significant increase in the export volume of copper ore and crude oil, Mongolia's exports have increased. In 2016, there were 127 countries engaged in foreign trade with Mongolia. The total foreign trade was 820 million US dollars, and the export value was 480 million US dollars. The export value of copper ore ranked first among the trade, accounting for 43 percent of Mongolia 's total export value. Despite the impact of the reduction in total coal imports in countries

[16] Xu, Y.Y., 2018, "Research on the calculation of the bilateral trade cost and the influence factors between Mongolia and China", Inner- Mongolia University of Finance and Economy, M.A thesis

such as China, Mongolia ’s total coal export output still accounted for 20 percent of Mongolia ’s exports in 2016, followed by iron ore exports and crude oil the proportion of exports is also large. By summing up the proportion of exports of coal, copper ore, iron ore, crude oil, gold and zinc ore, mineral resources products account for up to 90 percent of Mongolia ’s exports. Mongolia's export trade is mainly based on mineral raw materials and primary products and livestock products. Although the export volume has increased, the added value of the products is lower and the income growth is limited. This means that once the export of mineral resources shrinks, Mongolia's total export value will not only show a trend of reduction, but will also show a collapse. In fact, the formation of this export structure has a great relationship with the economic structure of Mongolia ’s long-term development of the processing and manufacturing industry, <Table 2.1-1 >. Foreign investors mainly invest in mineral resources-related industries. Mongolia has long lacked the technology, equipment and abundant labor resources to develop manufacturing in history. Coupled with harsh weather conditions, high investment costs of fixed assets such as factory buildings and weak infrastructure conditions such as transportation, it is difficult for Mongolia's manufacturing industry to develop effectively, thus forming the current situation. On this basis, the large concentration of foreign direct investment in the resource industry has also brought about the phenomenon of resource mining and export industry blowouts, which has concentrated Mongolia's domestic resources and manpower in the field of resource mining. In this context, Mongolia's export structure has to focus on low value-added resource products.

Table 2.1-1 The Top 5 exports and imports of Mongolia in 2016, million USD

Export to the world			Import from the world		
Metalliferous ores	2,108.65	43.1%	Petroleum, petroleum products	540.74	16.2%
Coal, coke and briquettes	973.07	19.9%	Road vehicles	400.62	12.0%
Gold, non-monetary	758.41	15.5%	Electrical machinery	156.06	4.7%
Petroleum, petroleum products	337.18	6.9%	Telecommunication	139.64	4.2%
Textiles fibres	262.97	5.4%	Specialised machinery	138.66	4.2%
Top 5	4,440.28	90.7%	Top 5	1,375.72	41.3%
Others	455.65	9.3%	Others	1,957.91	58.7%
Total exports	4,895.92	100%	Total imports	3,333.63	100%

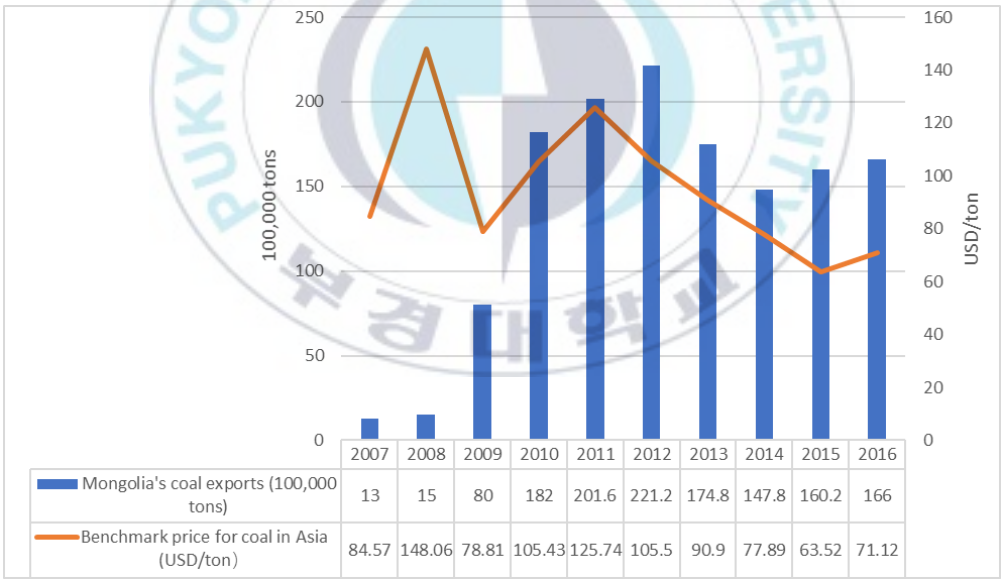
Source: Calculated by author using data from World Integrated Trade Solution

There are more than 80 kinds of mineral resources in Mongolia, such as coal, copper, tungsten, quartz, gold, silver, aluminum, tin, iron, lead, zinc and petroleum. Oil, natural gas, gold and copper are among the world's top ten reserves. There are more than 250 coal mines with reserves of about 50-152 billion tons[17]. Besides, the reserves of mineral, iron, phosphorus, copper, zinc, gold, silver, uranium and petroleum are also quite rich. By 2016, among the export structures of Mongolia, the income of coal accounted for the highest proportion, but the export scale of copper ore grew the fastest. In 2015, the Mongolian copper ore exports a historic leap, the size of the rose from 600,000 tons to 1.4 million tons, and become the world's copper ore exports the country with the fastest speed increase also became the highest export gross tonnage. Compared

[17] Mineral Resources Authority of Mongolia. Retrieved from https://zasag.mn/en/m/mra .

with the main exporter of copper ore such as Indonesia, Chile. Mongolia's total copper ore deposits is very huge. In the past decade, gold mining has increased tenfold, copper and molybdenum mining has increased by 30 percent, and fluorine concentrate mining has increased by 14.6 percent. The amount of coal mined increased to 288.4 billion tons in 2011. These mineral products are exported to foreign markets based on meeting Mongolia's domestic needs. Mongolia accounts for 0.6-1.1 percent of the world's total production of copper and molybdenum concentrates.

Figure 2.1-3 Benchmark price for coal in Asia（USD/ton）[18] and Mongolia's coal exports (100,000 tons) (2007-2016)



	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Mongolia's coal exports (100,000 tons)	13	15	80	182	201.6	221.2	174.8	147.8	160.2	166
Benchmark price for coal in Asia (USD/ton)	84.57	148.06	78.81	105.43	125.74	105.5	90.9	77.89	63.52	71.12

Source: International Energy Agency

[18] International Energy Agency. Retrieved from https://www.iea.org/ .

As the <Figure 2.1-3> shows, the trend of Mongolia's coal export is basically similar to that of international coal prices. Influenced by the financial crisis and the fall in international commodity prices, Mongolia's coal export once fell into a downturn in 2008 and 2012, but the overall trend is to increase.

Mongolia's total export of coal began to rise sharply after 2008. In terms of the overall trend, Mongolia's coal export has gone through two stages. From 2007 to 2012, Mongolia's total coal export increased significantly, while from 2012 to 2016, Mongolia's total coal export on the whole showed a trend of decline. According to many scholars research, it has to do with the Chinese market weakness, but it is worth noting that even Mongolia's coal exports between 2012-2016 presented the overall downward trend, its relative to the total in 2008 is a leap of growth, so relative to 2008, even if the total decline, Mongolia's coal exports are still at a higher stage. Specifically, Mongolia's coal export trade in recent years can be further divided into four stages. From 2008 to 2010, Mongolia's coal resources gained a huge export market due to the huge increase in Chinese market demand, which led to a large demand for coal. Mongolia's coal resources increased by more than 10 times. Between 2010 and 2012, Mongolia's total coal exports began to rise slightly, but the total is still rising. From 2012 to 2014, Mongolia's coal export declined, but by 2016, the situation had recovered to a slow recovery. This trend of change and China's economic development has a high correlation. Like copper ore, Mongolia's coal exports are highly dependent on the Chinese market, and China's imports of coal are directly affected by changes in China's domestic economic structure.

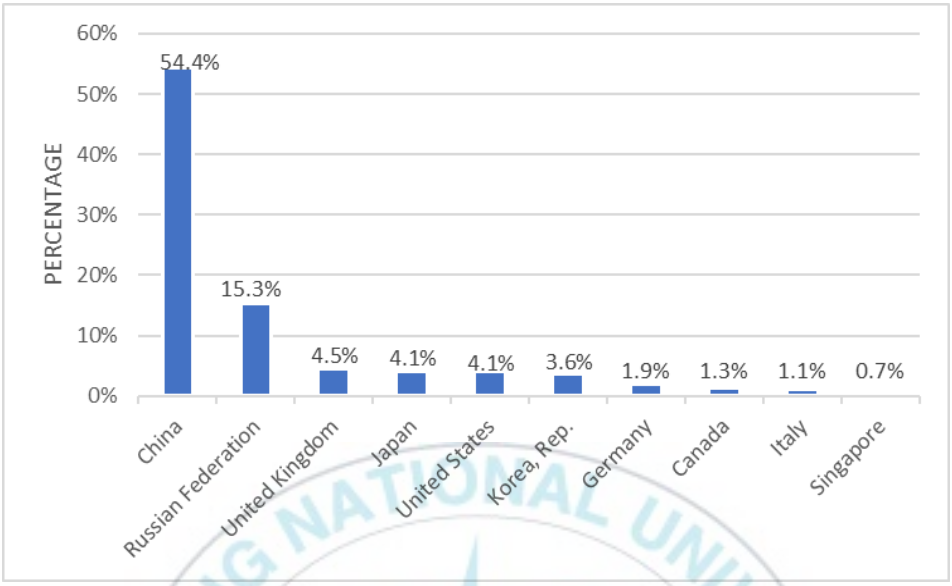
2.2 Mongolia’s trading partners

With a series of market reforms and a major push for economic cooperation between countries, Mongolia's export markets are largely limited to its two neighbors due to its geographical location. Mongolia has also failed to establish closer economic ties with other countries because of its underdeveloped infrastructure and inadequate roads and railways. Therefore, Mongolia pursues the policy of "third neighbor policy", the essence of which is to build closer political ties with other powerful countries to gain their support[19]. It is another important factor in strengthening foreign trade in foreign investment and economic cooperation. Similarly, there is a strong public desire to expand and develop diplomatic relations with other countries, particularly economic cooperation. At the same time, Mongolia formulated the economic strategy of "mining country"[20], hoping to attract a large number of foreign investors in Mongolia with the help of its rich mineral resources. China, Russia, the United States, Canada, Australia, Japan, Europe, South Korea and other countries and regions have entered the Mongolian resource development market, and the investment of foreign capital has played a very important role in the economic development of Mongolia. Particularly, China, as a close neighbor of Mongolia, has been playing an increasingly important role in Mongolia's foreign trade in recent years. On the one hand, China has overtaken Russia as the largest trading partner, <Figure 2.1-1 > and <Figure 2.2-2>. On the other hand, China has become the largest importer of coal and copper ore, Mongolia's most important exports.

[19] Shen, L., 2013, “Mongolian Third Neighbor Policy”, *Contemporary World*, Vol 4, pp. 45-48.

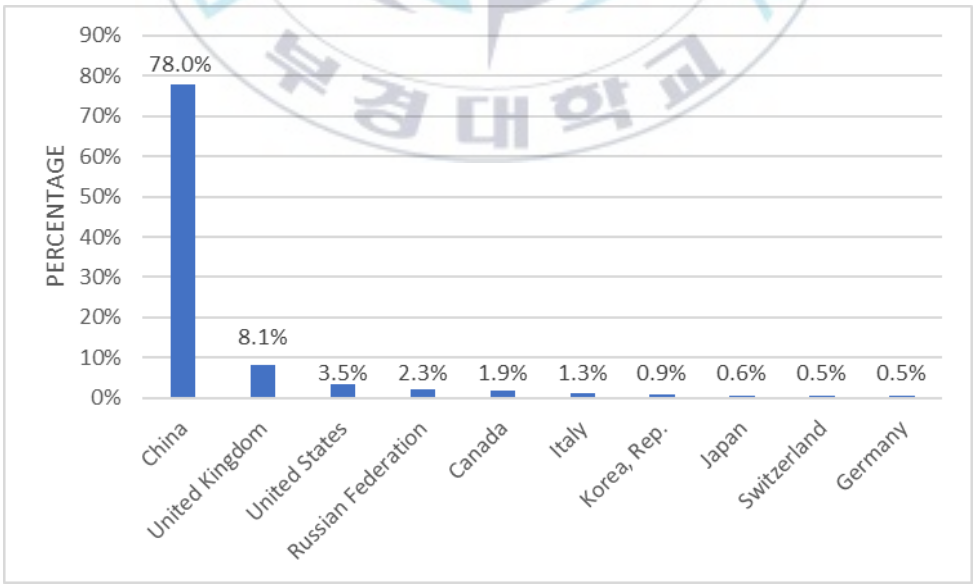
[20] Zhang, Z.Y. and Li L.,2006, “Ore industry in Mongolia”, *World Nonferrous Metals*, Vol 4, pp. 34-38.

Figure 2.2-1 The major trading partner of Mongolia by total trade (1997-2017)



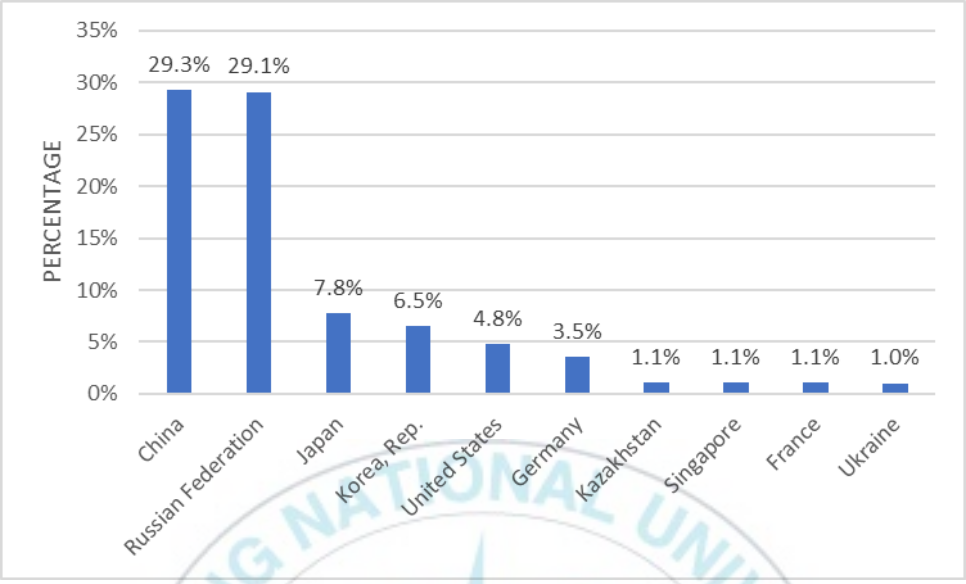
Source: Calculated by author using data from World Integrated Trade Solution

Figure 2.2-2 Mongolia's major export destinations (1997-2017)



Source: Calculated by author using data from World Integrated Trade Solution

Figure 2.2-3 Major import origins for Mongolia's market (1997-2017)



Source: Calculated by author using data from World Integrated Trade Solution

As is shown in the <Figure 2.2-3 >, from 1997 to 2017, Mongolia's most important partner country in import and export trade was China, accounting for about 50 percent of the total trade volume, and 78 percent of the total trade volume exported to China. Meanwhile, China is also Mongolia's largest source of imported goods. This is enough to show that Mongolia and China's economic cooperation are inseparable. Also, as Mongolia's long-time trading partner, Russia ranks the second, accounting for 15 percent of its total trade volume, and in terms of imports, Russia is in a nearly similar proportion to China. The UK accounts for 8 percent of Mongolia's exports in the main export markets. It is noteworthy that with the growing interest of east Asian countries in investing in Mongolia, Japan and South Korea have become important sources of Mongolian imports, accounting for 7.8 percent and 6.5 percent respectively.

In the 1990s, Mongolia had just transformed into a market economy country and received a lot of foreign direct investment every year. When the Mongolian government opened up the mining industry to foreign investment, this inflow began to increase dramatically. Due to the prosperity of the mining industry, the inflow of foreign direct investment has increased nearly 19 times in the past two decades[21].But in 2008, the Mongolian economy was hit hard by the international economic and financial crisis. The country 's economic growth rate was negative, based on the World Bank report[22]. However, FDI inflows recovered rapidly in 2010, growing at an alarming rate of over 170 percent, far exceeding the average level of 24 percent in East Asia, reaching a record 4.7 billion US dollar in 2011. <Figure 2.2-4> shows that as far as the source country is concerned, China 's foreign direct investment inflows so far are Mongolia 's largest source of FDI (49 percent from 1900-2012), followed by Canada, the Netherlands and Luxembourg. Between 2012 and 2016, foreign direct investment gradually developed and registered about 140 Singapore companies and 100 Canadian companies in Mongolia. Canadian companies are mainly concentrated in mining and related industries. Mining companies account for 56 percent of total foreign direct investment, followed by companies in the banking, textile, beverage, telecommunications and tourism industries[23]. Most of these investments are in joint ventures, such as the largest copper and gold Oyu-Tolgoi.

[21] Enkhbat, T., 2018, "Political and economic analysis of China's investment in Mongolia", Shanghai International Studies University, M.A thesis.

[22] World Bank. "Mongolia Investment Report", 2017.

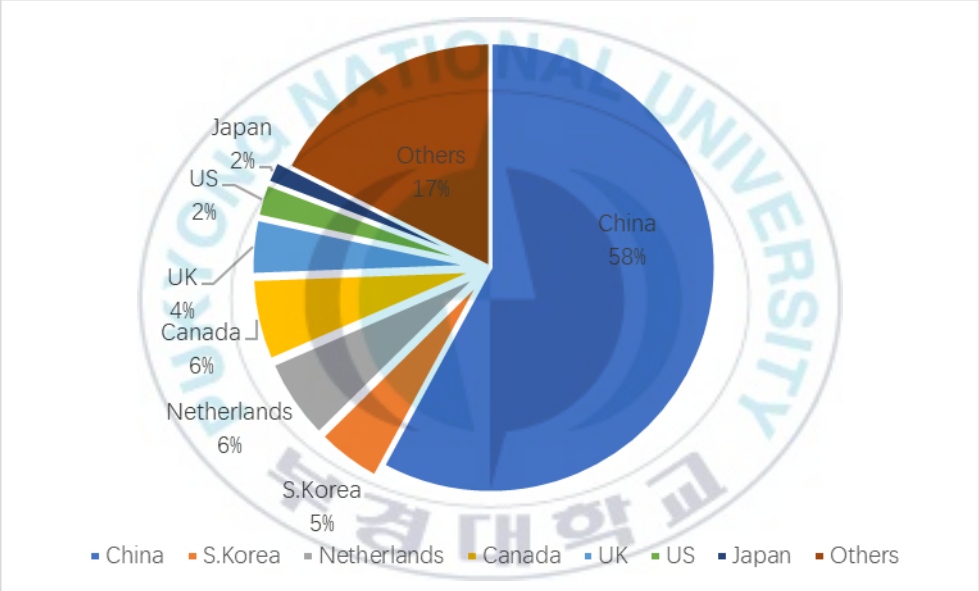
[23] Suo, N., 2018, "An analysis China's Direct Investment in Mongolia", China University of Mining and Technology, M.A thesis.

Table 2.2-1 Foreign Investment in the Mining sector (Billions MNT)

Investment in the Mining sector (Billions MNT)								
Year	2007	2008	2009	2010	2011	2012	2013	2014
Flow	437	503	751	2,940	3,176	751	472	391

Source: Mineral Resources Authority of Mongolia

Figure 2.2-4 FDI inflow share by major source in total (2005-2010)



Source: National Statistics Office of Mongolia

Table 2.2-2 Statistics on China's direct investment in Mongolia, million USD

Year	China's investment	Total investment	percent
2008	339.6	431.5	78.7
2009	497.8	604.9	82.3
2010	521.3	630.4	82.7
2011	561.0	714.7	78.5
2012	384.3	590.5	65.1
2013	321.2	524.4	61.3
2014	523.0	986.7	53.0
2015	320.0	526.0	61.0
2016	226.8	420.0	54.0

Source: Mongolia Foreign Investment Agency[24]

China has the highest proportion of direct investment in Mongolia's mineral exploration and development industry. Since 2008, China's investment in the mining industry has increased. Then, in 2012, the investment in the mineral industry declined, which was attributed to the unstable investment environment in Mongolia and the serious damage of foreign capital since it was the year with the highest proportion of

[24] Mongolia Foreign Investment Agency. Retrieved from http://www.investmongolia.com/

changes in the legal environment in Mongolia. Chinese direct investment in Mongolia fell to 384 million US dollars in 2012, according to Mongolian Foreign Investment Agency data. Although the scale of Chinese enterprises' investment in Mongolia continues to expand, it only accounts for a small proportion of China's total outbound investment. In 2014, due to the influence of the China-Russia-Mongolia economic corridor and the improvement of Mongolia's foreign investment environment, especially the improvement of the legal environment, China's direct investment in Mongolia reached 523 million US dollars. It also makes China's direct investment in Mongolia larger than that of other countries, at 53 percent. The top five industries for China's direct investment in Mongolia are mineral exploration and development, trade and service catering, engineering construction, light industry and animal product processing. Whether Chinese investment in Mongolia increases or decreases, the proportion of investment in mining has been the highest, see < Table 2.2-2>.

Chapter III MONGOLIA-CHINA ECONOMIC RELATIONS

3.1 Introduction

In 1949, with the founding of the People's Republic of China. Mongolia was one of the first countries to recognize China's status, and the two countries established international trade relations in 1951, which provided political guidance for the development of bilateral economic and trade and make a foundation for the further development of bilateral relations in the future. During this period, leaders of the two countries exchanged visits many times and signed a series of cooperation treaties, which pointed out the development direction and provided a political guarantee for the economic and trade development of China and Mongolia. In 1955, the railway running through China, Mongolia and Russia was officially put into operation, which further promoted the development of bilateral economy and trade, especially the transit trade. Due to its special geographical location between China and Russia, Mongolia has become the only place for China to trade with the Soviet Union and other eastern European countries, and the transit trade has also been greatly developed.

