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เกาหลีสหรัฐอเมริกาสหภาพยุโรปไต้หวันและ ฮองกง

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CHINESE BILATERAL INTRA-INDUSTRY TRADE WITH HER MAJOR TRADING PARTNERS

Mr. Bin Tang

A Thesis Submitted in Partial Fulfillment of the
Requirements
for the Degree of Master of Arts Program in International
Economics and Finance
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Thesis Title ~~CHINESE BILATERAL INTRA-~~
MAJOR TRADING PARTNERS

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วัตถุประสงค์ของงานวิจัยนี้เป็นการวิจัยลักษณะและปัจจัยกำหนดการค้าภายในอุตสาหกรรมเดียวกันของประเทศสาธารณรัฐประชาชนจีนในช่วงปี 1992-2010 การศึกษาคำนวณดัชนีการค้าภายในอุตสาหกรรมเดียวกันโดยรวม(TIIT)การค้าภายในอุตสาหกรรมเดียวกันในแนวดิ่ง(VIIT) และการค้าภายในอุตสาหกรรมเดียวกันในแนวนอน(HIIT) พร้อมกับแสวงหาปัจจัยกำหนดการค้าภายในอุตสาหกรรมเดียวกับประเภทต่างๆปัจจัยที่สำคัญได้แก่ การลงทุนโดยตรงจากต่างประเทศ การค้าภายในขนาดเศรษฐกิจของประเทศคู่ค้า โครงสร้างการค้าрынนิยมของผู้บริโภคระยะห่างระหว่างประเทศคู่ค้าและนโยบายการเปิดเสรีทางการค้าสำหรับประเทศสาธารณรัฐประชาชนจีนการค้าภายในอุตสาหกรรมเดียวกันในแนวดิ่งมีขนาดใหญ่กว่าการค้าภายในอุตสาหกรรมเดียวกันในแนวนอนทั้งนี้เพราะประเทศคู่ค้าหลักมีทรัพยากรการผลิตและความสามารถทางเทคโนโลยีการผลิต แตกต่างจากประเทศจีน

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Mr. BIN TANG: CHINESE BILATERAL INTRA-
INDUSTRY TRADE WITH HER MAJOR TRADING
PARTNERS: A CASE STUDY OF KOREA, US, EU,
TAIWAN AND HK.

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The purpose of this thesis is to research the characteristics and determinants of Chinese bilateral intra-industry trade over the 1992-2010 reforming periods. Total intra-industry trade (TIIT), vertical intra-industry trade (VIIT) and horizontal intra-industry trade (HIIT) are computed and the determinants of each type of the intra-industry trade are found. Major determinants are foreign direct investment, economic size, trade composition, consumer preference, geographical distance, openness and trade liberalization policies. Vertical intra-industry trade is larger than horizontal intra-industry trade in China because the country's major trading partners have a different factor endowment and technological capability from China.

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Trade Partners.....

CHAPTER I

INTRODUCTION

1.1 Background

China started to open the market to the global world in 1987. As a result of the overall economic reform and opening-up policy, foreign direct investment has been attracted to steadily flow into the country. In addition, bilateral trade between China and her major trading partners, such as United State, Japan as well as European Union has also dramatically increased. The ratio of export to GDP is getting higher from 23 percent to 27 percent from 2001 to 2011, and the percentage of manufactured goods in exports and intra-industry trade to inter-industry also increase simultaneously, which indicates that China's trade structure has changed dramatically from 2001 to 2010. Although the amount of bilateral trading value increases specially in recent decade, it is time to upgrade the export and import trading structure for sustainable development capacity of China with the world. Therefore, in this thesis, we aim to analyze the characteristics of Chinese bilateral intra-industry trade which has contributed greatly to the recent rapid growth of international trade in China.

Since 2001 academic attention has focus on the increasing international trade volume in developing nations like China, India and South Africa, due to rapid integration into the world economy and their high growth rate of GDP. In terms of scale and structure, intra-industry trade between bilateral countries has been growing the fastest. As a result, these developing countries begin to play a significant role in development of world trade and output. China in particular has put great effort on economic reforms and development of human and natural resources in order to fasten facilitate the trade and output growth.