In 1955 and 1960, China and Mongolia signed labor exchange agreements twice. By the terms of the agreement, important projects needed by the Mongolian economy were built, factories and infrastructure were built, and 18,000 experts and workers from China were sent to Mongolia. Besides, according to the agreement, the Chinese government provided a total of 460 million rubles of aid to Mongolia during the four

years from 1956 to 1960 to help Mongolia build several complete projects and public facilities. At the same time, Mongolia also donated 15,000 horses, 600 thousand tons of flour, 100 tons of beef and mutton and 10,000 tons of wheat to China in 1958 and 1961 when China was hit by massive natural disasters.

In May 1960, Chinese Prime Minister Zhou Enlai visited Mongolia, and in December 1962, Mongolian leaders visited Mongolia. Bilateral high-level visits have further boosted the prosperity and development of bilateral trade. According to statistics, the bilateral trade volume between China and Mongolia once reached 49.94 million US dollars in 1961, an increase of more than 60 times that of 750,000 US dollars ten years ago, with an average annual growth rate of 52 percent. At this stage, the commodity trade structure between China and Mongolia was at a relatively low stage, mainly consisting of some primary products. China's export products were mainly daily chemicals, silk and satin, medicine and some mechanical equipment, while animal husbandry products were the main products exported from Mongolia to China.

Due to the deterioration of international political relations, China-Mongolia economic and trade cooperation also encountered obstacles. In 1967, the bilateral trade volume was only 350,000 US dollars, which reached a historical low. Such economic and trade tensions between China and Mongolia continued into the 1980s.[25]

In 1985 for 7.6 million US dollars for total bilateral trade between the two countries, including Mongolia export to China for 2.7 million US dollars, account for fourth export trading partners. The top three in Russia, Japan, and Switzerland, its

[25] Hu, J., 2015, “The relationship between Mongolia and Third Neighbors”, Jinan University, M.A thesis.

exports share 530.7 million US dollars, 7.6 million US dollars, and 6.6 million US dollars respectively. At that time, the economic and trade cooperation between China and Mongolia was still very low.

After the collapse of the Soviet Union in 1991, Mongolia gradually changed to a market economy. During this period, China's position in Mongolia's foreign trade was greatly transformed.

In September 2014, during the first meeting between the heads of state of China, Russia and Mongolia, President Xi Jinping put forward the initiative of jointly building the silk road economic belt[26] given the current economic and trade development of China, Russia and Mongolia. The heads of state of Mongolia and Russia responded positively to the initiative. In order to further implement the strategy of "The Silk Road Economic Belt" with Russia "Across the Eurasian Development Belt" strategy, Mongolia docking "Prairie Road" strategy, proposed three states build "China-Russia-Mongolia economic corridor", to achieve the three transportation network connectivity, strengthen cooperation in infrastructure, energy, electric power, provide new opportunity and platform for cooperation.

In July of 2015, the three heads of states held the second meeting, the Chinese government, the Russian federation, Mongolia “development mid tripartite cooperation roadmap ”, points out the key areas of the tripartite cooperation priority is economic and trade cooperation, the three countries should be according to their actual situation, negotiate cooperation, to speed up the construction of the economic corridor. On

[26] China News. 2015, Retrieved from http://www.chinanews.com/cj/2015/09-01/7501540.shtml .

November 10, 2015, in Beijing, the heads of Mongolia and China pointed out that the current bilateral relation are in the best period in history, should strengthen the government departments at all levels between the two countries communication, cooperation, discusses the China economic belt "Silk Road" and Mongolia's "Prairie Road", jointly safeguard regional security and stability, and benefit the two sides.

China has been Mongolia's largest trading partner since 1999. Bilateral trade between China and Mongolia has been increasing, and the increase is relatively large. According to the chart, over the past decade, the total trade volume between Mongolia and China has been growing, and the trade balance between the two countries has been in surplus with China. In 1998, the bilateral trade volume between Mongolia and China was only 243 million US dollars, which increased by more than 10 times in 10 years. In 2008, it reached 2.43 billion US dollars, among which, China's export to Mongolia increased from 63.4 million US dollars to 908 million US dollars, and Mongolia's export to China increased by 1.527 billion US dollars from 181 million US dollars. As a result of the financial crisis, the bilateral trade between Mongolia and China decreased by 1.51 percent in 2009 compared with 2008, among which the Mongolian export to China decreased by 16.5 percent. However, China's export to Mongolia increased by 12.3 percent. By 2014, the total trade volume between Mongolia and China reached 7.117 billion US dollars, which was more than 30 times of the bilateral trade volume in 1998.[27]

Although the total bilateral trade between Mongolia and China continues to grow, the scale of bilateral trade only accounts for a small part of China's total foreign trade,

[27] Bater B.S., 2013, "Natural resources and Mongolian economic growth", Jilin University, M.A thesis.

and the growth rate is relatively slow. As <Table 3.1-1 > showing that from 2009 to 2008, the trade volume between China and Mongolia accounted for less than 0.1 percent of China's total foreign trade. In 2009, it exceeded 0.1 percent for the first time, but the growth rate was slow. And cover trade in the proportion in the total foreign trade in Mongolia in 1998 reached 24.65 percent, growth to 53.58 percent of the total to 2006, the first time more than half, and presents the increasing trend, to 2009 years of bilateral trade accounts for Mongolian trade more than 60 percent, with more than half of Mongolia trade share, make China overtook Russia, become Mongolia's largest trading partner.

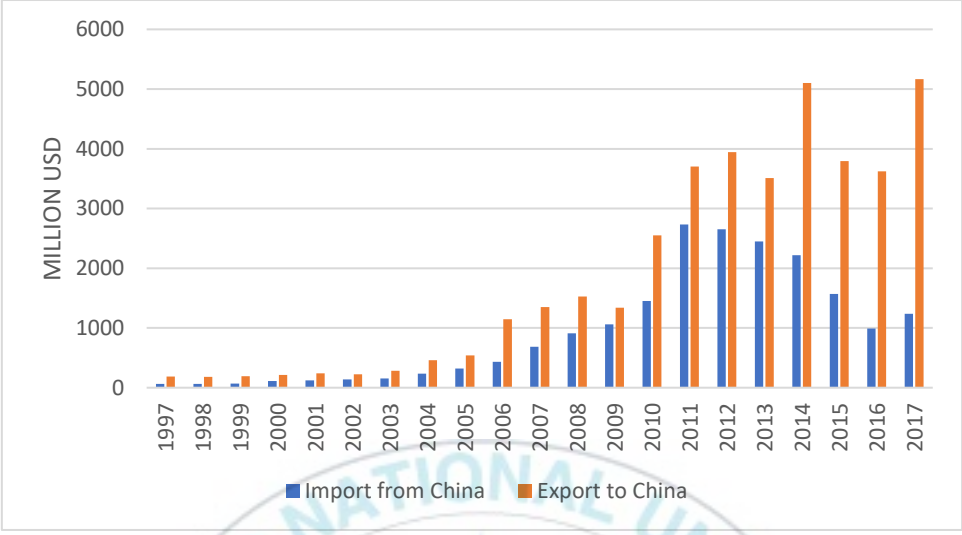
Table 3.1-1 Bilateral trade between Mongolia and China, billion USD (1997-2017)

Year	M-C total trade	China's total trade	Mongolia's total trade	M-C total trade/China's total trade (%)	M-C total trade/Mongolia's total trade (%)
1997	2.94	3,251.62	9.36	0.09%	31.43 %
1998	2.53	3,240.46	9.78	0.08%	25.91 %
1999	2.73	3,606.30	10.21	0.08%	26.71%
2000	3.77	4,674.87	12.29	0.08%	30.64 %
2001	3.51	5,009.45	12.60	0.07%	27.86 %
2002	2.17	6,058.65	12.04	0.04%	18.04 %
2003	4.57	8,275.83	16.02	0.06%	28.50 %
2004	6.32	11,161.13	20.42	0.06 %	30.95 %
2005	8.07	13,671.06	23.65	0.06 %	34.14 %
2006	14.50	16,873.15	29.71	0.09 %	48.80 %

2007	20.58	20,904.50	42.32	0.10 %	48.62 %
2008	24.33	24,708.23	56.77	0.10 %	42.86 %
2009	23.97	21,209.04	39.62	0.11 %	60.50 %
2010	40.00	28,669.86	59.79	0.14 %	66.90 %
2011	64.33	35,192.89	115.43	0.18 %	55.73 %
2012	65.98	37,242.67	112.15	0.18 %	58.83 %
2013	54.86	40,015.29	127.14	0.14 %	43.15 %
2014	67.70	41,576.59	102.63	0.16 %	65.96 %
2015	52.40	38,099.09	75.87	0.14 %	69.07 %
2016	49.19	36,855.58	66.67	0.13 %	73.78 %
2017	66.78	39,750.15	86.64	0.17 %	77.08 %

Source: Calculated by author using data from World Integrated Trade Solution

Figure 3.1-1 Mongolia's trade with China, million USD (1997-2017)



Source: Calculated by author using data from World Integrated Trade Solution

From the figure above <Figure 3.1-1 >, it can be seen clearly that Mongolia's total export volume and its export volume to China show a synchronous growth trend, and their growth rates are basically the same. To sum up, from the perspective of the trade scale, China is a very important foreign trade partner of Mongolia. This is more than 10 years China has been Mongolia's largest trading partner, is one of the largest import and export traders, Mongolia is in the rapid development of bilateral trade, during this time, the size of its trade expanded rapidly, especially the export side, Mongolia exports to China accounted for more than half of the total amount of export, Mongolia exports to China have stronger dependence.

Table 3.1-2 Mongolia trade balance with China, million USD (1997-2017)

	Import from China	Export to China	Total trade	Trade balance
1997	63.63	188.25	251.88	124.61
1998	62.39	180.75	243.14	118.36
1999	68.78	194.27	263.05	125.49
2000	110.54	212.07	322.61	101.53
2001	122.84	239.50	362.34	116.65
2002	140.03	223.42	363.44	83.39
2003	155.89	283.95	439.84	128.06
2004	233.35	461.07	694.42	227.71
2005	318.89	541.03	859.91	222.14
2006	433.50	1,147.48	1,580.98	713.99
2007	683.62	1,351.65	2,035.27	668.03
2008	907.83	1,525.61	2,433.44	617.78
2009	1,057.93	1,338.68	2,396.61	280.75
2010	1,449.76	2,549.85	3,999.62	1,100.09
2011	2,731.76	3,700.78	6,432.53	969.02

2012	2,653.51	3,944.21	6,597.72	1,290.70
2013	2,449.59	3,509.55	5,959.14	1,059.96
2014	2,216.38	5,102.09	7,318.47	2,885.71
2015	1,570.70	3,795.38	5,366.08	2,224.68
2016	988.54	3,622.60	4,611.14	2,634.06
2017	1,235.61	5,167.31	6,402.93	3,931.70

Source: Calculated by author using data from World Integrated Trade Solution

From the point of <Table 3.1-2 >, in the bilateral trade for many years showed a trend of non-equilibrium development, trade surplus of 125.4 million US dollars, since 1999 the trade surplus has been showing a growing trend, to this number reached 713.99 million US dollars in 2006, in the following due to the outbreak of the financial crisis in 2008, the international prices of raw materials and mineral resources, combined with the domestic economic downturn, lead to China's imports shrank dramatically, so that the trade surplus fell sharply in the relatively low for 280 million US dollars in 2009. With the elimination of the impact of the financial crisis and the continuous recovery of the economy, China's import demand for mineral products gradually recovered, and the trade surplus between China and Mongolia further expanded. In 2010, the trade gap between China and Mongolia reached a high of 1,100 million US dollars. Since then, the trade surplus has been widening, reaching 1,059.96 million US dollars in 2013. Mongolia's trade surplus with China nearly doubled than in 2004, then stabilized, and in 2017 it was the highest since 1997.

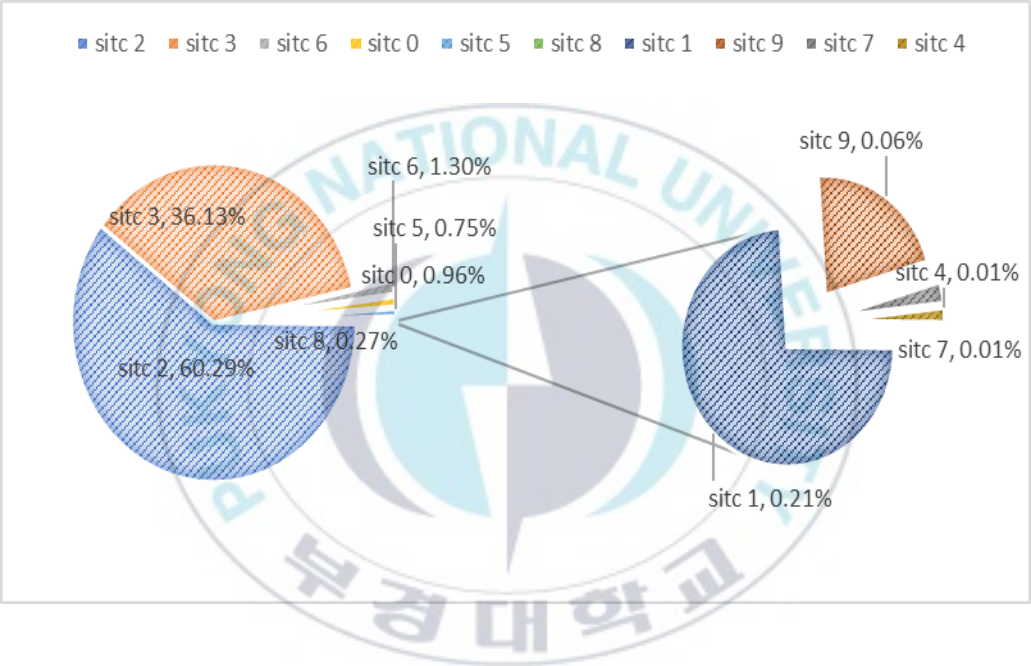
From the analysis of the trade balance between China and Mongolia, it can be seen that the development of bilateral trade between China and Mongolia is seriously unbalanced. Since China became Mongolia's largest trading partner in 1999, its trade deficit with Mongolia has been constantly expanding. This is mainly because China's rapid economic growth requires a large amount of mineral resources to support the development of manufacture industries, while Mongolia is rich in mineral resources and has become an important source country of China's mineral resources. According to the Chinese customs data in 2013, the products imported by China from Mongolia mainly include three categories (metal ore and metal chips, coal coke and petroleum, petroleum products). Among them, China imports a large number of molybdenum, zinc, copper, tungsten, fluorite, and other metal mineral resources from Mongolia. Mongolia's coking coal, anthracite coal, coal bricks, briquettes, and similar solid fuels made from coal, lignite, and other coal resources are also important imported products from China. Another major category of products is animal husbandry related products. Meanwhile, Mongolia's products are mainly focused on manufacturing goods imported from China, but the poor quality of products of China's exported to Mongolia, the Chinese enterprise credibility is not high at the same time, caused more imports from Russia, Mongolia, in turn, led to the Mongolia trade imports from China is far lower than the export trade imbalances.[28]

[28] Bayar, Z.E., 2017, “Analyzing the effect of macroeconomic factors on Mongolian currency exchange rate”, Donghua University, M.A thesis.

3.2 The trade structure between Mongolia and China

Bilateral trade commodity structure refers to the proportion of various categories of commodities or the import and export volume of a certain commodity in the foreign trade of a certain country within a certain period of time, <Figure 3.2-1 >.

Figure 3.2-1 Commodity structure of Mongolia export to China (1997-2017)

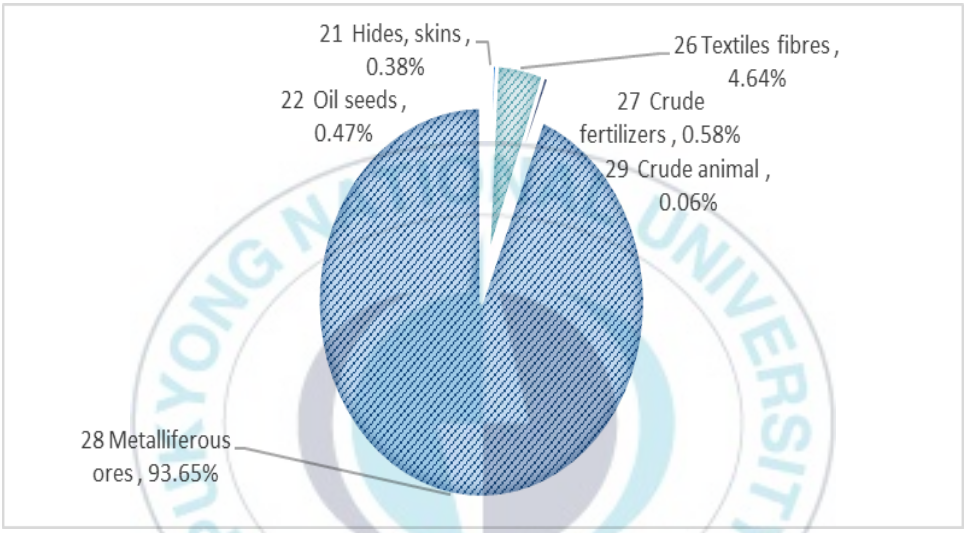


Source: Calculated by author using data from World Integrated Trade Solution

As can be seen from the figure above, the commodities which Mongolia export to China mainly focus on the SITC 2 and SITC 3, namely the two primary products of non-edible raw materials (excluding fuel) and fossil fuels, lubricants and related raw materials, which account for 60.29 percent and 36.1 percent respectively. The reasons are as follows: first, Mongolia is rich in coal, oil and livestock related products, and its production technology is backward, so it has a comparative advantage in some raw materials, resources, energy and other primary products.

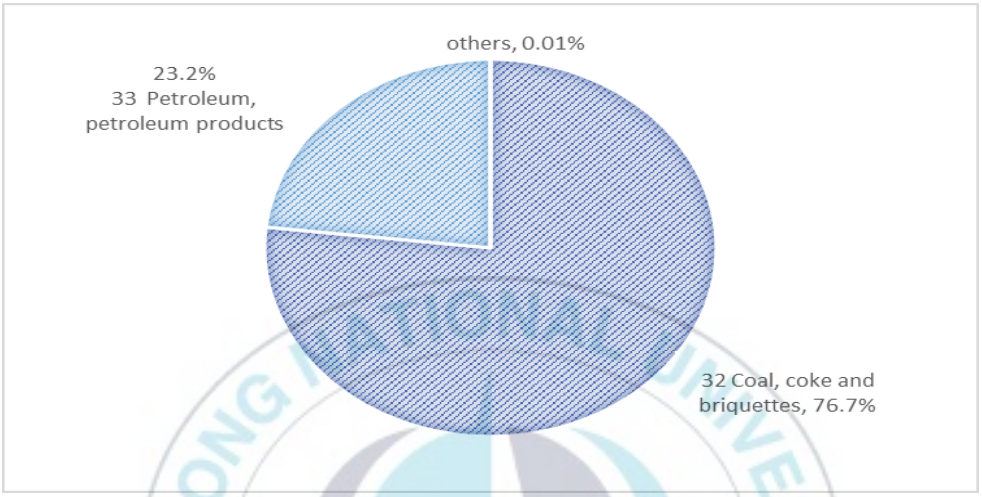
Second, in recent years, China's economy has been growing at a high level and its demand for mineral resources is large, while domestic resources cannot fully meet China's huge demand for resources and energy, <Figure 3.2-2 >.

Figure 3.2-2 The commodity structure of SITC 2, from Mongolia to China (1997-2017)



Source: Calculated by author using data from World Integrated Trade Solution

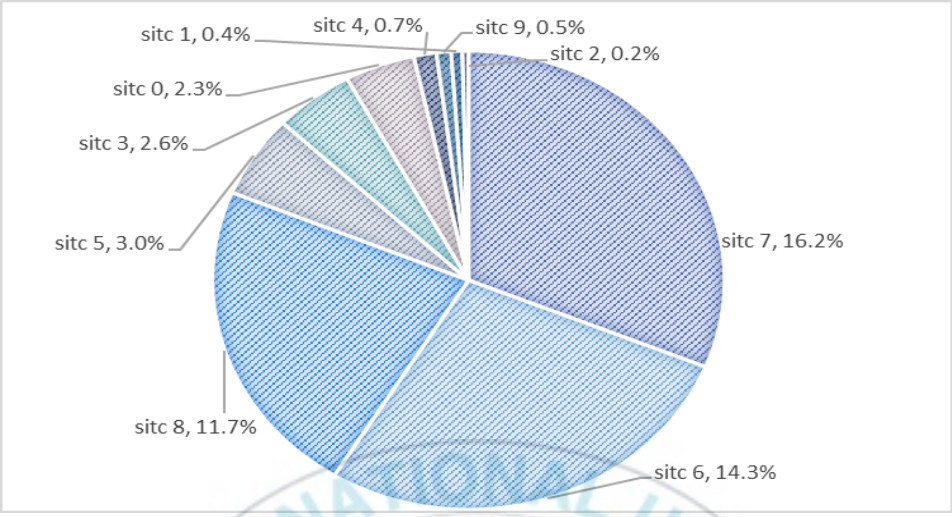
Figure 3.2-3 The commodity structure of SITC 3, from Mongolia to China (1997-2017)



Source: Calculated by author using data from World Integrated Trade Solution

As <Figure 3.2-3> show that China's imports from Mongolia in the SITC 3 are mainly 32 (coal, coke and coal bricks) and 33 (petroleum, petroleum products and related raw materials), accounting for 72 percent and 28 percent, respectively. It can be seen that China has a huge demand for Mongolian coal, coke, coal bricks, petroleum, petroleum products and related raw materials.

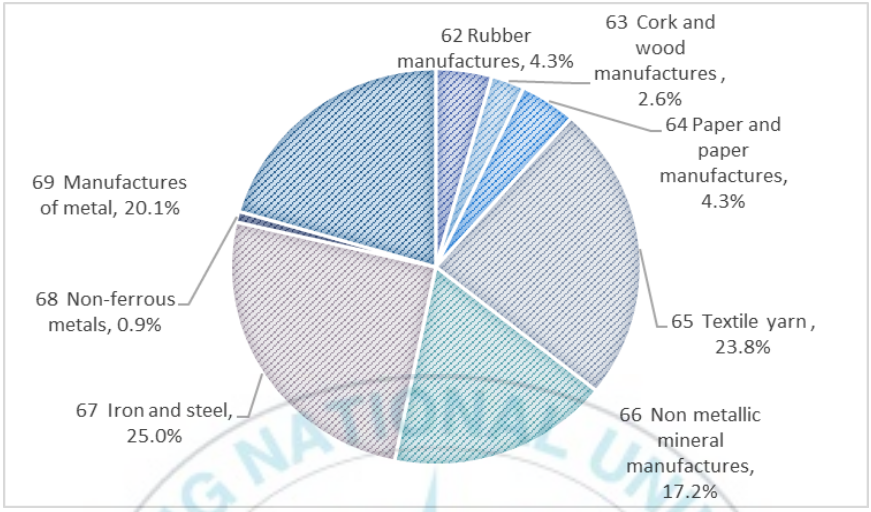
Figure 3.2-4 Commodity structure of Mongolia imports from China (1997-2017)



Source: Calculated by author using data from World Integrated Trade Solution

From above <Figure 3.2-4>, the main import commodities from China is focused on the SITC 7 (machinery and transport equipment), SITC 6 (manufactured goods), SITC 8 (miscellaneous products), 16.2 percent, 14.3 percent and 11.7 percent of total exports respectively, accounted for a total of 42.2 percent of total imports. However, the products are all manufactured goods, which indicates that Mongolia has a high demand for China's manufactured goods, and also reflects Mongolia's low level of economic strength and scientific and technological development.

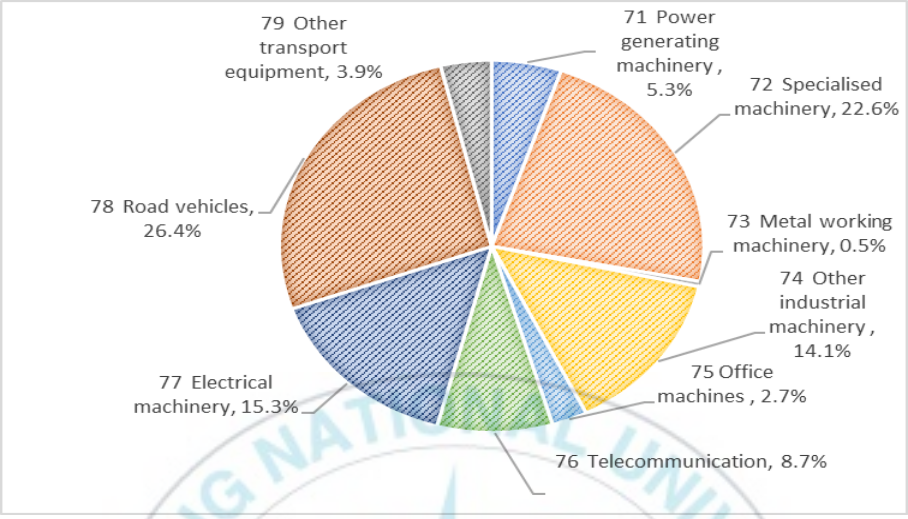
Figure 3.2-5 The commodity structure of SITC 6, Mongolia imports from China (1997-2017)



Source: Calculated by author using data from World Integrated Trade Solution

From above <Figure 3.2-5>, in SITC 6 of export products, mainly in 67 (steel), 65 (textile yarn, fabric, not otherwise specified in the finished products and related products), 69 (not otherwise specified metal products), 66 (not stated non-metallic minerals) and the four types of products, the proportion were 25.0 percent, 23.8 percent, 20.1 percent, 17.2 percent, total account for 86.1 percent.

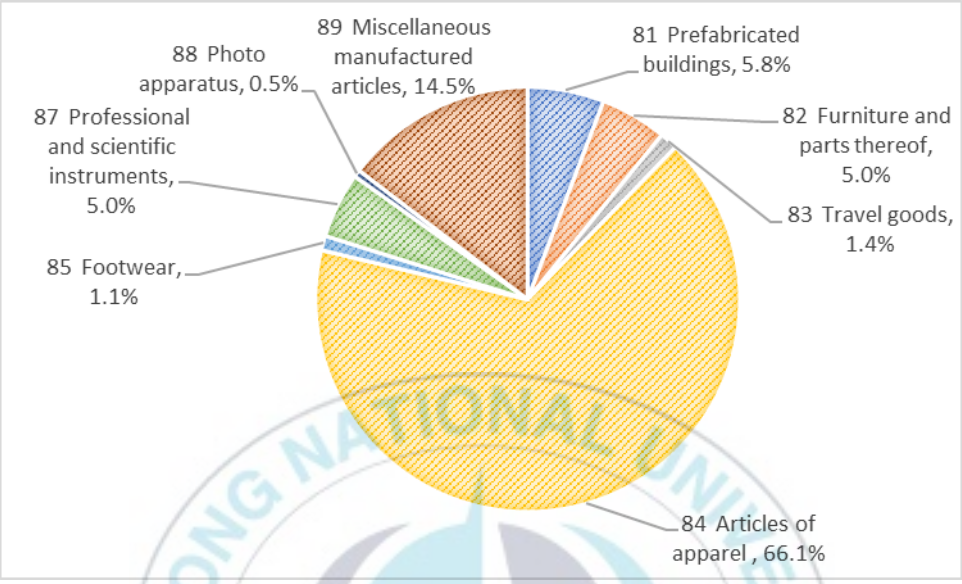
Figure 3.2-6 The commodity structure of SITC 7, Mongolia imports from China (1997-2017)



Source: Calculated by author using data from World Integrated Trade Solution

Showing at <Figure 3.2-6>, Mongolia for SITC 7 import products mainly depends on China, are mainly concentrated in the 78 (road vehicles), 72 (specialized machinery), 77 (electrical machinery,) and 74 (other industrial machinery and parts) on the four types of goods, they account for the proportion of exports were 26.4 percent, 22.6 percent, 15.3 percent and 14.1 percent respectively.

Figure 3.2-7 The commodity structure of SITC 8, Mongolia imports from China (1997-2017)



Source: Calculated by author using data from World Integrated Trade Solution

Mongolia imports of SITC 8 products mainly from China, < Figure 3.2-7>. Products of SITC 8 import from China are mainly concentrated in various clothing and apparel goods, accounted for 66.1 percent, this is mainly due to the backward light industry of Mongolia, so mainly rely on domestic demand for clothing accessories imports, China products in this sector is relatively developed, especially China's cheap clothing is the main source of Mongolian residents demand.

Mongolia is rich in mineral resources and developed in animal husbandry. There are more than 80 kinds of proven mineral resources, with 50 billion tons of reserves. About 150 mineral deposits are being mined, and a large part of them are yet to be mined. Therefore, in the bilateral trade between Mongolia and China, Mongolia mainly exports mineral products and animal husbandry products to China, but the industrial

development of Mongolia is backward, and China's rapid economic development has a large supply gap for mineral resources and animal husbandry. Secondly, China's industry is more developed than that of Mongolia, and it is rich in manufactured products, so it can provide Mongolia with mechanical and electrical processing, clothing, food processing, and other products.

3.3 Bilateral exchange rate

In the current globalized and open economy, the exchange rate plays a huge role. For example, the exchange rate can affect the import and export prices and then the import and export volume as well as the balance of payments. Generally speaking, the main factor that determines the exchange rate is the supply and demand of the country's currency. When domestic products are sold abroad or invested, the demand for the country's currency will be increased in the market. When residents want to buy foreign goods or invest in foreign industries, demand for the country's money is reduced. There are many factors affecting the exchange rate. The first is a country's balance of payments. When an international trade deficit occurs, the market will respond that the country's demand for foreign exchange is greater than its supply[29]. The second is the impact of the inflation rate. If the inflation rate of a country is higher than that of other countries, its export advantage will be reduced. Relatively speaking, it will enhance the competitiveness of foreign goods in the country's market, resulting in the country's

[29] Byambasuren T., 2013, "A Long-Run Relationship between Real Exchange Rates and Real Commodity Prices: The Case of Mongolia", *Journal of Economics, Business and Management*, Vol. 1-3, pp. 257-261 (Online at http://mpra.ub.uni-muenchen.de/61551/).

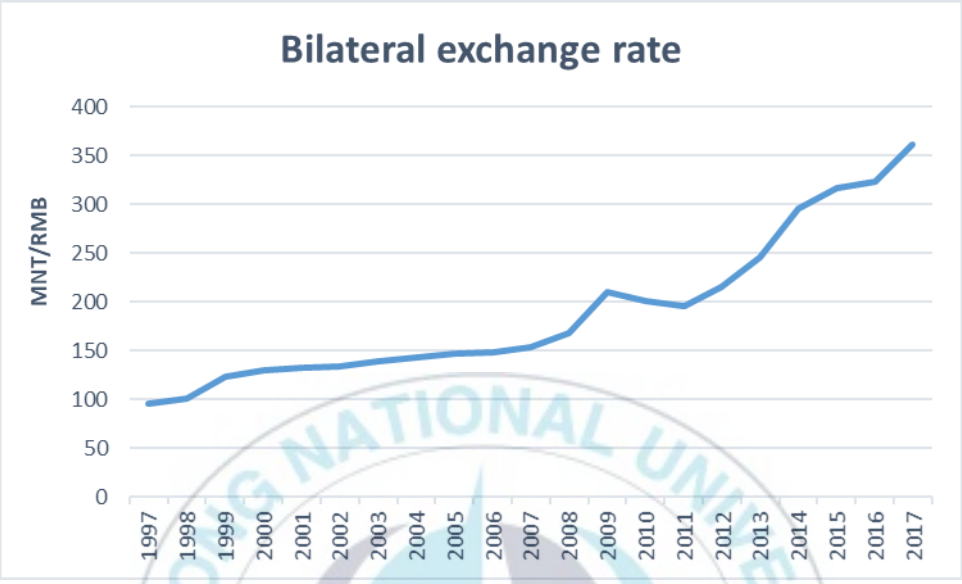
trade deficit, the gap between the supply and demand of foreign exchange, and the decline of the exchange rate of its currency.[30]

The exchange rate can also affect the domestic price level and then affect the effectiveness of monetary policy and fiscal policy transmission, and then affect the implementation of national policies. Therefore, the exchange rate between Mongolia and China affects the promotion of bilateral trade.

As the globalization of the economy deepened, the Mongolian economy gradually integrated into the world economy, and Mongolia ’s exchange rate policy also changed significantly. In March 1973 the government began to adopt an appropriate management of an effective floating exchange rate system. At the same time, Mongolia's trade with other countries in the world is becoming more and more frequent. The exchange rate, as a medium for currency exchange between countries, is also a bridge for national trade transactions, and it is very important in international trade. Since 2005, China's exchange rate system has been reformed for many times, with the continuous appreciation of RMB and the continuous turbulence of the international economy. As a result, the exchange rate between Mongolia and China affected the trade.

[30] Heckscher, E, 1919, “The Effect of Foreign Trade on the Distribution of Income”, *Ekonomisk Tidshriji,* Vol.21, pp. 1-32.

Figure 3.3-1 Bilateral exchange rate between Tugrik and Renminbi, MNT/ RMB (1997-2017)



Source: Calculated by author using data from Wind database[31]

The data shows that since 1997, the bilateral exchange rate has shown an upward trend, which is related to the appreciation of the RMB in the international environment[32], <Figure 3.3-1>.

In international financial theory, a country's balance of payments, domestic economic development, inflation, and international financial policies all have a direct impact on a country's exchange rate. A large increase in a country 's foreign exports will create a sufficient supply of foreign currency in the domestic capital market, which in turn will lead to an appreciation of foreign currency. The sound development of the

[31] Wind database. Retrieved from https://www.wind.com.cn/NewSite/edb.html .

[32] Wang, Y., 2012, "Chinses currency policy analysis", *The Central Bank Institute of China*, Vol 6, pp.57-60.

domestic economy and higher bank interest rates will also attract more international capital to the country. Inflation rate will also reduce the impulse of domestic capital to escape risks, thereby reducing the demand for foreign currency, which in turn will bring the trend of appreciation of local currency.

However, the current Tugrik of Mongolia is always in the process of depreciation. Fundamentally, devaluation of the local currency is one of the important ways to increase exports, this is the internal self-price reduction brought by the previous devaluation of Tugrik to the resource-based industry, which led to a reduction in export income, which in turn reduced the domestic.[33]

Theoretical analysis believes that the direct increase in foreign investment will cause the inflow of foreign capital, which in turn will increase the demand for domestic currency and cause the domestic currency to appreciate. Attracting international direct investment to balance the supply-demand balance between local and foreign currencies in the international financial market is an important means to avoid large volatility in the national currency. However, an important prerequisite for balancing international balance of payments by absorbing international direct investment is that after foreign capital enters the country, it can form a large purchase of domestic products and labor, thereby forming a foreign currency supply to the domestic foreign exchange market. Therefore, the ability to purchase domestic products and services in large quantities is the prerequisite and basis for balancing the balance of payments and addressing exchange rate risk. However, when foreign countries invest in Mongolia for the development of mineral resources and other fields, foreign investors are often faced

[33] Bater B.S., 2013, “Natural resources and Mongolian economic growth”, Jilin University, M.A thesis.

with the problem of not being able to obtain sufficient labor supply and the mechanical equipment and manufacturing products they need to purchase from the country. Therefore, the final results of foreign direct investment are that in addition to a small amount of money paid to the local government of Mongolia to form a foreign currency supply, a large amount of international investment is eventually converted into the import of machinery and other products.

The result of foreign currency supply is also the result of the current high inflation rate in Mongolia. A lower inflation rate will also reduce the impulse of domestic capital to escape risks, thereby reducing the demand for foreign currency, which in turn will bring a trend of appreciation of the local currency. However, the current Tugrik of Mongolia is always in the process of depreciation[34]. Fundamentally, this is the internal self-price reduction brought by the previous devaluation of Tugrik to the resource-based industry, which led to a reduction in export income, which in turn reduced the domestic. The result of foreign currency supply is also the result of the current high inflation rate in Mongolia.

[34] Bayar, Z.E., 2017, "Analyzing the effect of macroeconomic factors on Mongolian currency exchange rate", Donghua University, M.A thesis.

Chapter IV ANALYSIS OF TRADE STRUCTURE

4.1 Introduction

In this chapter the author will analysis on the trade structure, the main international trade theory been employing in the research. The author uses the RCA and TCI trade indexes to analyze the trade structure between Mongolia and China, in order to investigate the trade complementarity and revealed comparative advantage for bilateral trade. Also includes the trade theory and literature review for relative studies, and finally draws a conclusion for the trade structure analysis.

4.2 Literature review

Due to the backward economic development of Mongolia and the small proportion of Mongolia-China trade volume in China's foreign trade, Chinese scholars are more concerned about the development of Mongolia-China relations, and the study of Mongolia-China economic and trade relations is very less,<Appendix A-1: summary of literature reviews on trade structure>.

Pan (2016) detailed the characteristics of Mongolia-China trade by calculating indicators such as revealed comparative advantage index, trade intensity index and

trade complementarity index. And the analysis summarizes: Mongolia and China trade is closely related, and its bilateral trade is mainly based on inter-industry trade.[35]

Ding (2016)[36] though calculating the trade complementarity index, revealed comparative advantages index and trade intensity index, give the conclusion that the export structure of Mongolia is relatively primitive and single, and the small population in Mongolia leads to limited consumption capacity. China's advantageous industries cannot fully play their role in the Mongolian market.

Zhu (2017) [37] used trade complementarity index, revealed comparative advantages index and trade intensity index as many scholars did. The finding shows that China mainly exports labor-intensive products and capital-intensive products; It means that Mongolia is mainly engaged in exporting resource-intensive products.

Şimşek et.al (2017)[38] was work on the bilateral trade between Turkey and Russia. They used trade intensity index, trade complementarity index and bilateral revealed comparative advantages. There is a strong import relationship for Turkey with Russia while its export intensity is a little higher than expected. Trade complementarity index

[35] Pan, Y.J., 2016, 中蒙双边贸易的实证分析及潜力测算--基于贸易引力模型 [Empirical Analysis and potential estimates on Sino-Mongolian bilateral trade on the Gravity Model of Trade], China and Mongolia Trade is closely related, and its bilateral trade is mainly based on inter-industry trade by using revealed comparative advantage index, trade intensity index and trade complementarity index.

[36] Ding, Q.Y., 2016, "中蒙俄经济走廊的贸易互补性分析" [The trade complementarity analysis of Sino-Mongolia-Russia economic corridor] *Economic Research Guide*, Vol 26, pp. 140-142.

[37] Zhu, Y.Q., "中蒙俄经济走廊"的贸易潜力研究", 2017, [Study on Trade Potential of China-Mongolia-Russia Economic Corridor], Dept. of International Trade, Liaoning University.MA

[38] Simşek, N., Şimşek, H. A.and Zhanaltay, Z., 2017, "Analysis of bilateral trade relations between Turkey and Russia federation". *Bilig,* Vol 83, pp. 1-26.

between Turkey and Russia, showing a strong complementarity, means that the export structure of Turkey is compatible with import structure of Russia.

O'Callaghan (2009)[39] use RCA index to study the Korea – EU FTA issues, the scholar improve that EU and Korea are structurally complementary, particularly in most agricultural products. More specifically EU is structurally weak in Telecommunications and sound-recording and reproducing apparatus and equipment (SITC 76), office machines (SITC 75) and electrical machinery (SITC 77).

Lv and Xiang (2010)[40], Shuai and Wang (2011) all working on the case of China-US trade structure, in fact they got the similar finding though RCA and TCI index that there is a strong trade complementarity relationship between China and the US; China shows the comparative advantage gradually in the area of capital goods and technology intensive products.

Ibrahim (2015)[41] study on Nigeria and India bilateral trade, though calculate RCA index they have shown that Nigeria has comparative advantage in only few products like mineral fuels, ships boats and floating structures, rubber and articles thereof, lac; gums resins and other vegetables. India have advantages in organic chemicals, nuclear reactors, fish crustacean and other aquatic, copper, coffee tea, residues and waste from food industries, footwear, man-made staple, edible fruit and nuts, cereal.

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[39] Andreosso-O'Callaghan, B. 2009, "Economic structural complementarity: how viable is the Korea-EU FTA?" *Journal of Economic Studies*, Vol 36-2, pp.147-167.

[40] Lv J., Xiang L.B., 2010, "Empirical analysis of bilateral trade complementarity between China and the U.S.A", IEEE.

[41] Ibrahim, K. H., 2015, "Trade Complementarity and Similarity between Nigeria and India in the context of Bilateral Trade Relations", *Journal of Economics and Finance*, Vol 6, pp. 28-32. (Online at www.iosrjournals.org).

In the past literatures on the bilateral trade between Mongolia and China, Ding (2016) ; Liu (2016); Zhu (2017) ,Pan (2016) analyzed the bilateral trade structure by calculating the trade index, they have analyzed that there is strong complementarity between Mongolia and China trade, and analyzed the advantage industries of Mongolia and China respectively. But the limitation of prior research is that all of them analyzed the trade structure at aggregate level of industry. No research is specific to the disaggregated level of industry. Therefore, this thesis will contribute to existing works by investigating patterns of trade structure at disaggregated level of industry, using SITC 3-digit products.

4.3 Theoretical background

The absolute advantage theory of economist Adam Smith (1776) believes that there is an absolute difference in production technology between countries, which makes labor productivity and production cost also have absolute differences. The country and the labor cost of producing a commodity in one country is less than that of another country, then the product of this country has an absolute advantage over than other countries; on the contrary, the productivity of a country's products is low, The cost of production is high, then a product of this country has an absolute disadvantage. When the production cost and labor productivity of a country's manufactured products are higher than those of other countries, the country should export such products and import those products with low labor productivity so that both parties can profit from a trade.

International trade theory stems from market economy and commodity exchange. Ricardo (1918) proposed the theory of comparative advantage trade, supplemented the theory of absolute advantage, and more systematically explained the mutual trade relations between countries. The theory holds that the absolute difference between labor productivity and production costs between countries is not the main reason for international trade. It is pointed out that as long as there is a relative difference in labor productivity between countries, there will be a relative difference in the production costs of commodities, which will result in a relative difference in the prices of products of various countries, which will eventually lead countries to have comparative advantages in different commodities. Countries should concentrate on resource production and produce products that have "comparative advantages"[42] in their labor productivity, and import products that do not have "comparative advantages" to benefit from the trade.

At the beginning of the last century, the neo-classical trade theory emerged and developed gradually. The theory is represented by the H-O theory. The H-O theory was further developed in the point of view of the factor endowment. Based on comparative advantage trade, the theoretical model analyzes the production cost of products with various production factors. The core content is: Under the premise of equal skill level between the two countries, the factor adequacy between the two countries is different and the factors of commodity production are dense. The difference leads to the difference in comparison costs.

[42] Balassa, B, 1965, "Trade Liberalization and 'Revealed' Comparative Advantage", *The Manchester School,* Vol 33, pp. 99-123.

According to the H-O theory[43], the trade complementarity index is used as a research method to measure the degree of trade complementation and close trade relationships. The index takes the comparative advantage of exports from both countries and the comparative advantage of imports into account. If the main export product category of one country matches the main imported product category of another country, the complementary index between the two countries will be larger, but if the main export product category of one country does not match the main imported product category of the other country The complementary index between the two countries is smaller.

4.4 Methodology

Based on Ricardo theory, revealed comparative advantage index is used to measure a country's relative advantage or disadvantage in a specific industry as the research methodology. In this paper, original Balassa's index has been applied in order to calculate the comparative advantage of a country, Balassa (1963) proposed not to include all elements which affect country's comparative advantage. On the contrary, he suggested that comparative advantages can be revealed through the observed trade patterns, which reflect differences in factor factors between countries. Balassa 's comparative advantage index is calculated as follows:

[43] Vollrath, T.L.,1991, "A Theoretical Evaluation of Alternative Trade Intensity Measures of Revealed Comparative Advantage", *Weltwirtschaftliches Archiv*, Vol 127- 2, pp. 265-280.

$$RCA_{ikt} = (x_{ik}/X_{it}) / (x_{wk}/X_{wt}) \quad (4\text{-}1)$$

Where x_{ik} and x_{wk} are the trade volume of country i's exports of product k and world exports of product k and where X_{it} and X_{wt} refer to the country's total exports and world total exports. Values higher than 1 indicate a "shown" comparative advantage, and when the index is less than 1, the country has a comparative disadvantage.