Both the rapid growth of output and trade world to gather with other Major Countries in term pushes the world economy forward. In this thesis, we would emphasize the explanation of China's intra-industry trade and its determinants in order to understand this important aspect of the country's growth engine.

1.2 Objectives

The main objectives of this study are as follows:

- To measure the magnitude of Chinese total intra-industry trade, vertical intra-industry trade as well as horizontal intra-industry trade with her major trade partners;
- To explore the Chinese trade performance and the reason why the intra-industry trade happens and increases rapidly, in China;
- To examine empirically the determinants of Chinese total, vertical and horizontal intra-industry trade with major trade partners;
- To find policy implications.

1.3 Scope of the Study

The study will be based on database of China's trade with her major trade partners namely, Japan, South Korea, United State, European Union, China, Taiwan and Hong Kong. The annual data will be from 1992 to 2010.

In this study, we will include China's bilateral intra-industry trade of all goods. That is, the goods classified by Standard International Trade Classification, SITC 0-9. The data will come from the OECD database, the World Bank database, the China Statistics Yearbook, the China Foreign Economic Statistical Yearbook, the China Trade and External Economic Statistical Yearbook, and the China Foreign Merchant Investment Report.

CHAPTER II

CHINA'S TRADE WITH MAJOR TRADE PARTNERS

2.1 China's Trade Performance in the World

Academic research has focus on the increasing value of trade in emerging economies, due to rapid integration into the world economy and their high growth rate of GDP, from 2001 to 2010, like China. Even though the economic crisis influences the entire capitalist world, Chinese economy still develop dramatically through a series of reform in economy and society system. Meanwhile, the structure of the economy also is carried out to promote the economic growth as well as development of international trade in transfer to be diversification.

In addition, China with high development pace, its human and natural resources and unique reform system, has made a huge achievement in economic transformation and global economic position. The value of China's bilateral trade with principal trade partners, such as US, EU and Japan, has risen dramatically over the last ten years, from 2001 to 2011. According to the Table 1, the proportion of China's bilateral trade relative to principal trade partners remained 65% approximately in the export side, while it has decreased gradually from 76.73% to 57% in the import side. In particular, the value of China's export and import with principal trade partners has an increase, but the ratio of that relative to total trade has an obvious decrease after 2007. Because, China has tried to diversify its markets by trading with an increasing number of countries in order to minimize its trade fluctuation, especially reducing the effect in the economic crisis. Before 2007, China's trade of manufactured commodities mainly concentrated with

developed countries, such as the US, the EU and Japan. Over time, as China's manufacturing sector grew and the production technology development, China's international trade in export destinations and import supply sources diversified to more countries, especially in the East Asian and Southeast Asian countries and regions gradually.

Table 1: Details Structure of Standard International Trade Classification

SITC (Standard International Trade Classification) Section [↗]
SITC 0 Food and Live Animals [↗]
SITC 1 Beverages and Tobacco [↗]
SITC 2 Crude Materials, Inedible, Except Fuels [↗]
SITC 3 Mineral Fuels, Lubricants and Related Materials [↗]
SITC 4 Animal and Vegetable Oils, Fats and Waxes [↗]
SITC 5 Chemicals and Related Products, n. e. s. [↗]
SITC 6 Manufactured Goods Classified Chiefly by Material [↗]
SITC 7 Machinery and Transport Equipment [↗]
SITC 8 Miscellaneous Manufactured Articles [↗]
SITC 9 Commodities and Transactions not Classified Elsewhere in SITC [↗]

Note: The information about details structure of SITC is collected from United Nations Statistics Division.

As illustrated at the table 1, 10 sections divide commodities in trade classification.

The SITC could help us to analyze the Chinese trade structure and composition. In addition, for the SITC 5-8, it is manufactured industry, besides the SITC 0-4 is almost agricultural industry. From these data in the following tables, we cannot only know the situation of Chinese performance, but also where happens in China's intra-industry trade.

Table 2: The Values of China's Trade with Major Trading Partners

From the World 100 Million USD	2001		2003		2005		2007		2009		2010	
	Import	Export	Import	Export	Import	Export	Import	Export	Import	Export	Import	Export
USA	262	542.8	338.66	924.67	486.22	1628.91	693.91	2326.77	774.6	2208.02	1020.99	2832.87
EU	357.12	408.96	530.14	720.55	735.8	1437.04	1109.35	2451.78	1271.18	2332.23	1683.7	3112.19
Japan	427.87	449.41	741.48	594.09	1004.08	839.86	1339.42	1020.09	1309.15	978.68	1767.36	1210.44
Korea	233.77	125.19	431.28	200.95	768.2	351.08	1037.52	560.99	1025.45	536.7	1383.49	687.66
Hong Kong	94.22	465.41	111.19	762.74	122.25	1244.73	128.04	1844.36	87.02	1662.29	122.6	2183.02
Taiwan	273.39	50	493.6	90.04	746.8	165.5	1010.27	234.6	857.2	205.01	1157.39	296.75
Others	787.16	619.21	1481.25	1089.24	2736.18	1952.41	4240.99	3739.17	4734.63	4093.68	6826.91	5454.61
Total	2435.53	2660.98	4127.6	4382.28	6599.53	7619.53	9559.5	12177.76	10059.23	12016.61	13962.44	15777.54

Note: Calculated by the author based on the data from China Foreign Economic Statistical Yearbook, China Trade and External Economic Statistical Yearbook.

Table 3: The Percentage of China's Trade with Major Trading Partners

From the World Unit 100%	2001		2003		2005		2007		2009		2010	
	Import	Export	Import	Export	Import	Export	Import	Export	Import	Export	Import	Export
USA	10.8	20.4	8.2	21.1	7.4	21.4	7.3	19.1	7.7	18.4	7.3	18
EU	14.7	15.4	12.8	16.4	11.1	18.9	11.6	20.1	12.6	19.4	12.1	19.7
Japan	17.6	16.9	18	13.6	15.2	11	14	8.4	13	8.1	12.7	7.7
Korea	9.6	4.7	10.4	4.6	11.6	4.6	10.9	4.6	10.2	4.5	9.9	4.4
Hong Kong	3.9	17.5	2.7	17.4	1.9	16.3	1.3	15.1	0.9	13.8	0.9	13.8
Taiwan	11.2	1.9	12	2.1	11.3	2.2	10.6	1.9	8.5	1.7	8.3	1.9
Sub-total	67.7	76.7	64.1	75.1	58.5	74.4	55.6	69.3	52.9	65.9	51.1	65.4
Others	32.3	23.3	35.9	24.9	41.5	25.6	44.4	30.7	47.1	34.1	48.9	34.6
Total	100	100	100	100	100	100	100	100	100	100	100	100

Note: Calculated by the author based on the data from China Foreign Economic Statistical Yearbook, China Trade and External Economic Statistical Yearbook.

Table 4: The Values of China's Trade with All Trading Partners in Commodity Composition

From the World	2001		2003		2005		2007		2009		2010	
100 Million USD	Import	Export	Import	Export	Import	Export	Import	Export	Import	Export	Import	Export
SITC 0	79.34	140.78	114.37	190.19	167.78	244.44	229.37	326.65	347.4	344.05	464.61	432.87
SITC 1	10.53	12.53	11.52	15	20.99	17.34	26.86	24.71	37.97	35.02	56.71	39.7
SITC 2	165.53	198.77	218.94	291.91	290.27	460.75	401.4	633.65	392.18	639.8	564.23	865.98
SITC 3	224.74	98.42	377.03	127.35	922.93	209.2	1620.82	235.88	1968.86	227.66	3030.28	303.75
SITC 4	7.76	1.18	29.25	1.28	33.11	2.84	75.76	3.27	77.37	3.3	88.84	3.69
SITC 5	190.71	127.94	317.89	185.27	505.83	318.53	685.69	510.85	694.21	540.26	932.07	749.73
SITC 6	559.32	865.01	839.08	1266.27	1196.02	2108.06	1589.27	3484.24	1682.1	3089.33	2146.73	4038.36
SITC 7	1170.88	1027.23	2190.89	2010.31	3421.42	3788.16	4871.59	6245.21	4789.48	6396.37	6444.03	8440.67
SITC 8	9.84	183.02	15.91	284.8	21.04	453.45	33.99	690.22	36.43	722.9	50.33	885.54
SITC 9	16.82	5.95	12.68	9.72	20.12	16.5	24.73	22.48	33.16	16.79	184.59	16.27
Total	2435.47	2660.83	4127.56	4382.1	6599.51	7619.27	9559.48	12177.16	10059.16	12015.48	13962.42	15776.56