Generally speaking, the trade complementarity index is greater than 1, it shows that the complementarity between exporting countries and importing countries is higher than the average level of other markets, while the trade relations between the two countries are relatively close. The calculation method of trade complementarity index is as follows

$$CI_{ijk} = RCA_{xik} \cdot RCA_{mjk} \quad (4.2)$$

Among them, RCA_{xik} expresses the comparative advantage of country I in bilateral trade on export commodity k, while RCA_{mjk} express the comparative disadvantage of country j in bilateral trade on import commodity K. Among them, RCA_{xik} expresses the comparative advantage of country i in bilateral trade on export commodity k, while RCA_{mjk} expresses the comparative disadvantage of country j in

bilateral trade on import commodity K. The calculation formula of the latter is as follows:

$$RCA_{mjk} = (M_{jk}/M_{wk})/(M_{jt}/M_{wt}) \quad (4.3)$$

M_{jk} is the amount of K imported by the state, M_{wk} is the amount of K imported by the world, M_{jt} is the total import of all commodities of country j, and M_{wt} is the total import of all commodities of the world.

This part conducts an index analysis of bilateral trade between Mongolia and China to further analyze the bilateral trade structure. And based on the ranking of total trade value, the author picked top 30 products which present almost 80 percent in total trade between Mongolia and China. And the data collection is classified according to the International Trade Standards of the United Nations Commodity Trade Database (SITC Rev.3). The method measures and analyzes the 3-digit trade data of Mongolia and China at the industry level in the past twenty years from 1997 to 2017. The index analysis mainly includes the revealed comparative advantage index and the trade complementarity index.

4.4.1 Revealed comparative advantage index of China (1997-2017)

Table 4.4-1 Summary results for revealed comparative advantage index of China vis-à-vis world

RCA>1				RCA<1			
SITC	**Label**	**SITC**	**Label**	**SITC**	**Label**	**SITC**	**Label**
268	Wool and other animal hair	**658**	Made-up articles, of textile materials	**057**	Fruits and nuts	**281**	Iron ore and concentrates
661	Lime, cement	**679**	Tubes, pipes and hollow profiles	**283**	Copper ores	**287**	Ores
691	Structures，parts of iron	**699**	Manufactures of base metal	**321**	Coal	**333**	Petroleum oils
716	Rotating electric plant and parts thereof	**744**	Mechanical handling equipment	**676**	Iron and steel bars	**682**	Copper
764	Telecommunication equipment	**772**	Apparatus for electrical circuits	**723**	Civil engineering	**728**	Other machinery for particular industries
775	Household type equipment	**786**	Trailers	**744**	Mechanical handling equipment	**782**	Motor vehic
821	Furniture，parts	**841**	Men's clothing of textile fabrics	**783**	Road motor vehicles		
843	Men's or boy's clothing	**845**	Articles of apparel, of textile fabrics				
893	Articles of plastics						

It can be seen from the average calculation results of China's revealed comparative advantage index, < Appendix A-2: results of revealed comparative advantage index of China vis-à-vis world> that China has strong international competitiveness in the manufactured goods (SITC 6), which including made-up articles （SITC 658），which have highest value, up to 4.4; machinery and transport equipment products (SITC 7), especially trailers and semi-trailers (SITC 786), the RCA value of this product is 2.92; and miscellaneous manufactured articles (SITC 8), which presented by men's clothing of textile fabrics (SITC 841), men's or boy's clothing, of textile (SITC 844), articles of apparel, of textile fabrics (SITC 845), the value of these products are 3.86, 3.61 and 3.57, respectively. But for the product of SITC 8, the index value showing that the comparative advantage of miscellaneous manufactured articles goods is losing international competitiveness gradually, even the value still greater than 1.

4.4.2 Revealed comparative advantage index of Mongolia (1997-2017)

Table 4.4-2 Summary results for revealed comparative advantage index of Mongolia vis-à-vis world

RCA>1				RCA<1			
SITC	**Label**	**SITC**	**Label**	**SITC**	**Label**	**SITC**	**Label**
268	Wool and other animal hair	**281**	Iron ore and concentrates	**057**	Fruits and nuts	**333**	Petroleum oils
283	Copper ores	**287**	Ores	**658**	Made-up articles, of textile materials	**661**	Lime, cement
321	Coal	**682**	Copper	**676**	Iron and steel bars, rods, angles	**679**	Tubes
841	Men's clothing of textile fabrics	**843**	Men's or boy's clothing	**691**	Structures and parts of iron	**699**	Manufactures of base metal
844	Women's clothing	**845**	Articles of apparel, of textile	**716**	Rotating electric plant	**723**	Civil engineering
				728	Other machinery for particular industries	**744**	Mechanical handling equipment
				764	Telecommunication equipment	**772**	Apparatus for electrical circuits
				775	Household type equipment	**782**	Motor for transport of goods
				783	Road motor vehicles	**786**	Trailers and semi-trailers
				821	Furniture and parts	**893**	Articles of plastics

According to the summary of the Mongolian revealed comparative advantage index, < Appendix A-3: results of revealed comparative advantage index of Mongolia vis-à-vis world >. Mongolia has strong international competitiveness in the SITC 2 (crude materials, inedible, except fuels) and SITC 3 (mineral fuels, lubricants and related materials). From the results of Top 5 highest value of RCA, copper ores and concentrates, copper mattes (SITC 283); women's clothing, of textile (SITC 844), ores and concentrates of base metals (SITC 287), coal, whether or not pulverized, not agglomerated (SITC 321), iron ore and concentrates (SITC 281), the value is 247.95, 111.91, 27.6, 27.58 and 4.55, respectively. The number clearly shows that Mongolia is rich in coal, oil and livestock-related products, while Mongolia's manufacturing industry is backward, so it can only export raw materials and resource-intensive primary products.

4.4.3 The trade complementarity index between China's exports and Mongolia's imports

Table 4.4-3 Trade complementarity index between China's exports vis-à-vis Mongolia's imports

TI>1				TI<1			
SITC	**Label**	**SITC**	**Label**	**SITC**	**Label**	**SITC**	**Label**
658	Made-up articles, of textile materials	**661**	Lime, cement	**057**	Fruits and nuts	**268**	Wool and other animal hair
676	Iron and steel bars, rods, angles	**679**	Iron and steel bars, rods, angles	**281**	Iron ore and concentrates	**283**	Copper ores and concentrates
691	Structures and parts of iron	**699**	Manufactures of base metal	**287**	Ores and concentrates of base metals	**321**	Coal
716	Rotating electric plant	**723**	Civil engineering	**333**	Petroleum oils	**682**	Copper
744	Mechanical handling equipment	**764**	Telecommunication equipment	**728**	Other machinery for particular industries,	**772**	Apparatus for electrical circuits
775	Household type equipment	**786**	Trailers and semi-trailers	**782**	Motor for transport	**783**	Road motor vehicles
821	Furniture and parts	**843**	Men's or boy's clothing of textile	**841**	Men's clothing of textile fabrics	**845**	Articles of apparel, of textile fabrics
844	Women's clothing of textile	**893**	Articles of plastics				

As can be seen from the above table, the average results of the trade complementarity index calculated by China's exports and Mongolia's imports show that the products of SITC 6 and SITC 7 are more complementary goods. Among them, lime, cement (SITC 661), trailers & semi-trailers (SITC 786), structures & parts, of iron (SITC 691), made-up articles, of textile materials (SITC 658), rotating electric plant & parts (SITC 716), the value of them shows 11.6, 6.48, 5.6, 4.21 and 3.83, respectively. Which are Mongolia’s products with high dependence on foreign countries, and are also the main products produced by China as a manufacturing-intensive country, <Appendix A-4: results of trade complementarity index between China's exports vis-à-vis Mongolia’s imports >.

4.4.4 The trade complementarity index between China's imports and Mongolia's exports

Table 4.4-4 Trade complementarity index between China's imports vis-à-vis Mongolia's exports

TI>1				TI<1			
SITC	**Label**	**SITC**	**Label**	**SITC**	**Label**	**SITC**	**Label**
268	Wool and other animal hair	**281**	Iron ore and concentrates	**057**	Fruits and nuts	**333**	Petroleum oils
283	Copper ores and concentrates	**287**	Ores and concentrates of base metals	**658**	Made-up articles, of textile materials	**661**	Lime, cement
321	Coal	**682**	Copper	**676**	Iron and steel bars, rods, angles	**679**	Iron and steel bars, rods, angles
841	Men's clothing of textile fabrics			**691**	Structures and parts of iron	**699**	Manufactures of base metal
				716	Rotating electric plant	**723**	Civil engineering
				728	Other machinery for particular industries,	**744**	Mechanical handling equipment
				764	Telecommunication equipment	**772**	Apparatus for electrical circuits
				775	Household type equipment	**782**	Motor for transport
				783	Road motor vehicles	**786**	Trailers and semi-trailers
				821	Furniture and parts	**843**	Men's or boy's clothing of textile
				844	Women's clothing of textile	**845**	Articles of apparel, of textile fabrics
				893	Articles of plastics		

From the results of the trade complementarity index calculated by Mongolian exports and Chinese imports, <Appendix A-5: results of trade complementarity index between China's imports vis-à-vis Mongolia's exports >, the wool and other animal hair (SITC 268), its value is highest one, up to 796.59. then copper mattes (SITC 283) shows 612.76, ranking number 2 in total products. Ores and concentrates of base metals (SITC 287), iron ore and concentrates (SITC 281), and coal, coke and briquettes (SITC 321). The value shows 54.58, 30.33 and 19.04, respectively. These are the products that Mongolia is rich in, and it is also a relatively scarce and urgently needed product in China. Therefore, there is a high trade complementarity between China and Mongolia in this SITC. It shows that Mongolia's exports are very similar to those required for Chinese imports, and they are highly complementary.

4.5 Research findings

In this chapter the author picked the top 30 products which present almost 80 percent in total trade between China and Mongolia. According to the results of RCA and TCI index, we have conclusion that from the average calculation results of China's revealed comparative advantage index that China has strong international competitiveness in the manufactured goods (SITC 6), machinery and transport equipment products (SITC 7) and miscellaneous manufactured articles (SITC 8). But for the product of SITC 8, the index value showing that the comparative advantage of miscellaneous manufactured articles goods is losing international competitiveness gradually, even the value still greater than 1. Meanwhile from the Mongolia's perspective, Mongolia has strong international competitiveness in the SITC 2 (crude materials, inedible, except fuels) and SITC 3 (mineral fuels, lubricants and related materials). From the results of Top 5 highest value of RCA, copper ores and concentrates, copper mattes (SITC 283); women's clothing, of textile (SITC 844), ores and concentrates of base metals (SITC 287), coal, whether or not pulverized, not agglomerated (SITC 321), iron ore and concentrates (SITC 281), the value is 247.95, 111.91, 27.6, 27.58 and 4.55, respectively. The number clearly shows that Mongolia is rich in coal, oil and livestock-related products, while Mongolia's manufacturing industry is backward, so it can only export raw materials and resource-intensive primary products.

For the analysis of complementarity, China's exports and Mongolia's imports show that the product of SITC 6 and SITC 7 are more complementary goods. Which

are Mongolia’s products with high dependence on foreign countries, and are also the main products produced by China as a manufacturing-intensive country. From the results of the trade complementarity index calculated by Mongolian exports and Chinese imports, wool and other animal hair (SITC 268), copper mattes (SITC 283) , ores and concentrates of base metals (SITC 287), iron ore and concentrates (SITC 281), and coal, coke and briquettes (SITC 321) which are the products that Mongolia is rich in, and it is also a relatively scarce and urgently needed product in China. It shows that Mongolia's exports are very similar to those required for Chinese imports, and they are highly complementary.

Chapter V ANALYSIS OF THE IMPACT OF EXCHANGE RATE VOLATILITY ON EXPORTS

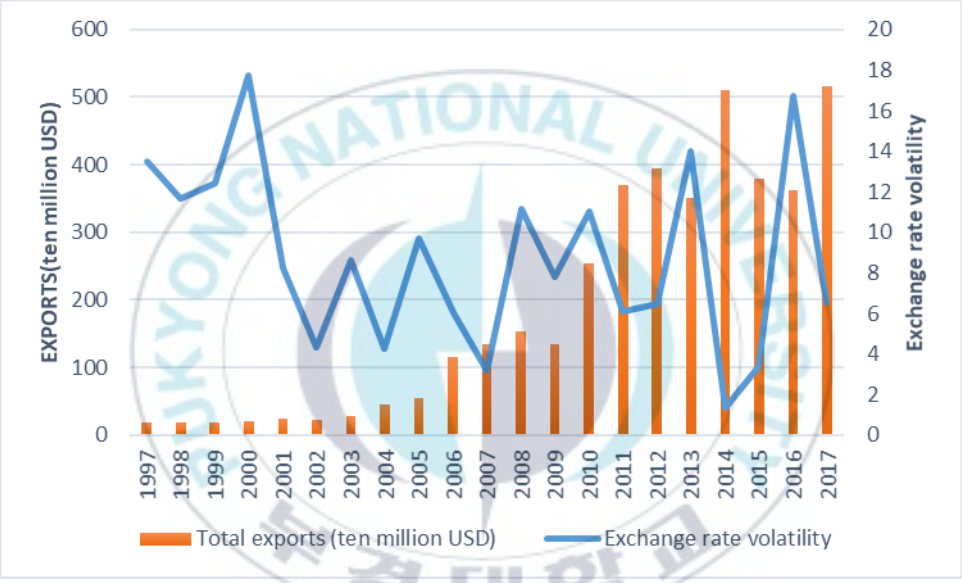
5.1 Introduction

With the Mongolia's economic development, and large amounts of foreign investment, the exchange rate between Tugrik and the RMB has changed significantly. According to statistics from the Central Bank of Mongolia and though the calculation of author, the exchange rate between MNT and the RMB in 1998 was 101.4:1. Subsequently, the exchange rate began to depreciate quickly, until the 2008 financial crisis, the exchange rate turned to 167.8:1. In 2009, MNT against RMB was 210: 1, which was depreciated compared with 2008 at 25 percent. Until the end of 2017, the exchange rate became 361.3: 1, a depreciation of 115 percent compared with 2008.

<Figure 5.1-1> shows the trend of bilateral exchange rate from 1997 to 2017. Due to the financial crisis has hit Mongolia big in this year, in 2009, exports of Mongolia began greatly reduced, and the exchange rate of Tugrik achieved highest depreciation in this year, since 1997. With the improvement of the international economic situation, by an influx of foreign capital, and the influence of Chinese import demand to expand infrastructure construction, Tugrik continued depreciation in the period from 2012 to 2017, and the volume of export from Mongolia to China shows upward trend. However, in 2013 under the influence of international bulk goods prices,

Mongolia's exports got suffered by this. Tugrik exchange rate volatility is most obvious, and due to the slow economic growth of China, and Mongolia in the domestic market purchasing power shortage, so although the bilateral trade volume growth but growth slowed significantly since 2014.

Figure 5.1-1 Bilateral exchange rate volatility and total exports from Mongolia to China (1997-2017)



Source: Calculated by author using data from World Bank

5.2 Literature review

Franke (1991)[44] demonstrates that export activity may increase as exchange rate volatility increase. He explained that when the turbulence intensified, the company could enter the international market sooner or later. The difference in time will increase the number of international trading companies and increase the volume of foreign trade. And based on Kasman's (2005)[45] study on Turkey's case, they supply aggregate data though the cointegration and error correction modeling approaches to prove that exchange rate volatility causes a positive effect on export for the long term. Following Serenis and Tsounis (2014)[46] shows that volatility of exchange rate has a positive impact on Croatia and Cyprus exports. They also employ the aggregate data to the autoregressive distributed lags (ARDL) methodology.

However, there is bunch of studies to study that the volatility of exchange rate has significant negative effect on foreign trade. Baak[47] (2004) find a significant negative impact of exchange rate volatility on the exports among Asia-Pacific countries using aggregate data from 1980-2002.

[44] Franke, G, 1991, "Exchange Rate Volatility and International Trading Strategy", *Journal of International Money and Finance,* Vol 10-2, pp. 292–307.

[45] Kasman, A. and Kasman S., 2005, "Exchange rate uncertainty in Turkey and its impact on export volume", *METU Studies in Development,* Vol 32, pp. 41–58.

[46] Serenis, D. and Tsounis, N., 2014, "Exchange Rate Volatility and Aggregate Exports: Evidence from Two Small Countries", *ISRN Economics*, pp 1-10.

[47] Baak, S. J., 2004, "Exchange rate volatility and Trade among the Asia Pacific Countries", *Journal of International Economic Studies*, Vol.8-1.

Chit[48] (2008) applied gravity model in the research and get the similar conclusion in Asian and China case. Volatility in bilateral real exchange rates have a statistically significant negative impact on the exports of the two countries in the major countries in the China-Asian Free Trade Area. But the value of the impact was quite small.

Chit (2017) did more specific research on Asian countries using disaggregated data, The results provide powerful evidence that exchange rate volatility lead a negative impact to exports in emerging East Asian countries. Still gravity model applied in his study as well as Šimakova (2016) and Chit (2008).

But with the deeply research on international trade, some scholar improved that the exchange rate volatility has mixed impact on foreign trade. Zhou[49] (2015) study on China and Russia bilateral trade, which use ARDL model and aggregate data to prove that exchange rate volatility could affect bilateral trade in two sides, negatively and positively.

Bahmani and Harvey[50] in 2016 and 2017 working on the bilateral trade of U.S.-Philippines and Singapore-Malaysia (1979-2013). They use same technology which applied import and export demand model to indicate that exchange rate volatility could affect trade both negatively and positively or no impact.

[48] Chit, M. M., 2015, "Exchange rate volatility and exports: evidence from the ASEAN-China Free Trade Area", *Journal of Chinese Economic and Business Studies*, Vol. 6- 3, pp. 262-275. (Online at http://dx.doi.org/10.1080/14765280802283543)

[49] Zhou C.H., 2015, "人民币-卢布汇率对中俄双边贸易的影响研究"[Analysis of the impact of exchange rate volatility on bilateral trade between RMB-RUB], *经济论坛*, pp. 18-22.

[50] Bahmani-Oskooee, M., and Scott. W. Hegerty, 2007, "Exchange rate volatility and trade flows: A review article", *Journal of Economic Studies,* Vol 34, pp. 211–55.

Uprasen and Zolin[51] (2017) applied disaggregated data to ARDL Model and study on the bilateral case between Korea and Japan, they find that exchange rate volatility could have positive and negative impact on trade flows between Korea and Japan.

In summary, there are four points related to this research. Nonetheless there has no certain theoretical agreement for the impact of exchange rate volatility on the international trade. From the empirical studies also prove that the impact of exchange rate volatility could have negative, positive even mixed results. The conclusion of these studies is that although exchange rate volatility has impact on exports, the impact depends on different circumstances in different countries. Secondly, there is not yet a standard proxy for exchange rate volatility (Bahmanii and Hegerty, 2007). Some measures of variance dominate the field, but the exact calculation of this measure varies from study to study. Later estimates involved using the standard deviation of the rate of change or the level of the variable. According to the previous studies, the author finds that there is no relative research on the "Mongolia-China" case. Therefore, this paper will be the first research on the impact of exchange rate volatility on trade between Mongolia and China. According to the compilation of the literature, some studies are based on the aggregate trade data of a country, which reflects the impact of exchange rate volatility on the overall trade balance of an economy. However, Bahmani and Harvey (2016) argued that "aggregate bias" exist. In order to make bilateral trade research more meaningful and the empirical results obtained more credible, the author will continue working on the industry level analysis, to detect the impact of exchange rate volatility on the specific industry products from Mongolia to China. Therefore, in

[51] Uprasen, U. and Zolin, M.B.,2017, "The Impact of Exchange Rate Volatility on Korea-Japan Trade Flows: An Industry Level Analysis", *Journal of International Trade & Commerce*, Vol.13-3, pp. 1-27.

this paper, the author will contribute to the previous study by studying the impact of exchange rate volatility on export from Mongolia to China using both aggregate and disaggregated data to study the overall trade level and industry level.

Therefore, based on previous work and empirical findings, there is no paper related to exchange rate volatility effect on bilateral trade between Mongolia and China at the industry level analysis. And in order to study the impact of exchange rate volatility on exports both aggregate and disaggregated level, the author will use two kinds of data from 1997-2017 which including the total trade volume and industries export volume.

Table 5.2-1 Summary of literature reviews on exchange rate volatility

Summary of literature reviews on exchange rate volatility			
Author /Publish year	Case study	Methodology and data	Finding (Positive significant to effects)
Kasman & Kasman (2005)	Turkey (1982-2001)	Aggregate data; Cointegration and error correction modeling approaches	Exchange rate volatility has a significant positive effect on export volume in the long run
Serenis & Tsounis (2014)	Croatia-Cyprus (1990-2012)	Aggregate data; autoregressive distributed lags (ARDL) methodology	Exchange rate volatility has a significant positive effect on exports of Croatia and Cyprus
			Finding (Negative significant to effects)
Saang Joon Baak (2004)	Asia Pacific Countries (1980-2002)	Aggregate data; Gravity model	Detect the exchange rate volatility has a negative impact on the volume of exports
Myint Moe Chit (2008)	ASEAN-China (1982-2005)	Aggregate data; Generalized gravity model	Bilateral real exchange rate volatility has a statistically negative impact on the bilateral exports of the major ACFTA countries. But the magnitude of the impact appears to be fairly small
Hui An & Wanyang Huang (2009)	China and Japan (1980-2004)	Aggregate data; Cointegration and error correction modeling approaches	The volatility of RMB have negative impact on Chinese exports
Jana Simakova(2016)	Vesegrad Countries (1999-2014)	Disaggregated data; Gravity model	Exchange rate volatility leads to decreasing of foreign trade turnover on the bilateral level

Chit *et al.* (2017)	East Asian Economies (1982-2006)	Disaggregated data; Gravity model	The results provide strong evidence that exchange rate volatility has a negative impact on the exports of emerging East Asian countries
Thuy & Thuy (2019)	Vietnam (2000-2014)	Aggregate data; Autoregressive distributed lag (ARDL)	The results show that exchange rate volatility negatively affects the export volume in the long run
Sugiharti *et al.*(2019)	Indonesia (2006-2018)	Disaggregated data; Autoregressive Distributed Lag (ARDL) Model and Non-liner Autoregressive Distributed Lag (NARDL) Model	Both NARDL and ARDL models suggest that Indonesian exports are negatively affected by exchange rate volatility
			Finding (Mixed results)
Conghui Zhou (2015)	China-Russia (2006-2014)	Aggregate data; Autoregressive distributed lags (ARDL) methodology	Mixed with positive and negative results
Bahmani & Harvey (2016)	U.S.- Philippines (2016)	Disaggregated data; Export and import demand model	Mixed with positive and negative results, almost half of the commodities flows are affected in the short-run
Bahmani & Harvey (2017)	Singapore-Malaysia (1979-2013)	Disaggregated data; Export and import demand model	Mixed with positive and negative results
Uprasen & Zolin (2017)	Korea-Japan (1970-2016)	Disaggregated data; Autoregressive Distributed Lag (ARDL) Model	Exchange rate volatility affects bilateral trade flows between Korea and Japan in both short run and long run.

5.3 Theoretical background

The impact of exchange rate volatility on international trade is a controversial issue. David Ricardo's (1918) theory of comparative advantage can be considered as the earliest research on the relationship between exchange rate and trade balance. The theory points out that a country's exports of products with comparative advantages and imports of products with comparative disadvantages will increase the welfare of both parties. We further express the comparative advantage by the level of production cost and price. When the cost of producing a product is low in the country, the country has the comparative advantage of producing the product, otherwise it is in the production of the product has a comparative disadvantage. If we further express the exchange rate in terms of purchasing power parity theory, it can be argued that the comparative advantage of the two countries in trade can be determined according to the exchange rate level. Specifically, when the exchange rate of a country is valued, the variety of exportable products will increase and the trade balance will improve; on the other hand, when the relative price decreases, the foreign demand for exported products may also increase, thereby improving trade income and expenditure.

Clark (1973)[52] first established a theoretical model for the connection between exchange rate volatility and international trade. He described a hypothetical example in which a single product produced by the company did not include import inputs for import inputs under perfect competition. Since the company only pays in foreign

[52] Clark, Peter B, 1973, "Uncertainty, exchange risk, and the level of international trade", *Economic Inquiry,* Vol 11, pp. 302–313.

currencies, the export revenue of the national currency depends on the exchange rate level (unpredictable). In this model, the company assumes that it is small and has limited access to currency hedging. In addition, as the cost of adjusting production levels to factors other than demand is high, it is assumed that output will not change due to favorable or adverse changes in export profits due to exchange rate volatility. The uncertainty in the future exchange rate is directly interpreted as the uncertainty in the future of the currency. Therefore, the relevant companies need to determine the level of export that includes this uncertainty. If the company believes to maximize profits and avoid risks greater than zero, the main condition of company production is that marginal income exceeds marginal costs to compensate for the assumed exchange risk.

And Hooper et al (1978)[53] provided the theoretical evidence for the first time and found that exchange rate volatility increased trade risks. When such trade risks could not be effectively avoided by financial instruments or the cost of avoidance was too high, firms would choose to reduce the amount of trade to avoid risks. The conclusion of exchange rate volatility has a negative impact on international trade is widely supported.

However, some scholars found that exchange rate volatility not only meant risks for firms, but also “profit opportunity”. Franke (1991) first proved that exporters can also benefit from exchange rate volatility. Exports can choose to optimize their output according to different exchange rate volatility levels.

[53] Hooper, P. and Steven, W. K., 1978, “The effect of exchange rate uncertainty on the prices and volume of international trade”, *Journal of International Economics*, Vol 8, pp. 483–511.

5.4 Research Methodology

This study used panel data This study uses balanced panel data from 1997 to 2017 to analyze the impact of bilateral exchange rate volatility on exports from Mongolia to China. Baltagi [54](1995) believes that the use of panel data has many advantages. According to Baltagi (1995), the balanced panel data controls the individual heterogeneity of each segment and represents more reliable information. In addition, balanced panel data includes higher degrees of freedom and higher efficiency.

Panel data has more advantages than conventional cross section and time series data analysis (Bahmani and Harvey, 2016). Panel data usually enable researchers to obtain large amounts of data, thereby increasing the degree of freedom and reducing the collinearity between exogenous variables, thus improving the efficiency of econometric estimation. In addition, panel data or longitudinal data provide research opportunities to analyze a variety of economic issues that are not possible using the cross-section rule or the time series data model.

This paper using panel data from 1997 to 2017. In order to study the impact of exchange rate volatility on export from Mongolia to China at the both aggregate level and disaggregated level, the author employs the exports volume of total 2-digit level of SITC (Rev.3) industry data to get aggregate data set which stand for the total exports from Mongolia and China. And due to the "aggregate bias" may exist cause the specific effects of exchange rate volatility on each industry to be ignored, the author also

[54] Baltagi, B. H.,1995, "Econometric Analysis of Panel Data", *New York: John Wiley & Sons,*

employs the disaggregated data for industries to investigate the more specific and credible affect by exchange rate volatility. According to the calculation by the author, there is 20 exporting industry which stands for 99 percent from Mongolia to China, <Table 5.4-1>. Therefore, the 20 industries show strong evidence that the study is significant. Because of the unavailability of data for SITC 22 and SITC 08, so the author employs the 18 industries in the estimation using 2-digit level of SITC (Rev.3) industry data.

5.4.1 Empirical model

The basic idea of Trade gravity model comes from Newton's law of universal gravitation, which indicates that the mutual attraction between two objects is proportional to the mass between them and inversely proportional to the distance between them. The model of trade driving force was proposed by Tinbergen and Poyhon (1962) almost simultaneously in the 1960s. It shows that the bilateral trade volume between two countries or regions is inversely proportional to the spatial distance, and in direct proportion to their economic aggregate. In other words, if the space distance between two countries is large, the trade volume between them is small. When two countries have a large economy, they have a large trade volume. The initial form of the traditional trade gravity model is:

$$T_{ij} = \frac{AG_iG_j}{D_{ij}} \tag{5.1}$$

In the formula, T_{ij} refers to the bilateral trade volume between country i and country j; G_i, G_j refer to the national income of country i and country j respectively, which is usually replaced by GDP; D_{ij} refers to the spatial distance between country i

and country j; A is a constant. Since the above formula is a nonlinear model, in order to facilitate the empirical test, the model is converted into the form of linear logarithm:

$$\mathrm{LnT_{ijt}} = \beta_0 + \beta_1 \mathrm{lnG_i G_j} + \beta_2 \mathrm{lnD_{ij}} + \varepsilon \quad (5.2)$$

β_0 , β_1, β_2 are regression coefficient, ε as error term.

Since the classical trade gravity model was proposed, it has attracted the interest of some experts and scholars. Their studies have developed the model to a certain extent. These studies mainly focus on the expansion of variables and the empirical study of the model. The expansion of variables is the introduction of explanatory variables and dummy variables that affect the trade volume. The empirical study is mainly based on the quantitative regression analysis of cross-section data. This paper also improves the above two aspects. First, in terms of explanatory variables, in addition to the GDP factors involved in the classical trade gravity model, three explanatory variables are introduced: per capita national income, real exchange rate and real exchange rate volatility.

Most empirical papers that study on the connection between exchange rate volatility and bilateral trade use the gravity model. (Baak 2004, Chit 2008, Šimakova 2016, Chit et al. 2017), in these studies, except exchange rate volatility, the gravity model is combined with some variables that can affect trade flows such as sharing border, using the same language, the member of international organization. So this article will employ the new variables to extend the original gravitational model proposed by Tinbergen (1962) in order to detect the impact of exchange rate volatility between China and Mongolia. The resulting extended model is:

$$lnEX_{ijt}^{s} = \beta_0 + \beta_1 lnGDP_{it} + \beta_2 lnGDP_{jt} + \beta_3 lnPGDP_{it} + \beta_4 lnPGDP_{jt} + \beta_5 lnRER_{ijt} + \beta_6 lnVOL_{ijt} + \varepsilon \quad (5.3)$$

As follow Zhu et al. (2016), the multiplication of GDP for two countries stand for the economic size. And the multiplication of per capita GDP for two countries stand for the income of residents. Therefore the author shorten down the equation (5.3), turn to;

$$\ln EX_{ijt}^{s} = \alpha + \beta_1 \ln GDP_{ijt} + \beta_2 \ln PGDP_{ijt} + \beta_3 \ln RER_{ijt} + \beta_4 \ln VOL_{ijt} + \varepsilon \quad (5.4)$$

Where, EX_{ijt}^{s} represents Mongolia's real exports of product s to China; GDP_{ijt} is the multiplication of Mongolia's real GDP and China's real GDP in year t; $PGDP_{ijt}$ is the multiplication of Mongolia's real per capita GDP and China's real per capita GDP in year t; RER_{ijt} is the real exchange rate, MNT against RMB; VOL_{ijt} is the exchange rate volatility. Regarding the functional form, Khan and Ross (1977) argue that the log-linear form is better than the standard linear form, both empirically and theoretically. That is, the former allows the dependent variable to respond proportionately to an increase or decrease in the regression coefficient of the dependent variable, and exhibits an interaction between elasticities. Thus, all variables in equation (5.4) are represented in logarithmic form.

During the estimation process, the author used Fixed Effects and Random Effects model. Because the regression model contains both Random Effects and Fixed Effects. When performing model regression on panel data, we need to use the Hausman test to determine whether to choose a Fixed Effects model or a Random Effects model. The calculations were evaluated by using EViews 10 software.

The gravity model studied so far includes three scenarios. They are Pool OLS, Fixed Effects regression (FE), and Random Effects (RE) regression models. The Pool model is not used in this article because the results of the Pool model lack precision and reliability.

The Fixed Effects regression model is one of the most common used models in econometric analysis. The Fixed Effects assumes that each observed variable has an intercept, but a similar slope, which means that each variable is different with each other. So the scholars control the Fixed Effects model is for all time-invariant differences between variables, which results in the estimated coefficients of the fixed-effect model not including any deviation because it omits time-invariant characteristics.

Under the Random effect (RE), the average of all variable intercepts obtained under the estimation is the agent intercept. The model has separate residuals (error terms) that are not automatically correlated with other variables. Using RE, we can exclude heteroskedasticity.

For the calculation of panel data, the important thing is to find out which regression of Fixed Effects or Random Effects is more suitable to interpret the results. We use the Hausman test.

According to the Hausman test hypothesis, if the p-value of Chi-square is tested by Hausman test. Chi-square is significant at the 1 percent or 5 percent level, and we reject the null hypothesis and accept the fixed effect as the appropriate choice for interpreting the results. The null hypothesis does not relate to correlations between explanatory variables and random effects. When the p-value Hausman test is not significant, we accept the null hypothesis. Accepting the null hypothesis means that

random effects regression is better suited to interpret our estimates.

5.4.2 Data description

The analysis on the impact of the exchange rate volatility on overall exports from Mongolia to China at the aggregate level employs the overall export volume from 1997 to 2017. For the quantity of data set, the author using all SITC 2-digit classifications which substitute the overall exports to widen the observations, total 987 observations applied in the estimation. In order to make the research more specific on the industry level, the author employs the industries export volume of SITC 2-digit from 1997 to 2017. According to the calculation, the author employs the specific 20 industries which account for 99% in the total export from Mongolia to China. It shows that strong evidence to express the significant of research.

The export value (EX) is overall export volume from Mongolia to China, in U.S dollars, are collected from the World Integrated Trade Solution (WITS), the real value of exports be applied in the estimation. Real exports are using the nominal export values deflated by the country's export price indices. However, exports price indices are not available for Mongolia. Therefore, the real exports calculated by deflating the volume by the China's import price indices (2010=100).

According to Zhu et al. (2016) and Muhammad et al. (2018), they employed log (GDP_{it} GDP_{jt}) as a proxy variable to stand for the economy size. For this research, the real gross domestic product (real GDP, 2010=100) which come from the World Bank. Therefore, the economy size of Mongolia and China are proxy by the real gross

domestic product (GDP_{ijt}), calculated as the natural logarithm form of real GDP of Mongolia multiple China in the year.

We also control for real per capita of GDP, which is ($PGDP_{ijt}$), which is estimated as the natural logarithm form of the real per capita GDP of Mongolia multiple China. The data source from the World Bank.

$RER_{ijt}$is the natural logarithm form of real exchange rate between Mongolia and China (MNT/RMB) The real exchange rate is simply the real exchange rate of the MNT against RMB. The real exchange rate not only takes into account the relative movements of all bilateral nominal exchange rates, but also excludes the effect of inflation on the value of the currency itself and reflects the external value and relative purchasing power of the national currency. The RER was calculated as the nominal exchange rate between the MNT and RMB multiplied by the ratio of Chinese consumer price index to Mongolian consumer price index. Where the formula to calculate real exchange rate is:

$$RER = E * P^{CN}/P^{MN} \quad (5.5)$$

E is the nominal exchange rate, P^{CN} and P^{MN} stand for the consumer price (all items index, 2010=100) for Mongolia and China respectively, the author applied CPI and nominal exchange rate statistic for Mongolia and China in monthly to calculate the real exchange rate. However, there is still no direct exchange rate statistic between Mongolia and China. So the author follow Zhou (2015) using cross exchange rate, taking MNT/USD and RMB/MNT to get the bilateral exchange rate between Mongolia and China (MNT/RMB). The official exchange rate data come from WIND database. The statistic of CPI for both countries are from International Financial Statistics (IFS).

Based on theory, the increase of RER represents the depreciation of Mongolia's currency which company with the more exports. The data source from Wind database.

VOL_{ijt} is the exchange rate volatility of the pair of real exchange rates between Mongolia and china in year t. Similar to Nguyen and Vo (2017), Uprasen and Zolin (2017) , Bahmani and Harvey (2017), exchange rate volatility is calculated as the the standard deviation of the change for 12 monthly real exchange rates in the year. The data source from Wind database. Where the formula to calculate the exchange rate volatility is:

$$VOL = \left[\frac{1}{m}\sum_{i=1}^{12}(X_i - \bar{X})^2\right]^{\frac{1}{2}} \quad (5.6)$$

Table 5.4-1 The selected 18 exporting industries from Mongolia to China by total export volume

SITC	Industry	%	SITC	Industry	%
01	Meat and meat preparations	0.832	33	Petroleum, petroleum products and related materials	7.103
05	Vegetables and fruits	1.091	61	Leather, leather manufactures and dressed furskins	0.294
21	Hides, skins and fur skins	0.01	65	Textile yarn and related products	0.025
24	Cork and wood	0.001	67	Iron and steel	0.009
26	Textiles fibres and their wastes	4.726	68	Non-ferrous metals	1.073
27	Crude fertilizers and crude minerals	0.696	69	Manufactures of metal	0.025
28	Metalliferous ores and metal scrap	41.666	72	Specialized machinery	0.038
29	Crude animal and vegetable materials	0.089	78	Road vehicles	0.024
32	Coal, coke and briquettes	41.747	84	Articles of apparel & clothing accessories	0.082

Table 5.4-2 Expected signs of variables and their rationales.

Variables	Expected Signs	Rationale	Source
Exports		The goods, the services of the country that are trade to the rest of the world.	WITS
The gross domestic product of exporting country i(GDP_{it})	+	It reflects a country's export capacity. The larger the economy, the greater the productive capacity, the greater the export capacity and the greater the volume of bilateral trade.	World Bank
The gross domestic product of importing country j (GDP_{jt})	+	It reflects a country's import capacity. The larger the economy, the greater the potential demand for imports and the greater the volume of bilateral trade.	World Bank
Per capita of the gross domestic product of exporting country i($PGDP_{it}$)	+	It reflects a country's export capacity. The larger the per capita economic output, the greater the production and supply capacity and the greater the volume of bilateral trade.	World Bank
Per capita of the gross domestic product of importing country j($PGDP_{jt}$)	+	It reflects a country's import capacity. The larger the per capita economic output, the greater the market demand and consumption capacity, and the greater the bilateral trade volume.	World Bank
	-	Higher-income for importing side may increases the demand for goods with high quality. Demand for low quality imported products can be declined. (Eita, J.H. and Jordaan, A.C., 2007)	
RER (Real exchange rate between two countries)	+	Increase in RER represent the depreciation from one side currency against the other side's currency which would induce higher exports.	WIND
VOL (Real exchange rate volatility)	+	The traders might just trade more, as a response to increased volatility in order to offset the expected decline in revenue per exported unit. (Franke, 1991)	WIND (calculated by author)
	-	Increased exchange rate volatility will increase trade risks and reduce the expected profit of exporters. (Clark ,1973)	

5.4.3 Estimation results

Table 5.4-3 Findings of the impact of exchange rate volatility on exports from Mongolia to China

			Fixed Effects model						Random Effects model					
SITC	Industry	Percent of total exports	C	$lnGDP_{ijt}$	$lnPGDP_{ijt}$	$lnRER_{ijt}$	$lnVOL_{ijt}$	R^2	C	$lnGDP_{ijt}$	$lnPGDP_{ijt}$	$lnRER_{ijt}$	$lnVOL_{ijt}$	R^2
Total exports	Aggregation of 18 industries.	100	7.935 a (2.890)	0.000 b (0.000)	0.348 a (0.123)	-0.637 (0.521)	0.000 (0.000)	0.914	7.935 a (2.925)	0.000 a (0.000)	0.348 a (0.120)	-0.637 c (0.509)	0.000 (0.000)	0.179
01	Meat and meat preparations	0.832	5.049	0.143	-0.124	1.436	0.235 a	0.673	12.509	-0.009	0.047	0.571	0.233	0.301
			(55.982)	(1.146)	(1.294)	(6.491)	(0.015)		(57.159)	(1.142)	(1.289)	(6.469)	(0.015)	
05	Vegetables and fruits	1.091	-14.194 a	0.079 a	-0.082 a	-0.058 a	0.007	0.916	-13.324 a	0.075 a	-0.078 a	-0.053 a	0.012	0.417
			(1.448)	(0.006)	(0.007)	(0.008)	(0.008)		(1.822)	(0.007)	(0.008)	(0.009)	(0.009)	
21	Hides, skins and fur skins	0.010	1.738	-0.888	0.934	-0.451 c	0.016 a	0.883	1.812	-0.772	0.806	-0.362	0.016 a	0.571
			(1.060)	(0.629)	(0.682)	(0.238)	(0.006)		(1.135)	(0.670)	(0.727)	(0.254)	(0.006)	
24	Cork and wood	0.001	6.326 b	-1.064 b	1.144 b	-0.519 a	0.001	0.963	5.592 c	-0.929 c	0.997 c	-0.458 b	0.002	0.286
			(3.013)	(0.492)	(0.533)	(0.186)	(0.004)		(3.134)	(0.511)	(0.554)	(0.193)	-0.004	
26	Textiles fibres and their wastes	4.726	5.199 b	-0.152 b	0.167 b	-0.058 b	0.000	0.980	5.205 b	-0.153 b	0.168 b	-0.058 b	0.000	0.322
			(2.414)	(0.071)	(0.074)	(0.021)	-0.002		(2.348)	(0.070)	(0.073)	(0.021)	-0.002	
27	Crude fertilizers and crude minerals	0.696	-11.293a	0.170 a	-0.175 a	0.361	0.002	0.811	-11.111a	0.170 a	-0.175 a	0.395	0.002	0.605
			(2.006)	(0.001)	(0.004)	(0.373)	(0.005)		(2.142)	(0.001)	(0.004)	(0.370)	(0.005)	
28	Metalliferous ores and metal scrap	41.666	4.794 a	-0.061 b	0.072 b	-0.182	-0.002	0.920	8.537 a	-0.111 a	0.124 a	-0.250 b	0.003	0.300
			(1.530)	(0.026)	(0.028)	(0.114)	(0.004)		(2.889)	(0.041)	(0.041)	(0.114)	(0.003)	
29	Crude animal and vegetable materials	0.089	-0.519	0.029	0.021	-0.203	0.014 a	0.698	-0.602	0.042	0.008	-0.200	0.014 a	0.580
			(4.158)	(0.625)	(0.647)	(0.163)	(0.001)		(4.158)	(0.617)	（0.639）	（0.161）	-0.001	

32	Coal, coke and briquettes	41.747	-0.679	0.236	-0.193	0.028	0.011 a	0.767	0.062	0.191	-0.110	0.112	0.012 a	0.445
			(4.582)	(0.722)	(0.829)	(0.211)	(0.001)		(11.708)	(1.563)	(1.880)	(0.098)	(0.001)	
33	Petroleum, petroleum products and related materials	7.103	48.883c	-0.139 c	0.157 c	-0.300	0.003	0.834	46.066 c	-0.130c	0.147 c	-0.263	0.003	0.449
			-24.145	(0.072)	(0.084)	(0.314)	(0.003)		(22.714)	(0.067)	(0.078)	(0.293)	(0.003)	
61	Leather, leather manufactures and dressed fur skins	0.294	8.588 a	0.224 a	-0.241 a	0.107 a	0.031 a	0.958	8.927 a	0.237 a	-0.254 a	0.111 a	-0.031a	0.655
			(2.494)	(0.076)	(0.083)	(0.029)	(0.007)		(2.522)	(0.077)	(0.083)	(0.029)	(0.007)	
65	Textile yarn and related products	0.025	10.186	-0.208 a	0.240 a	-0.195 b	-0.004 a	0.950	3.139	-0.166 a	0.199 a	-0.265 b	-0.039 a	0.259
			(7.726)	(0.045)	(0.044)	(0.076)	(0.007)		(11.625)	(0.061)	(0.058)	(0.102)	(0.010)	
67	Iron and steel	0.009	-1.188	0.416	-0.470	0.183	0.032 a	0.918	-1.861	0.652	-0.729	0.392	0.036 a	0.315
			(2.952)	(0.522)	(0.559)	(0.260)	(0.005)		(2.172)	(0.415)	(0.446)	(0.266)	(0.008)	
68	Non-ferrous metals	1.073	-4.203 a	-0.154 a	0.175 a	-0.519 a	-0.003	0.832	-4.888 a	-0.185 a	0.206 a	-0.616 a	0.006	0.488
			(0.276)	(0.012)	(0.013)	(0.038)	(0.004)		(0.388)	(0.017)	(0.019)	(0.073)	(0.012)	
69	Manufactures of metal	0.025	4.415	0.102	-0.110	0.452	0.017 c	0.664	6.258	0.140	-0.151	0.687	0.024 c	0.119
			(2.994)	(0.099)	(0.107)	(0.316)	(0.008)		(5.160)	(0.190)	(0.205)	(0.548)	(0.010)	
72	Specialized machinery	0.038	4.255	-0.575	0.663	-0.173 b	0.005	0.636	4.622	-0.654	0.758	-0.211 b	0.002	0.442
			(3.367)	(0.495)	(0.533)	(0.083)	(0.011)		(3.848)	(0.547)	(0.581)	(0.074)	(0.011)	
78	Road vehicles	0.024	-11.065	1.006 a	-0.656 a	-1.219	-0.053	0.724	-8.935	0.979 a	-0.654 a	-0.814	-0.070	0.492
			(8.870)	(0.112)	(0.007)	(1.687)	(0.072)		(9.570)	(0.115)	(0.007)	(1.718)	(0.073)	
84	Articles of apparel & clothing accessories	0.082	2.332 c	0.093 b	-0.098 b	0.102	0.010 a	0.400	3.398 b	0.124 a	-0.132 a	0.232	0.009	0.171
			(1.287)	(0.040)	(0.043)	(0.155)	(0.003)		(1.406)	(0.039)	(0.042)	(0.175)	(0.003)	

Note:

1. The figures in parentheses are standard errors; C means “constant”; Percent indicates shares of each exporting industry to total exports in per cent.

2. R^2 describes the goodness of fit for the model.

3. The asterisks marks (a, b and c) follow with the coefficient means that statistically significant at 1percent, 5 percent and 10 percent levels respectively.

Table 5.4-4 Hausman Test for estimation

SITC	Test Summary	Chi-sq. Statistic	Chi-sq.d.f	Prob.
Total exports	Cross-section Random	0.000000	4	1.0000
01	Cross-section Random	0.000000	4	1.0000
05	Cross-section Random	0.000000	4	1.0000
21	Cross-section Random	0.000000	4	1.0000
24	Cross-section Random	0.000000	4	1.0000
26	Cross-section Random	0.000000	4	1.0000
27	Cross-section Random	0.000000	4	1.0000
28	Cross-section Random	0.000000	4	1.0000
29	Cross-section Random	0.000000	4	1.0000
32	Cross-section Random	0.000000	4	1.0000
33	Cross-section Random	0.000000	4	1.0000
61	Cross-section Random	0.000000	4	1.0000
65	Cross-section Random	0.000000	4	1.0000
67	Cross-section Random	0.000000	4	1.0000
68	Cross-section Random	0.000000	4	1.0000
69	Cross-section Random	0.000000	4	1.0000
72	Cross-section Random	0.000000	4	1.0000
78	Cross-section Random	0.000000	4	1.0000
84	Cross-section Random	0.000000	4	1.0000

The Hausman test results show that the p value is 1.000, which means that the null hypothesis cannot be rejected, and random effects are appropriate, not fixed effects. At the same time, Chi-Sq. Statistic shows the number is 0.000000, and for Chi-Sq. degree of freedom is 4. Kitetu (2015) could not find any empirical evidence, and believed that these numbers were insufficient to draw a proper conclusion that random effects were appropriate. Therefore, below we explain the results of random effect estimation. Therefore, based on the previous work, we can conclude that the result shows that the random effect of the cross-sectional variance is estimated to be zero, so there is no evidence that there is an individual effect. In addition, Glenn (2011) explained that there is no guarantee that the Hausman test statistical estimator of the coefficient variance is positive definite. If statistics cannot be calculated, the Eviews software will set the value to zero. Therefore, based on the testing results of Hausman, the author

chooses the Random Effects model to be the appropriate regression to explain the results carefully.

Table 5.4-5 Summary of Affected Exporting Industries from Mongolia to China

Negative Impact			Positive Impact			No Impact	
SITC	Label	Coefficient	SITC	Label	Coefficient	SITC	Label
61	Leather, leather manufactures and dressed fur skins	-0.03	01	Meat and meat preparations	0.23	Total exports	
65	Textile yarn and related products	-0.03	21	Hides, skins and fur skins, raw	0.01	05	Vegetables and fruits
			29	Crude animal and vegetable materials	0.01	24	Cork and wood
			32	Coal, coke and briquettes	0.01	26	Textiles fibres and their wastes
			67	Iron and steel	0.03	27	other than division 56, crude fertilizers and crude minerals
			69	Manufactures of metal	0.02	28	Metalliferous ores and metal scrap
			84	Articles of apparel clothing accessories	0.009	33	Petroleum, petroleum products and related materials
						68	Non-ferrous metals
						72	Specialized machinery
						78	Road vehicles

Recording to the estimation results showing as <Table 5.4-5 >, indicate that from the perspective of aggregate level analysis, the coefficient per capita GDP result is

significant at 1 percent level. That's show that if the income of residents in both sides increase by 1 percent, the exports from Mongolia to China will improve 0.348 percent. But the coefficient of exchange rate volatility is not statistically significant, confirm that the exchange rate volatility has no effect on overall exports. So, we need investigate the effect of exchange rate volatility at the aggregate level to observe the "aggregate bias" problem, but also still need examine the specific effect of exchange rate volatility at the exporting industries level. From the presentation of results, there are only 2 industries out of 18 industries have negative impact on export from Mongolia to China due to exchange rate volatility, leather, leather manufactures and dressed fur skins (SITC 61) and textile yarn and related products (SITC 65). The negative sign proves that exchange rate volatility lead to decline of the exports. However, in our study SITC 61 and SITC 65 contribute only 0.319 percent to the total exports share from Mongolia to China while an increase in exchange rate volatility by one standard deviation around its mean would lead to a 0.03 percent reduction of the exports of SITC 61 and SITC 65 from Mongolia to China. For the other explanatory variables, like GDP and per capita of GDP, shows the expected sign in the SITC 61. The coefficient of RER shows positive in the SITC 61 represents that the increase of exchange rate, MNT get depreciation at the time and improve the exports. The exporter in the industry of textile yarn and related products avoid to risk, prefer to export less. The change of exchange rate will increase the risk of enterprise income. Especially when enterprises cannot use financial tools to avoid risks or the cost of avoiding risks is too high, the change of exchange rate will reduce the expected earnings of risk-averse exporters and further inhibit exports.

On the other hand, the estimation results of positive impact on meat and meat preparations (SITC 01), hides, skins and fur skins raw (SITC 22), crude animal and vegetable materials(SITC 29) , coal, coke and briquettes(SITC 32), iron and steel (SITC 67), Manufactures of metal (SITC 69),Articles of apparel clothing accessories (SITC 84) reveal that due to exchange rate volatility, the exports from Mongolia to China in these industries are improved even though the value is so small. 7 industries account for 42.79 percent out of the 18 industries. Among them, coal, coke and briquettes (SITC 32) take 41.74 percent and an increase in exchange rate volatility by one standard deviation would lead to a 0.01 percent increase of the exports. Related to the trade structure of Mongolia which mainly export primate product, we can imagine that the exporters of these industries prefer to trade more to increase their current revenue. The change of exchange rate may have a positive impact on the trade of enterprises with risk appetite, which may increase the export willingness of enterprises and thus lead to the increase of their profits. And the results are similar to Canzoneri et al[55]. (1984), they made argument of the firm if has ability to choose its factor inputs to get profit from the volatility in exchange rate, a higher volatility rate may cause greater opportunity to make benefit.

From the estimation results we can discover that exchange rate volatility have no impact on vegetables and fruits(SITC 05), cork and wood(SITC 24), textiles fibers and their wastes (SITC 26), other than division 56, crude fertilizers and crude minerals (SITC 27), metalliferous ores and metal scrap (SITC 28), petroleum, petroleum products and related materials (SITC33), non-ferrous metals(SITC68), specialized

[55] Canzoneri, Matthew B., Peter B. Clark, and Thomas C. Glaessner, 1984, "The Effects of Exchange Rate Variability on Output and Employment". *International Finance Discussion, pp* 240.

machinery (SITC 72), road vehicles (SITC 78). They contribute to the 56.41 percent out of the 18 industries. According to the estimation results, the coefficient of above are no significant. And it's showing the similar findings with Zhou (2015), Bahmani and Harvey (2016), Bahmani and Harvey (2017), Uprasen and Zolin (2017). Different countries have different products, which will produce different results due to exchange rate volatility (An and Huang 2009).

Exchange rate volatility also has an impact on Chinese exports to Mongolia. In addition, to better study the impact of exchange rate volatility on exports, the top 15 products exported from China to Mongolia as 79.3 percent of total exports were also included in the estimation of the regression analysis, showing as <Table 5.4-6>.

According to the authors' estimate analysis, exchange rate volatility negatively affects 6 industries among the top 15 industries, including SITC 04 (cereals, SITC 33 (petroleum products), SITC 65 (textile yarn), SITC 67 (iron and steel), SITC 71 (power generating machinery), SITC 84 (articles of apparel). The total share of these 6 industries is 35.3 percent. It should be noted that SITC 84 (articles of apparel), with a share of 15.5 percent, is the largest exporting commodity from China to Mongolia.

In addition, according to the analysis, exchange rate fluctuations have no significant impact on exports in most of the top 15 industries (9 industries out of 15 industries). This corresponds to the findings at the aggregate data level. These include: SITC 66 (nonmetallic mineral manufactures), SITC 69 (manufactures of metal), SITC 72 (specialized machinery), SITC 74 (other industrial machinery and parts), SITC 76 (telecommunication), SITC 77 (electrical machinery), SITC 78 (road vehicles), SITC 81 (prefabricated buildings), SITC 89 (miscellaneous manufactured articles). These industries account for 44 percent of total exports.

Table 5.4-6 Findings of the impact of exchange rate volatility on exports from China to Mongolia

			Fixed Effects model						Random Effects model					
SITC	Industry	Percent of total exports	C	$lnGDP_{ijt}$	$lnPGDP_{ijt}$	$lnRER_{ijt}$	$lnVOL_{ijt}$	R^2	C	$lnGDP_{ijt}$	$lnPGDP_{ijt}$	$lnRER_{ijt}$	$lnVOL_{ijt}$	R^2
Total exports	Aggregation of 15 industries.	100	-5.271 (3.018)	-0.788 c (0.338)	1.036 a (0.390)	-0.441 a (0.051)	-0.015a (0.003)	0.546	-3.263 (4.166)	-0.539 (0.468)	0.751 (0.543)	-0.448 c (0.076)	-0.016 (0.010)	0.674
04	Cereals	1.337	-1.983 (3.296)	0.138 (0.163)	-0.144 (0.322)	-0.011 (0.428)	-0.009 (0.031)	0.603	-2.408 (6.930)	0.156 (0.304)	-0.182 0.616	0.049 (0.998)	-0.009a (0.002)	0.594
33	Petroleum	2.596	-1.195 (1.126)	-0.175 (0.142)	0.210 (0.162)	-0.050 c (0.023)	-0.003a (0.000)	0.749	1.877 (3.247)	0.184 (0.379)	-0.196 (0.430)	-0.100 (0.056)	-0.005c (0.002)	0.487
65	Textile yarn	6.887	3.280 a (0.868)	0.357 a (0.098)	-0.410 a (0.114)	-0.061 a (0.012)	-0.004a (0.000)	0.502	3.568 a (1.253)	0.381 a (0.141)	-0.440 a (0.165)	-0.070 a (0.015)	-0.004a (0.001)	0.417
66	Nonmetallic mineral manufacture	4.965	-10.068 (6.358)	-0.123 (0.070)	0.153 (0.081)	-0.176 (0.123)	-0.003 (0.005)	0.913	-10.068 (5.290)	-0.123c (0.058)	0.153c (0.067)	-0.176 (0.108)	-0.003 (0.007)	0.813
67	Iron and steel	7.212	-15.403 (11.416)	-0.192 (1.281)	0.237 (1.477)	-0.339 (0.205)	-0.013 (0.007)	0.833	3.233 (11.357)	0.290 (1.349)	-0.183 (1.545)	-0.467 c (0.189)	-0.032c (0.015)	0.493
69	Manufactures of metal	5.809	-11.662 (6.819)	-0.148 (0.075)	0.185 c (0.087)	-0.380 a (0.140)	-0.006 (0.009)	0.911	-19.263 (10.366)	-0.242c (0.120)	0.294 c (0.139)	-0.386 a (0.133)	-0.001 (0.009)	0.724
71	Power generating machinery	1.728	-1.551 (1.711)	-0.192 (0.190)	0.237 (0.219)	-0.033 (0.035)	-0.002 (0.002)	0.763	-1.575 a (0.287)	-0.187 a (0.030)	0.233 a (0.031)	-0.027 (0.018)	-0.002 a (0.000)	0.641
72	Specialized machinery	7.368	-7.118 (9.428)	-0.102 (0.102)	0.130 (0.118)	-0.440 c (0.201)	-0.012 (0.011)	0.892	-16.371 (8.692)	-0.202c (0.095)	0.244c (0.110)	-0.207 (0.177)	-0.013 (0.016)	0.605
74	Other industrial machinery	4.600	1.995 (1.214)	-0.029 (0.053)	0.220 c (0.106)	-0.689 a (0.172)	-0.019 a (0.004)	0.886	2.439 (1.843)	-0.086 (0.101)	0.369 (0.220)	-0.815 a (0.279) a	-0.017 (0.018)	0.664
76	Telecommunication	2.850	-6.055 c (2.626)	0.185 c (0.078)	-0.190 c (0.085)	-0.094 a (0.032)	-0.001 (0.001)	0.874	-4.235 (3.334)	0.130 (0.100)	0.008 （0.639）	-0.066 （0.046）	0.007 (0.001)	0.793
77	Electrical machinery	4.994	-6.069 (7.615)	-0.854 (0.847)	0.113 (0.097)	-0.436a (0.156)	-0.028a (0.001)	0.885	-5.974 (7.608)	-0.893 (0.887)	0.118 (0.102)	-0.551 a (0.149)	-0.015 (0.016)	0.769
78	Road vehicles	8.625	-12.563 (11.382)	-0.173 (0.125)	0.213 (0.144)	-0.546c (0.238)	0.003 (0.007)	0.882	-19.190 (10.413)	-0.250c (0.117)	0.303 c (0.134)	-0.498 (0.261)	0.003 (0.018)	0.771

81	Prefabricated buildings	1.365	-3.091	-0.372 c	0.444 c	-0.017	0.002	0.801	-3.091 a	-0.372 a	0.444 a	-0.017	0.002	0.791
			(1.601)	(0.178)	(0.205)	(0.032)	0.002		(0.922)	(0.103)	(0.118)	(0.020)	(0.001)	
84	Articles of apparel	15.549	9.434	-0.915	1.171	-0.312	-0.021a	0.613	0.002	0.352	-0.268	-0.412	-0.023a	0.447
			(9.039)	(1.255)	(1.440)	(0.233)	(0.007)		(7.620)	(1.128)	(1.288)	(0.356)	(0.008)	
89	Miscellaneous manufactured article	3.418	2.911	0.053	0.049	-0.658a	-0.018	0.888	-8.621	-1.238	1.544	-0.483c	0.000	0.716
			(9.137)	(1.016)	(1.171)	(0.187)	(0.012)		(11.242)	(1.250)	(1.440)	(0.230)	(0.015)	

Note:

1. The figures in parentheses are standard errors; C means "constant"; Percent indicates shares of each exporting industry to total exports in per cent.

2. R^2 describes the goodness of fit for the model.

3. The asterisks marks (a, b and c) follow with the coefficient means that statistically significant at 1percent, 5 percent and 10 percent levels respectively.

5.5 Conclusion

In 1973, the introduction of exchange rate volatility introduced a new element to international financial markets. Scholars have studied the issue theoretically and empirically, and most have focused on the impact of exchange rate volatility on trade flows. Their research suggests that exchange rate volatility can promote or harm trade, depending on the risk tolerance of market participants. Since this paper is focused on Mongolia's trade to China, no research on exchange rate volatility has been found so far. On the basis of previous literature studies, in order to better study the impact of exchange rate volatility on trade, the author first analyzed Mongolia's total exports to China from the level of aggregate data, and the results proved that exchange rate volatility have a boosting effect on total exports, but then the author used disaggregated data to assess the impact of exchange rate volatility on 18 industries of Mongolia's exports to China. In the study, 18 export industries combined accounted for more than 99 percent of the market share, using annual data from 1997 to 2017 and panel data regression analysis using the trade gravity model. And the final results were obtained by selecting a random effects model for interpretation according to the Hausman test. We find that trade flows in most industries are not affected by exchange rate volatility, but only a few industries have positive or negative effects, which is consistent with the previous study finding that the “aggregate problem” does exist. More specifically, as suggested by Zhou (2015), Uprasen and Zolin (2017), Bahmani and Harvey (2016), the mixed effects of exchange rates are presented.

Chapter VI CONCLUSION AND POLICY RECOMMENDATIONS

The impact of the exchange rate between Mongolia and China on bilateral trade is complex. One of the reasons is determined by the typical structure of bilateral trade, at present, Mongolia imports mostly electromechanical and manufacturing industry products from China and more than 80 percent of its main exports are energy and raw materials product, these commodities prices are denominated in U.S. dollars on the international market, so the impact of exchange rate volatility between Tugrik and RMB on the main export commodities is difficult to generalize. Secondly, the lack of direct exchange rate instrument between MNT and RMB, this article adopts the exchange rate based on the US dollar, and the RMB refers to a basket of currencies for reconciliation, there are many factors affecting the exchange rate of the two currencies, which makes the transmission to bilateral trade more complicated. Third, the complex international situation makes it more difficult to study the impact of the exchange rate on bilateral trade, and in addition to the global financial crisis of 2008, political factors between the two countries may also interfere to some extent with the impact of the exchange rate on bilateral trade.

The trade between China and Mongolia has strong complementary characteristics. The products with strong trade competitiveness are mainly primary products such as coal and copper, labor-intensive products of SITC 7 and SITC 8, and a small amount of capital and technology-intensive products. It basically conforms to the factor endowments and comparative advantages of Mongolia and China.

The trade structure between Mongolia and China is basically in line with the theory of comparative advantage. In order to promote bilateral trade, Mongolia and China should develop their revealed advantageous products. China should continue to leverage the traditional advantages of manufacturing to produce high quality products. Mongolia is rich in natural resources, such as primary industrial raw materials such as coal and copper mines, as well as animal husbandry in Mongolia. Wool products are its superior products, so Mongolia should fully recognize its advantages in international trade.

By studying the trade complementarity index, there is still huge potential between Mongolia and China. Mongolia's wool products, coal and copper mines exported to China occupy a very large proportion of the market. China's machinery and equipment, steel products and textile products are exactly what Mongolia needs as a backward developing country. The calculated values also show that these products have very obvious complementary advantages in the bilateral trade between Mongolia and China indicating that Mongolia and China can continue to strengthen trade cooperation in these product areas and both of them should expand the export of superior products based on their revealed advantages.

In the regression results, there are only two industries that are negatively affected due to exchange rate volatility. In addition, in the study of 18 industries, 9 industries are not affected by exchange rate volatility, and 7 industries are positively affected, but the value is very low. This shows that the exchange rate fluctuation between Mongolia and China will not have much impact on bilateral trade. The possible explanation is that exporters are more inclined to seize the opportunity of exchange rate volatility to expand exports to offset possible future loss of profits. It is recommended that both

governments should continue to expand cooperation, at the same time stabilize the bilateral exchange rate mechanism, and strengthen cooperation between financial institutions.

This article empirically analyzes the impact of bilateral exchange rate volatility on exports. By sorting out the references, the trade gravity model is used as a means of analysis. Using Eviews10 software, using panel data analysis, because the results of Pool OLS cannot have reference significance, the author chose Fixed Effects regression and Random Effect regression models to estimate the impact of exchange rate volatility on exports. The observation period was selected from 1997 to 2017 (a total of 21 years). In order to observe the effect of exchange rate volatility on overall exports, the author get the estimation results at the aggregate level first. We conclude that the exchange rate volatility has no impact on the overall export from Mongolia to China. For getting specific findings on the industry level, the author selected the top 20 products that Mongolia exported to China. Due to incomplete data, only 18 sets of product data were used. The Hausman test results of all models can not reject the original hypothesis, that is, the random effect is a suitable model to explain the impact of China-Mongolia bilateral exchange rate volatility on exports. Therefore, the author applied Random Effects model to analyze and summarize the results. The results show the mixed findings which also detect the “aggregate bias” exists. The explanatory variables of the valuation are selected based on the previous gravitational model research. The author expands based on the original classic gravity model by adding GDP, GDP per capita, bilateral real exchange rate and bilateral real exchange rate volatility. Since the research object of this paper is bilateral between Mongolia and China, the distance factor in the

classic gravity model is eliminated (because the distance factor is a fixed value in this study, it has no research value).

Recording to the estimation results that only 2 industries out of 18 industries have negative impact on export from Mongolia to China due to exchange rate volatility, leather, leather manufactures and dressed fur skins (SITC 61) and textile yarn and related products (SITC 65). That's especially improve that when enterprises cannot use financial tools to avoid risks or the cost of avoiding risks is too high, the change of exchange rate will reduce the expected earnings of risk-averse exporters and further inhibit exports.

The estimation results of positive impact on meat and meat preparations (SITC 01),Hides, skins and fur skins raw (SITC 22),crude animal and vegetable materials (SITC 29), coal, coke and briquettes (SITC 32), iron and steel (SITC 67), manufactures of metal (SITC 69),articles of apparel clothing accessories (SITC 84) reveal that due to exchange rate volatility, the exports from Mongolia to China in these industries are improved. The change of exchange rate may have a positive impact on the trade of enterprises with risk appetite, which may increase the export willingness of enterprises and thus lead to the increase of their profits.

Exchange rate volatility have no impact on vegetables and fruits(SITC 05), cork and wood (SITC 24), textiles fibers and their wastes (SITC 26), other than division 56, crude fertilizers and crude minerals (SITC 27), metalliferous ores and metal scrap (SITC 28), petroleum, petroleum products and related materials (SITC33), non-ferrous metals(SITC68), specialized machinery (SITC 72), road vehicles (SITC 78).

According to the previous analysis, Mongolia ’s current export product structure is too simple, mainly exports primary products and energy raw materials, and relies heavily on limited trading partners. Trade risks increase. Under this background, Mongolia has further adjusted through industrial structure. To realize the adjustment of the structure of export products, on this basis to achieve the upgrade and optimization of the structure of export products, As continuously improve the control of export product prices, is of great significance to Mongolia. As far as China is concerned, it should continue to exert its industrial advantages. Also, accelerate the optimization and upgrading of the industrial structure.

Through the analysis of the bilateral exchange rate between China and Mongolia and the results of regression analysis of the trade gravity model, it can be seen that although the actual exchange rate volatility have no impact on the most (9 out of 18) bilateral product trade, but in view of the trade structure of China and Mongolia, the trade risk It still exists. Both parties should establish a financial mechanism to stabilize exchange rates and reduce the negative impact of exchange rate volatility.

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Appendix

Table A-1. Summary of literature reviews on trade structure

Summary of literature reviews on trade structure analysis			
Author /Publish year	**Case study**	**Methodology**	**Finding**
		China-Mongolia	
Diao *et al.* (2015)	China-Mongolia-Russia (2005-2014)	1.Trade complementarity index 2. Trade combination degree	1. China-Mongolia complementary products are SITC2, SITC6, SITC7, SITC9. 2. The TCD index of China and Mongolia is far greater than 1, which fully shows that China and Mongolia are very close in trade.
Qiaoyi Ding (2016)	China-Mongolia-Russia (2003-2014)	1.Trade complementarity index 2. Revealed comparative advantages index	1.China and Mongolia have strong complementarities in SITC 0, 6, 7, 8 products. 2. Mongolia 's export commodities with comparative advantages are mainly concentrated in SITC2.

Yunjiao Pan (2016)	China-Mongolia (2005-2014)	1.Revealed comparative advantages index 2.Trade complementarity index	1. China has significant presence in SITC 6,7 and 8 In terms of comparative advantage, Mongolia has a comparative advantage in the SITC 2 and 3. 2.The results of the trade complementarity index calculated by China 's exports and Mongolia 's imports show that the SITC 6, 7, 8 index values are greater than 1, indicating that China 's exports and Mongolia 's imports are highly complementary in these three sectors.
Yiqi Zhu (2017)	China-Mongolia-Russia (1998-2015)	1.Trade complementarity index	1.China's labor-intensive products (SITC6 and SITC8) exported to Mongolia have strong trade complementarity; The competitive products exported by Mongolia to China are mainly SITC 2
Wu *et al.* (2017)	wooden furniture tarde among China-Mongolia-Russia (1997-2016)	1.Trade intensity index 2. Revealed comparative advantages	China's wooden furniture industry has a strong comparative advantage and is relatively competitive in the export market; The wooden furniture trade relationship between China and Mongolia is relatively close.
		Other case studies	
Bernadette Andreosso-O' Callaghan (2008)	Korea - EU (1996-2006)	Revealed comparative advantages	EU and Korea are structurally complementary in the most agricultural products.

Jie Lv & Longbin Xiang (2010)	China - US (2000-2006)	Revealed comparative advantages	There is a strong trade complementarity relationship between China and the US; China has shown the comparative advantage gradually, especially in the area of capital goods and technology products.
Sarath Chandran, B.P.(2011)	India - ASEAN Countries (1990-2007)	Trade Intensity Index Revealed Comparative Advantage Index	India had advantage in some manufactured items; ASEAN has comparative advantage in Electrical and Electronic components.
Chuanmin Shuai & Xi Wang (2011)	China - US (1997-2007)	1.Revealed comparative advantages 2. Trade complementarity index	1.China's labor-intensive agri-products still have high comparative advantages; Comparative advantages exist in America's land intensive and capital intensive agricultural products. 2.The major agricultural products of China and the United States have strong trade complementarity.
Zhang *et al.*(2015)	China & Kazakhstan (2002-2014)	1.Revealed comparative advantages 2. Trade complementarity index	1.China has obvious comparative advantages in products SITC 6, 7 and 8; Kazakhstan has a clear comparative advantage in categories 2, 3 and 6 2.For China, in terms of SITC 0, 1, 5, 6, 7 and 8, China's trade complementarity with Kazakhstan is stronger than Kazakhstan's trade complementarity with China.

Chunyan Yu & Chunjie Qi (2015)	China and CEE Countries (2013)	1.Revealed comparative advantages 2. Trade complementarity index	1.China's agricultural products have very strong comparative advantages. 2. The trade complementarity of these countries' export and China's import are getting stronger.
Kabiru Hannafi Ibrahim (2015)	Nigeria and India (2000-2014)	Revealed comparative advantages	Nigeria has comparative advantage in mineral fuels, ships boats and floating structures, rubber and articles thereof, lac; gums resins and other vegetables; India have advantages in organic chemicals, nuclear reactors, fish crustacean and other aquatic, footwear, man-made staple fibres, edible fruit and nuts, cereals.
Şimşek *et al.*(2017)	Turkey -Russia (1992-2014)	1.Trade intensity index 2.Trade complementarity index	1.There is a strong import relationship for Turkey with Russia while its export intensity is a little higher than expected. 2.Trade complementarity index between Turkey and Russia, showing a strong complementarity, means that the export structure of Turkey is compatible with import structure of Russia.

Xiangyu Wei & Ze Tian (2018)	China - Guinea (2013-2015)	1.Revealed comparative advantages 2. Trade complementarity index	1. SITC9 is the strongest international competitiveness for Guinea. 2. SITC5, SITC6 and SITC7 are highly competitive in China's export products, among which SITC5 is the most competitive in the world market.
Jiandong Shi (2020)	China - CEE countries (1995-2015)	Trade combination degree	Both the bilateral TCDs of China and central and eastern European countries to each other are in relative low level.

Table A-2. Results of revealed comparative advantage index of China vis-à-vis world (top 30 industries of M-C trade)

SITC/Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
283	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
321	1.56	1.59	1.85	2.14	2.82	2.34	2.05	1.75	1.19	0.87	0.67	0.58	0.29	0.20	0.18	0.10	0.07	0.05	0.04	0.07	0.07
281	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.03
333	0.51	0.33	0.11	0.14	0.10	0.08	0.07	0.04	0.06	0.04	0.03	0.02	0.03	0.01	0.01	0.01	0.01	0.00	0.02	0.01	0.02
287	0.46	0.34	0.38	0.34	0.33	0.61	0.64	0.79	0.82	0.47	0.34	0.33	0.08	0.18	0.15	0.09	0.06	0.06	0.03	0.03	0.03
844	6.10	5.88	4.99	4.38	3.81	3.95	4.10	4.12	3.35	4.41	4.62	4.31	4.05	4.34	4.55	4.62	4.53	3.96	3.28	3.24	3.16
268	1.52	1.37	2.34	2.01	1.63	1.39	1.39	1.31	1.39	1.43	1.23	1.25	1.21	1.33	1.40	1.17	1.14	1.03	0.83	0.85	0.81
782	0.05	0.06	0.03	0.05	0.04	0.05	0.06	0.07	0.12	0.18	0.31	0.42	0.37	0.29	0.36	0.40	0.34	0.32	0.29	0.23	0.25
843	4.55	5.34	4.84	4.42	4.03	3.90	3.93	3.91	3.64	4.52	5.25	4.91	4.34	4.31	4.31	4.29	4.18	3.58	2.78	2.84	2.67
723	0.17	0.14	0.16	0.25	0.36	0.31	0.29	0.33	0.38	0.58	0.60	0.80	0.77	0.73	0.89	0.95	0.95	0.95	0.85	0.84	0.94
658	5.41	5.05	5.05	5.06	4.78	4.42	4.38	4.28	4.28	4.24	3.95	4.33	4.27	4.09	4.07	3.95	3.83	3.61	3.24	3.33	3.39
679	0.66	0.8	0.76	0.84	0.79	0.7	0.75	0.83	0.98	1.23	1.41	1.7	1.35	1.26	1.44	1.4	1.36	1.32	1.28	1.36	1.32
845	4.72	4.71	4.82	4.77	4.35	3.93	3.6	3.48	3.61	3.95	3.83	3.66	3.29	3.33	3.29	3.06	2.95	2.93	2.42	2.57	2.42
661	2.88	2.43	2.19	2.15	2.18	1.99	1.83	1.72	1.92	2.09	1.93	1.78	1.81	1.76	1.88	1.75	1.75	1.74	1.94	1.82	1.67
676	0.36	0.21	0.22	0.35	0.32	0.38	0.44	0.7	0.8	1.12	1.39	1.4	0.48	0.69	0.81	1.02	1.26	1.66	1.75	1.76	1.12
728	0.18	0.17	0.21	0.18	0.27	0.28	0.29	0.3	0.36	0.38	0.41	0.51	0.52	0.48	0.5	0.55	0.59	0.61	0.57	0.59	0.68
691	0.98	1.15	1.14	1.28	1.42	1.35	1.25	1.28	1.45	1.63	1.86	2.08	1.83	1.9	1.91	1.95	1.79	1.74	1.78	1.67	1.74
893	2.31	2.43	2.31	2.39	2.23	2.12	1.91	1.83	1.76	1.72	1.52	1.5	1.46	1.53	1.65	1.92	1.91	1.81	1.74	1.71	1.8
764	1.17	1.24	1.36	1.45	1.78	2.04	2.22	2.45	2.57	2.67	3.07	3.19	3.3	3.27	3.49	3.57	3.53	3.48	3.26	3.32	2.99
699	1.43	1.41	1.43	1.41	1.44	1.46	1.37	1.43	1.45	1.48	1.4	1.36	1.31	1.36	1.41	1.42	1.43	1.42	1.42	1.33	1.41
841	5.44	4.64	4.9	4.73	4.4	3.62	3.29	3.1	3.09	3.22	2.98	2.96	2.88	2.85	2.81	2.52	2.46	2.71	2.16	2.36	2.27
783	0.09	0.04	0.04	0.06	0.08	0.06	0.04	0.05	0.14	0.22	0.37	0.36	0.41	0.49	0.49	0.55	0.52	0.61	0.48	0.47	0.46
57	0.42	0.37	0.34	0.32	0.29	0.3	0.28	0.29	0.25	0.27	0.27	0.3	0.35	0.32	0.33	0.36	0.34	0.32	0.36	0.37	0.34
744	0.5	0.52	0.5	0.62	0.66	0.73	0.68	0.78	0.83	0.89	0.95	1.19	1.3	1.19	1.19	1.2	1.25	1.21	1.18	1.28	1.23
775	1.88	2.02	2.42	2.78	2.93	2.85	2.78	2.7	2.77	2.82	2.72	2.93	2.83	2.9	2.98	2.95	2.92	2.8	2.59	2.63	2.74
786	3.42	4.42	4.39	6.12	5.32	4.4	4.83	4.43	3.99	3.38	3.22	3.1	1.97	3.33	3.59	2.87	2.66	2.63	2.35	1.78	2.41
682	0.44	0.51	0.51	0.57	0.39	0.43	0.42	0.54	0.55	0.56	0.43	0.45	0.37	0.31	0.38	0.42	0.41	0.39	0.33	0.43	0.38
821	1.41	1.5	1.69	1.87	1.87	1.99	1.99	2.1	2.22	2.31	2.32	2.49	2.64	2.78	2.83	3.05	2.92	2.64	2.48	2.41	2.49
772	0.77	0.84	0.92	0.9	0.96	0.96	0.94	1.01	1.09	1.24	1.29	1.36	1.34	1.36	1.39	1.39	1.33	1.32	1.27	1.28	1.22
716	2.45	2.4	2.64	3.07	3.06	2.96	2.96	2.67	2.53	2.27	2.11	2.16	2.12	2.14	2.15	2.13	2.2	2.13	2.04	2.05	2.24

Table A-3. Revealed comparative advantage index of Mongolia vis-à-vis world (top 30 industries of M-C trade)

SITC/Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
283	418.20	379.09	363.43	276.86	259.70	287.00	232.86	216.61	159.37	149.74	155.33	171.21	141.33	119.15	123.00	122.10	77.52	156.80	171.42	106.53	77.70
321	0.00	0.02	0.01	0.00	0.00	0.00	3.10	5.26	5.30	6.73	15.34	27.84	25.33	24.19	21.81	23.90	42.11	27.24	25.13	40.89	55.16
281	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.38	1.56	2.63	2.85	14.70	13.65	8.82	7.45	9.02	20.01	11.86	11.35	10.74	9.09
333	0.00	0.05	0.09	0.06	0.06	0.12	0.14	0.13	0.14	0.17	0.41	0.79	1.00	0.88	0.77	0.81	1.43	1.49	2.03	1.76	1.83
287	29.85	33.35	26.43	13.70	11.62	26.94	31.93	20.13	30.43	46.79	62.85	24.38	31.13	24.28	24.06	25.87	23.98	17.98	21.49	30.06	25.35
844	0.11	0.15	0.62	0.98	2.24	6.64	10.14	7.27	6.00	2.92	0.24	1.67	1.40	1.46	1.47	1.32	0.85	0.62	0.70	0.78	1.01
268	106.99	138.67	264.09	208.49	179.67	117.02	118.96	113.43	165.11	226.14	222.46	199.88	206.78	178.38	150.67	178.30	157.31	145.69	146.92	135.34	116.82
782	0.03	0.02	0.05	0.00	0.16	0.02	0.05	0.00	0.23	0.22	0.13	0.04	0.06	0.05	0.05	0.05	0.01	0.02	0.02	0.02	0.02
843	0.58	0.70	2.17	0.91	0.85	15.40	11.65	9.86	3.49	1.92	0.14	1.21	1.09	1.15	1.12	1.07	0.30	0.28	0.24	0.20	0.28
723	0.17	1.70	0.19	0.32	0.17	0.03	0.50	0.07	0.15	0.27	0.19	0.39	0.50	0.49	0.45	0.45	0.79	1.07	0.02	1.15	0.19
658	0.36	0.20	0.11	0.19	0.05	0.07	0.16	0.09	0.10	0.13	0.16	0.10	0.08	0.09	0.09	0.09	0.07	0.05	0.07	0.04	0.08
679	0.16	0.05	0.38	0.01	0.02	0.04	0.23	0.38	0.12	0.03	0.01	0.03	0.03	0.04	0.04	0.03	0.07	0.01	0.00	0.03	0.00
845	1.59	1.93	6.28	5.46	5.25	4.74	4.00	6.20	3.15	2.34	0.90	1.08	0.97	1.08	1.11	1.14	0.13	0.10	0.14	0.16	0.15
661	0.06	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.01	0.07	0.02	0.02	0.02	0.02	0.02	0.00	0.00	0.07	0.00	0.00
676	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.03	0.04	0.03	0.00	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00
728	0.19	0.00	0.02	0.01	0.01	0.00	0.03	0.04	0.01	0.01	0.01	0.03	0.03	0.03	0.03	0.03	0.02	0.05	0.01	0.03	0.02
691	0.00	0.16	0.31	0.07	0.05	0.00	0.28	0.01	0.00	0.05	0.02	0.01	0.01	0.02	0.02	0.02	0.00	0.01	0.00	0.00	0.00
893	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
764	0.26	0.04	0.03	0.00	0.00	0.04	0.01	0.00	0.00	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.00	0.00	0.00	0.00
699	0.01	0.01	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.05	0.05	0.06	0.06	0.06	0.04	0.04	0.03	0.13	0.07
841	5.91	7.79	8.95	13.72	12.93	11.52	7.15	5.35	4.35	2.58	0.23	2.05	1.86	2.11	2.09	2.13	0.00	0.00	0.02	0.02	0.01
783	0.03	0.05	0.02	0.01	0.01	0.02	0.01	0.16	0.01	0.07	0.07	0.04	0.06	0.05	0.05	0.05	0.02	0.01	0.05	0.10	0.01
57	0.00	0.01	0.06	0.08	0.42	1.14	0.29	1.47	0.09	0.98	0.03	0.86	0.70	0.75	0.79	0.78	0.00	0.02	0.56	1.01	1.40
744	0.05	0.13	0.40	0.00	0.02	0.00	0.14	0.00	0.00	0.02	0.02	0.03	0.03	0.04	0.04	0.03	0.11	0.04	0.00	0.01	0.00
775	0.00	0.00	0.18	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
786	0.01	0.06	0.00	0.16	0.32	0.01	0.05	0.00	0.00	0.02	0.01	0.03	0.05	0.04	0.04	0.04	0.02	0.05	0.06	0.05	0.00
682	2.27	1.92	1.32	0.45	0.84	1.07	0.88	1.40	1.26	1.16	1.29	1.39	1.49	1.23	1.29	1.40	0.53	1.09	2.29	2.64	2.23
821	0.00	0.00	0.00	0.00	0.00	0.06	0.02	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00
772	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01
716	0.03	0.00	0.12	0.03	0.02	0.01	0.05	0.02	0.01	0.01	0.03	0.05	0.04	0.05	0.05	0.05	0.15	0.03	0.00	0.12	0.02

Table A-4. Trade complementarity index between China's exports vis-à-vis Mongolia's imports (top 30 industries of M-C trade)

	SITC283		SITC321		SITC281		SITC333		SITC287		SITC844		SITC268		SITC782		SITC843		SITC723	
Year	RCA_{mjk}	CI	RCA_{mjk}	CI	RCA_{mjk}	CI	RCA_{mjk}	CI	RCA_{mjk}	CI	RCA_{mjk}	CI	RCA_{mjk}	CI	RCA_{mjk}	CI	RCA_{mjk}	CI	RCA_{mjk}	CI
1997	0.01	0.00	1.52	2.38	0.01	0.00	0.06	0.03	0.00	0.00	0.02	0.14	0.00	0.00	0.86	0.05	0.19	0.85	3.81	0.65
1998	0.01	0.00	0.61	0.97	0.01	0.00	0.08	0.03	0.02	0.01	0.04	0.22	0.03	0.04	2.79	0.16	0.17	0.93	9.47	1.35
1999	0.01	0.00	1.10	2.03	0.00	0.00	0.06	0.01	0.00	0.00	0.03	0.15	0.03	0.07	3.41	0.11	0.37	1.77	10.64	1.75
2000	0.01	0.00	0.48	1.03	0.00	0.00	0.04	0.01	0.02	0.01	0.06	0.28	0.05	0.10	2.26	0.12	0.12	0.54	4.98	1.25
2001	0.04	0.00	0.14	0.39	0.00	0.00	0.02	0.00	0.01	0.01	0.06	0.21	0.03	0.04	2.78	0.12	0.43	1.73	6.11	2.19
2002	0.01	0.00	0.06	0.15	0.01	0.00	0.03	0.00	0.01	0.01	1.19	4.71	0.01	0.01	2.92	0.14	1.86	7.25	7.33	2.25
2003	0.01	0.00	0.00	0.01	0.01	0.00	0.07	0.00	0.01	0.01	2.13	8.73	0.00	0.00	3.25	0.19	3.15	12.40	8.18	2.41
2004	0.00	0.00	0.01	0.01	0.00	0.00	0.01	0.00	0.00	0.00	1.76	7.24	0.01	0.01	2.57	0.17	2.65	10.34	7.21	2.41
2005	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.01	0.36	1.22	0.00	0.00	2.41	0.28	0.68	2.46	7.67	2.88
2006	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.03	0.12	0.00	0.00	2.41	0.42	0.05	0.25	4.41	2.55
2007	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.09	0.40	0.00	0.00	3.39	1.06	0.08	0.43	5.61	3.37
2008	0.00	0.00	0.03	0.02	0.00	0.00	0.01	0.00	0.00	0.00	0.36	1.56	0.00	0.00	3.83	1.62	0.47	2.29	4.36	3.48
2009	0.00	0.00	0.03	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.30	1.21	0.00	0.00	4.90	1.80	0.40	1.75	5.62	4.30
2010	0.00	0.00	0.03	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.32	1.40	0.00	0.00	4.58	1.33	0.44	1.89	5.41	3.96
2011	0.00	0.00	0.03	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.34	1.55	0.00	0.00	4.60	1.68	0.44	1.88	4.91	4.34
2012	0.00	0.00	0.03	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.35	1.62	0.00	0.00	4.33	1.73	0.46	1.97	4.66	4.41
2013	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.19	0.84	0.00	0.00	7.47	2.58	0.17	0.72	7.76	7.37
2014	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.78	0.00	0.00	3.47	1.11	0.16	0.57	3.42	3.26
2015	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.67	0.00	0.00	2.01	0.58	0.16	0.45	3.66	3.09
2016	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.27	0.87	0.00	0.00	2.73	0.63	0.22	0.62	3.96	3.32
2017	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.26	0.82	0.00	0.00	5.82	1.48	0.24	0.64	6.49	6.12
Average	0.00	0.00	0.19	0.33	0.00	0.00	0.02	0.00	0.00	0.00	0.41	1.65	0.01	0.01	3.47	0.83	0.61	2.46	5.98	3.18

	SITC658		SITC679		SITC845		SITC661		SITC676		SITC728		SITC691		SITC893		SITC764		SITC699	
Year	RCA_{mjk}	CI	RCA_{mjk}	CI	RCA_{mjk}	CI	RCA_{mjk}	CI	RCA_{mjk}	CI	RCA_{mjk}	CI	RCA_{mjk}	CI	RCA_{mjk}	CI	RCA_{mjk}	CI	RCA_{mjk}	CI
1997	1.42	7.70	5.67	3.73	0.08	0.35	0.89	2.56	0.67	0.24	1.07	0.19	0.81	0.79	0.65	1.51	0.94	1.11	2.30	3.29
1998	1.50	7.56	2.36	1.90	0.10	0.45	1.52	3.71	2.15	0.46	1.17	0.20	1.98	2.27	0.51	1.24	1.17	1.44	1.22	1.73
1999	1.89	9.56	1.63	1.23	0.03	0.15	1.84	4.03	0.82	0.18	1.58	0.33	1.16	1.32	0.52	1.20	0.78	1.06	1.76	2.52
2000	1.03	5.21	1.13	0.95	0.04	0.19	2.79	6.00	0.74	0.26	2.19	0.40	0.71	0.91	0.67	1.61	1.06	1.54	1.94	2.74
2001	1.08	5.18	2.25	1.78	0.13	0.58	4.11	8.96	1.40	0.44	1.07	0.29	1.54	2.19	0.77	1.71	0.61	1.09	1.46	2.10
2002	0.91	4.03	2.33	1.63	0.15	0.57	4.81	9.60	1.11	0.42	1.84	0.51	2.11	2.83	0.78	1.65	0.84	1.72	1.55	2.26
2003	0.80	3.50	2.56	1.92	0.16	0.58	5.47	9.99	0.84	0.37	2.36	0.68	2.60	3.24	0.83	1.58	1.00	2.21	1.67	2.29
2004	0.57	2.45	3.21	2.67	0.38	1.33	5.36	9.22	1.11	0.78	1.33	0.40	1.95	2.50	0.65	1.19	0.68	1.67	2.25	3.23
2005	0.82	3.49	3.02	2.95	0.21	0.74	4.93	9.48	1.78	1.42	2.38	0.86	2.13	3.09	0.75	1.33	0.95	2.44	2.08	3.02
2006	0.52	2.19	2.72	3.35	0.05	0.21	5.68	11.84	2.44	2.72	2.11	0.79	2.30	3.76	0.73	1.25	0.73	1.95	1.16	1.73
2007	0.54	2.12	3.10	4.37	0.03	0.13	6.41	12.37	2.29	3.19	1.27	0.52	3.59	6.66	0.86	1.30	0.71	2.19	1.06	1.48
2008	0.99	4.30	2.12	3.60	0.19	0.71	7.25	12.93	2.69	3.77	2.05	1.05	3.99	8.32	1.11	1.66	0.78	2.49	1.58	2.13
2009	0.84	3.58	2.35	3.17	0.16	0.54	7.29	13.19	4.51	2.15	2.13	1.11	3.84	7.05	1.00	1.47	0.72	2.38	1.61	2.11
2010	0.91	3.73	2.80	3.54	0.19	0.62	7.87	13.88	4.08	2.82	1.86	0.90	4.68	8.91	1.06	1.61	0.70	2.30	1.68	2.28
2011	0.96	3.90	2.74	3.93	0.20	0.65	9.26	17.38	3.70	3.00	1.86	0.94	4.94	9.45	1.12	1.85	0.75	2.62	1.74	2.45
2012	1.01	3.98	2.66	3.72	0.21	0.65	9.01	15.74	3.95	4.03	2.11	1.16	4.66	9.10	1.12	2.15	0.70	2.51	1.74	2.47
2013	0.76	2.91	2.14	2.90	0.13	0.37	11.73	20.56	6.17	7.75	2.57	1.52	5.90	10.57	1.06	2.03	0.47	1.66	1.23	1.75
2014	1.05	3.78	3.37	4.44	0.18	0.54	13.94	24.28	7.01	11.62	2.71	1.65	6.62	11.53	1.33	2.40	0.53	1.83	1.53	2.18
2015	0.90	2.93	4.25	5.46	0.20	0.49	10.80	20.94	5.27	9.24	2.00	1.13	5.25	9.33	1.03	1.80	0.57	1.87	2.13	3.01
2016	1.03	3.42	2.13	2.88	0.29	0.74	6.30	11.44	2.87	5.04	1.28	0.75	3.04	5.09	1.05	1.80	0.81	2.67	1.87	2.48
2017	0.84	2.86	3.34	4.41	0.26	0.64	3.28	5.49	3.84	4.32	1.15	0.78	5.03	8.74	0.97	1.75	0.65	1.95	1.58	2.23
Average	0.97	4.21	2.76	3.07	0.16	0.53	6.22	11.60	2.83	3.06	1.81	0.77	3.28	5.60	0.88	1.62	0.77	1.94	1.67	2.36

	SITC841		SITC783		SITC057		SITC744		SITC775		SITC786		SITC682		SITC821		SITC772		SITC716	
Year	RCA_{mjk}	CI	RCA_{mjk}	CI	RCA_{mjk}	CI	RCA_{mjk}	CI	RCA_{mjk}	CI	RCA_{mjk}	CI	RCA_{mjk}	CI	RCA_{mjk}	CI	RCA_{mjk}	CI	RCA_{mjk}	CI
1997	0.07	0.40	0.53	0.05	0.80	0.34	4.04	2.02	1.12	2.12	0.78	2.65	0.12	0.05	1.02	1.44	0.27	0.21	2.01	4.94
1998	0.13	0.62	4.19	0.18	0.77	0.29	2.98	1.54	0.88	1.78	3.33	14.74	0.07	0.03	0.90	1.36	0.30	0.25	2.56	6.14
1999	0.10	0.48	3.53	0.14	0.62	0.21	1.15	0.58	0.79	1.91	1.15	5.06	0.08	0.04	0.68	1.14	0.36	0.33	2.06	5.43
2000	0.85	4.01	3.49	0.20	0.77	0.25	4.54	2.80	1.78	4.95	0.31	1.89	0.03	0.02	0.68	1.27	0.26	0.23	1.82	5.60
2001	1.30	5.72	2.21	0.18	0.86	0.25	0.60	0.39	1.01	2.96	0.72	3.81	0.23	0.09	0.66	1.23	0.30	0.29	2.90	8.90
2002	0.72	2.62	2.73	0.16	0.97	0.29	0.81	0.59	0.92	2.64	0.78	3.46	0.13	0.06	0.64	1.28	0.38	0.37	1.60	4.74
2003	0.23	0.75	3.13	0.12	1.07	0.30	0.95	0.65	0.90	2.51	0.80	3.85	0.05	0.02	0.66	1.31	0.44	0.41	0.62	1.84
2004	0.14	0.44	2.26	0.12	0.97	0.28	0.96	0.75	1.27	3.42	0.53	2.37	0.06	0.03	0.62	1.30	0.61	0.62	2.52	6.74
2005	0.14	0.42	2.60	0.36	0.80	0.20	2.22	1.85	0.94	2.60	0.44	1.77	0.06	0.03	0.60	1.33	0.56	0.61	1.35	3.43
2006	0.15	0.47	2.16	0.47	0.51	0.14	1.38	1.22	1.07	3.03	0.88	2.99	0.03	0.02	0.60	1.38	0.27	0.33	1.07	2.43
2007	0.19	0.56	2.25	0.84	0.40	0.11	1.61	1.53	1.33	3.61	1.07	3.45	0.05	0.02	0.73	1.70	0.56	0.72	1.66	3.49
2008	0.38	1.13	1.89	0.68	0.65	0.20	2.07	2.47	1.61	4.70	2.49	7.73	0.04	0.02	1.03	2.55	0.73	0.99	1.31	2.83
2009	0.34	0.98	2.61	1.07	0.53	0.18	2.37	3.09	1.44	4.08	3.58	7.03	0.04	0.02	0.99	2.61	0.70	0.94	1.18	2.49
2010	0.39	1.10	2.63	1.29	0.59	0.19	2.73	3.25	1.51	4.38	3.62	12.03	0.04	0.01	1.05	2.92	0.68	0.92	1.35	2.88
2011	0.38	1.08	2.27	1.11	0.62	0.20	2.63	3.13	1.65	4.90	3.19	11.44	0.04	0.01	1.14	3.24	0.71	0.98	1.37	2.95
2012	0.41	1.03	2.37	1.30	0.62	0.22	2.48	2.97	1.65	4.85	3.16	9.07	0.04	0.02	1.16	3.53	0.69	0.96	1.36	2.89
2013	0.28	0.70	1.73	0.89	0.36	0.13	3.58	4.49	1.49	4.37	2.34	6.21	0.04	0.01	1.15	3.37	0.73	0.97	1.97	4.33
2014	0.37	1.00	1.53	0.92	0.21	0.07	2.69	3.26	1.77	4.97	1.38	3.62	0.03	0.01	1.16	3.06	0.66	0.86	0.87	1.85
2015	0.36	0.77	2.75	1.31	0.57	0.20	2.42	2.85	1.61	4.15	1.22	2.86	0.04	0.01	1.03	2.55	0.58	0.74	0.83	1.69
2016	0.39	0.92	2.50	1.16	0.69	0.26	1.67	2.14	1.86	4.88	10.94	19.42	0.04	0.02	1.30	3.14	0.68	0.87	0.90	1.84
2017	0.37	0.85	1.48	0.68	0.52	0.18	1.76	2.17	1.66	4.56	4.38	10.55	0.04	0.01	0.86	2.14	1.01	1.24	1.37	3.06
Average	0.37	1.24	2.42	0.63	0.66	0.21	2.17	2.08	1.35	3.68	2.24	6.48	0.06	0.03	0.89	2.09	0.55	0.66	1.56	3.83

Table A-5. Trade complementarity index between China's imports vis-à-vis Mongolia's exports (top 30 industries of M-C trade)

	SITC283		SITC321		SITC281		SITC333		SITC287		SITC844		SITC268		SITC782		SITC843		SITC723	
Year	RCA_{mjk}	CI	RCA_{mjk}	CI	RCA_{mjk}	CI	RCA_{mjk}	CI	RCA_{mjk}	CI	RCA_{mjk}	CI	RCA_{mjk}	CI	RCA_{mjk}	CI	RCA_{mjk}	CI	RCA_{mjk}	CI
1997	2.86	1194.22	0.17	0.00	3.19	0.00	0.42	0.00	0.93	27.84	0.17	0.02	5.91	632.28	0.26	0.01	0.14	0.08	0.96	0.16
1998	3.06	1160.51	0.17	0.00	3.04	0.00	0.27	0.02	0.80	26.56	0.25	0.04	4.65	644.50	0.20	0.00	0.23	0.16	0.81	1.38
1999	2.68	975.62	0.17	0.00	2.99	0.00	0.42	0.04	0.77	20.38	0.31	0.19	5.01	1324.27	0.15	0.01	0.24	0.51	0.80	0.15
2000	3.19	882.27	0.13	0.00	2.65	0.00	0.49	0.03	0.87	11.89	0.27	0.27	5.53	1152.68	0.11	0.00	0.20	0.19	0.83	0.26
2001	3.05	791.06	0.09	0.00	3.40	0.00	0.35	0.02	1.33	15.40	0.29	0.66	5.30	951.66	0.10	0.02	0.15	0.13	0.79	0.14
2002	2.66	764.69	0.24	0.00	3.61	0.01	0.37	0.05	1.19	32.16	0.20	1.35	5.09	596.10	0.15	0.00	0.13	1.96	0.95	0.03
2003	2.87	669.44	0.20	0.63	3.26	0.00	0.29	0.04	1.26	40.17	0.15	1.48	3.51	416.96	0.18	0.01	0.11	1.31	1.11	0.56
2004	3.07	664.02	0.26	1.34	3.21	1.21	0.38	0.05	1.42	28.67	0.12	0.87	4.09	464.50	0.10	0.00	0.09	0.89	0.72	0.05
2005	4.05	645.45	0.29	1.54	4.72	7.36	0.33	0.04	1.97	59.95	0.10	0.58	4.74	782.18	0.07	0.02	0.10	0.35	0.55	0.08
2006	3.00	449.13	0.38	2.52	4.69	12.35	0.33	0.06	1.95	91.31	0.08	0.23	5.03	1137.33	0.09	0.02	0.09	0.17	0.59	0.16
2007	3.41	530.35	0.36	5.51	4.24	12.07	0.59	0.24	2.29	143.95	0.06	0.01	5.68	1263.17	0.11	0.01	0.07	0.01	0.59	0.11
2008	2.70	462.67	0.27	7.46	4.14	60.87	0.47	0.37	2.45	59.77	0.04	0.07	4.77	953.09	0.10	0.00	0.07	0.09	0.70	0.27
2009	3.11	439.00	1.25	31.56	6.06	82.71	0.70	0.70	3.80	118.33	0.03	0.04	5.49	1134.20	0.17	0.01	0.07	0.07	1.01	0.51
2010	2.54	302.56	1.38	33.31	5.42	47.81	0.67	0.60	3.31	80.38	0.02	0.04	4.36	778.50	0.18	0.01	0.07	0.08	1.01	0.50
2011	2.57	315.81	1.18	25.78	5.21	38.81	0.63	0.48	2.71	65.15	0.03	0.05	4.11	619.87	0.20	0.01	0.07	0.07	0.79	0.36
2012	2.99	365.58	1.46	34.86	4.96	44.75	0.55	0.45	2.35	60.74	0.03	0.05	4.32	770.17	0.15	0.01	0.07	0.08	0.45	0.20
2013	3.10	240.65	1.73	72.79	5.48	109.64	0.51	0.73	2.45	58.79	0.04	0.04	4.39	691.26	0.07	0.00	0.07	0.02	0.39	0.31
2014	3.54	555.57	1.33	36.28	4.89	58.04	0.63	0.95	2.25	40.48	0.05	0.03	4.17	608.20	0.05	0.00	0.07	0.02	0.36	0.39
2015	3.76	643.81	0.98	24.56	4.83	54.77	0.58	1.18	2.20	47.23	0.07	0.05	4.57	671.79	0.04	0.00	0.10	0.02	0.29	0.01
2016	4.60	489.94	1.23	50.21	5.52	59.32	0.79	1.40	2.14	64.47	0.07	0.05	4.22	571.25	0.04	0.00	0.10	0.02	0.24	0.27
2017	4.19	325.69	1.30	71.45	5.19	47.16	0.80	1.47	2.08	52.64	0.09	0.10	4.83	564.47	0.05	0.00	0.14	0.04	0.33	0.06
Average	3.19	612.76	0.69	19.04	4.32	30.33	0.50	0.42	1.93	54.58	0.12	0.30	4.75	796.59	0.12	0.01	0.11	0.30	0.68	0.28

	SITC658		SITC679		SITC845		SITC661		SITC676		SITC728		SITC691		SITC893		SITC764		SITC699	
Year	RCA_{mjk}	CI	RCA_{mjk}	CI	RCA_{mjk}	CI	RCA_{mjk}	CI	RCA_{mjk}	CI	RCA_{mjk}	CI	RCA_{mjk}	CI	RCA_{mjk}	CI	RCA_{mjk}	CI	RCA_{mjk}	CI
1997	0.10	0.04	1.00	0.16	0.33	0.53	0.42	0.03	2.06	0.00	1.83	0.34	0.89	0.00	0.39	0.00	1.41	0.36	0.43	0.00
1998	0.12	0.02	1.03	0.05	0.37	0.71	0.37	0.00	1.33	0.00	1.39	0.00	0.92	0.14	0.36	0.00	1.51	0.07	0.43	0.01
1999	0.10	0.01	0.70	0.27	0.34	2.15	0.26	0.00	0.69	0.00	1.46	0.03	0.41	0.13	0.36	0.00	1.13	0.04	0.35	0.00
2000	0.10	0.02	0.53	0.00	0.30	1.64	0.26	0.00	0.43	0.00	1.53	0.01	0.36	0.03	0.36	0.00	1.00	0.00	0.35	0.00
2001	0.10	0.00	0.62	0.01	0.28	1.47	0.27	0.00	0.35	0.01	1.74	0.02	0.37	0.02	0.33	0.00	1.03	0.00	0.37	0.00
2002	0.09	0.01	0.80	0.03	0.25	1.16	0.47	0.00	0.44	0.00	2.09	0.00	0.32	0.00	0.31	0.00	1.06	0.04	0.38	0.00
2003	0.06	0.01	0.66	0.15	0.18	0.72	0.14	0.00	0.55	0.00	2.07	0.05	0.28	0.08	0.32	0.00	1.05	0.01	0.41	0.00
2004	0.06	0.01	0.75	0.28	0.14	0.88	0.12	0.00	0.43	0.00	2.18	0.10	0.31	0.00	0.32	0.00	0.85	0.00	0.44	0.00
2005	0.05	0.00	0.78	0.09	0.16	0.51	0.10	0.00	0.41	0.01	1.76	0.02	0.17	0.00	0.32	0.00	0.72	0.00	0.45	0.00
2006	0.05	0.01	0.71	0.02	0.15	0.35	0.08	0.00	0.32	0.01	1.76	0.02	0.16	0.01	0.33	0.00	0.62	0.01	0.48	0.00
2007	0.05	0.01	0.54	0.00	0.11	0.10	0.08	0.01	0.26	0.01	1.64	0.02	0.14	0.00	0.31	0.00	0.63	0.01	0.44	0.00
2008	0.06	0.01	0.61	0.02	0.09	0.09	0.07	0.00	0.24	0.00	1.62	0.04	0.16	0.00	0.29	0.00	0.59	0.01	0.46	0.02
2009	0.06	0.00	0.50	0.02	0.05	0.05	0.08	0.00	0.34	0.00	1.51	0.05	0.16	0.00	0.29	0.00	0.54	0.01	0.50	0.03
2010	0.05	0.00	0.30	0.01	0.04	0.05	0.15	0.00	0.31	0.00	1.74	0.05	0.16	0.00	0.29	0.00	0.36	0.00	0.48	0.03
2011	0.06	0.01	0.26	0.01	0.05	0.06	0.09	0.00	0.27	0.00	1.80	0.05	0.13	0.00	0.28	0.00	0.32	0.00	0.43	0.02
2012	0.05	0.00	0.20	0.01	0.07	0.08	0.07	0.00	0.22	0.00	1.30	0.04	0.11	0.00	0.27	0.00	0.29	0.00	0.40	0.02
2013	0.05	0.00	0.25	0.02	0.07	0.01	0.08	0.00	0.23	0.00	1.35	0.03	0.11	0.00	0.25	0.00	0.29	0.01	0.36	0.02
2014	0.06	0.00	0.23	0.00	0.07	0.01	0.07	0.00	0.23	0.00	1.32	0.06	0.14	0.00	0.24	0.00	0.31	0.00	0.37	0.02
2015	0.06	0.00	0.23	0.00	0.09	0.01	0.06	0.00	0.24	0.00	1.41	0.01	0.16	0.00	0.25	0.00	0.33	0.00	0.37	0.01
2016	0.05	0.00	0.27	0.01	0.08	0.01	0.06	0.00	0.25	0.00	1.40	0.05	0.12	0.00	0.25	0.00	0.31	0.00	0.37	0.05
2017	0.08	0.01	0.26	0.00	0.12	0.02	0.09	0.00	0.32	0.00	1.62	0.03	0.07	0.00	0.30	0.00	0.37	0.00	0.41	0.03
Average	0.07	0.01	0.53	0.06	0.16	0.51	0.16	0.00	0.47	0.00	1.64	0.05	0.27	0.02	0.31	0.00	0.70	0.03	0.41	0.01

	SITC841		SITC783		SITC057		SITC744		SITC775		SITC786		SITC682		SITC821		SITC772		SITC716	
Year	RCA_{mjk}	CI	RCA_{mjk}	CI	RCA_{mjk}	CI	RCA_{mjk}	CI	RCA_{mjk}	CI	RCA_{mjk}	CI	RCA_{mjk}	CI	RCA_{mjk}	CI	RCA_{mjk}	CI	RCA_{mjk}	CI
1997	0.35	2.45	0.25	0.01	0.32	0.00	1.48	0.07	0.39	0.00	0.26	0.00	1.04	2.37	0.09	0.00	1.05	0.01	1.33	0.03
1998	0.40	3.42	0.18	0.01	0.19	0.00	1.22	0.16	0.27	0.00	0.23	0.01	1.21	2.33	0.10	0.00	1.02	0.00	1.05	0.00
1999	0.38	4.11	0.13	0.00	0.24	0.01	1.02	0.41	0.29	0.05	0.15	0.00	1.40	1.85	0.09	0.00	0.97	0.00	0.85	0.10
2000	0.28	4.12	0.20	0.00	0.36	0.03	0.77	0.00	0.31	0.00	0.07	0.01	1.36	0.61	0.11	0.00	0.95	0.00	0.93	0.03
2001	0.22	2.94	0.18	0.00	0.28	0.12	0.79	0.01	0.28	0.00	0.12	0.04	1.66	1.39	0.11	0.00	0.99	0.00	0.71	0.02
2002	0.21	2.93	0.18	0.00	0.19	0.21	0.85	0.00	0.25	0.00	0.10	0.00	1.95	2.08	0.10	0.01	1.20	0.00	0.70	0.01
2003	0.16	1.60	0.17	0.00	0.16	0.05	0.85	0.12	0.21	0.00	0.10	0.00	2.18	1.91	0.14	0.00	1.23	0.00	0.74	0.03
2004	0.12	0.95	0.10	0.02	0.14	0.20	0.85	0.00	0.23	0.00	0.10	0.00	1.91	2.68	0.12	0.00	1.22	0.00	0.91	0.02
2005	0.11	0.63	0.06	0.00	0.17	0.02	0.72	0.00	0.23	0.00	0.11	0.00	1.88	2.37	0.12	0.00	1.27	0.00	0.79	0.00
2006	0.10	0.35	0.05	0.00	0.15	0.15	0.67	0.01	0.23	0.00	0.09	0.00	1.57	1.82	0.13	0.00	1.36	0.02	0.81	0.01
2007	0.09	0.14	0.05	0.00	0.14	0.00	0.61	0.01	0.23	0.00	0.07	0.00	2.10	2.70	0.14	0.00	1.27	0.00	0.72	0.02
2008	0.08	0.04	0.05	0.00	0.15	0.13	0.60	0.02	0.22	0.00	0.09	0.00	1.88	2.60	0.14	0.00	1.22	0.01	0.69	0.03
2009	0.06	0.01	0.06	0.00	0.17	0.12	0.68	0.02	0.14	0.00	0.09	0.00	3.04	4.52	0.15	0.00	1.23	0.01	0.65	0.03
2010	0.07	0.01	0.08	0.00	0.16	0.12	0.68	0.03	0.15	0.00	0.08	0.00	2.75	3.39	0.15	0.00	1.13	0.00	0.60	0.03
2011	0.09	0.02	0.06	0.00	0.23	0.18	0.62	0.02	0.17	0.00	0.07	0.00	2.30	2.96	0.16	0.00	1.09	0.00	0.58	0.03
2012	0.10	0.01	0.05	0.00	0.29	0.23	0.48	0.02	0.10	0.00	0.07	0.00	2.33	3.27	0.15	0.00	1.05	0.00	0.53	0.03
2013	0.11	0.00	0.05	0.00	0.31	0.00	0.49	0.05	0.15	0.00	0.06	0.00	2.43	1.30	0.16	0.00	1.01	0.01	0.48	0.07
2014	0.10	0.00	0.04	0.00	0.32	0.01	0.49	0.02	0.14	0.00	0.08	0.00	2.15	2.33	0.15	0.00	1.01	0.00	0.53	0.02
2015	0.12	0.00	0.05	0.00	0.38	0.22	0.51	0.00	0.13	0.00	0.08	0.00	2.24	5.14	0.15	0.00	1.01	0.00	0.51	0.00
2016	0.12	0.00	0.08	0.01	0.51	0.52	0.41	0.00	0.13	0.00	0.11	0.01	1.96	5.17	0.15	0.00	0.90	0.00	0.46	0.06
2017	0.15	0.01	0.10	0.00	0.67	0.94	0.45	0.00	0.20	0.00	0.10	0.00	2.32	5.18	0.17	0.00	1.55	0.01	0.59	0.01
Average	0.16	1.13	0.10	0.00	0.26	0.16	0.73	0.05	0.21	0.00	0.11	0.00	1.98	2.76	0.13	0.00	1.13	0.00	0.72	0.03

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