Note: Calculated by the author based on the data from China Foreign Economic Statistical Yearbook, China Trade and External Economic Statistical Yearbook.

Table 5: The Percentage of China's Trade with All Trading Partners in Commodity Composition

From the World	2001		2003		2005		2007		2009		2010	
Unit %	Import	Export	Import	Export	Import	Export	Import	Export	Import	Export	Import	Export
SITC 0	3.3	5.3	2.8	4.3	2.5	3.2	2.4	2.7	3.5	2.9	3.3	2.7
SITC 1	0.4	0.5	0.3	0.3	0.3	0.2	0.3	0.2	0.4	0.3	0.4	0.3
SITC 2	6.8	7.5	5.3	6.7	4.4	6	4.2	5.2	3.9	5.3	4	5.5
SITC 3	9.2	3.7	9.1	2.9	14	2.7	17	1.9	19.6	1.9	21.7	1.9
SITC 4	0.3	0	0.7	0	0.5	0	0.8	0	0.8	0	0.6	0
SITC 5	7.8	4.8	7.7	4.2	7.7	4.2	7.2	4.2	6.9	4.5	6.7	4.8
SITC 6	23	32.5	20.3	28.9	18.1	27.7	16.6	28.6	16.7	25.7	15.4	25.6
SITC 7	48.1	38.6	53.1	45.9	51.8	49.7	51	51.3	47.6	53.2	46.2	53.5
SITC 8	0.4	6.9	0.4	6.5	0.3	6	0.4	5.7	0.4	6	0.4	5.6
SITC 9	0.7	0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.3	0.1	1.3	0.1
Total	100	100	100	100	100	100	100	100	100	100	100	100

2.2 China's Trade Composition with Major Trade Partners

Liberal economic policies started to be introduced in China, which cause amount of capital flowing from foreign countries and regions to promote the economic and international trade growth. In addition, the unique political, economic as social system reform are carried out gradually in China. From the table 6, we can find that most of proportion in international trade is in manufactured commodities around 80%, and there are upward and downward tendency for the values of China's trade from the world.

In addition, for the manufactured goods, the highest percentage for SITC 5 to 8 is SITC 7. That is, machinery and transportation equipment. Especially, Hong Kong has an increase sharply from 54.55% to 82.95% in export side, where there is also huge number of proportion in import side around 80% in 2009. The major reason why the most proportion of international trade took place in manufacture industry or machinery and transportation equipment department is the factor-endowment of China that is labor intensive endowment. Meanwhile, with technology development and R&D investment, the structure of China's trade with the trader partners also has changed gradually. And no matter what the human and natural resources has been taken full advantages but, the education in labor capital and technology in production also have a dramatically development, by the economic integration with global economy, including fundamental change in its trade structure.

In many ways, China's achievement no matter in development of economy and society leads to the trend of global political and economic reform. Therefore, this study aims to analyze what specific factors have effect on bilateral TIIT, VIIT and HIIT over the transition period between China and her major trade partners from 1992 to 2010 by a panel data.

Table 6: The Values of China's Trade with Major Trading Partners in Commodity Composition

From the World	2001		2003		2005		2007		2009		2010	
100 Million USD	Import	Export	Import	Export	Import	Export	Import	Export	Import	Export	Import	Export
SITC 0	28.982	97.6	45.011	113.981	57.66	156.3	80.14	196.66	140.259	197.275	173.217	240.116
SITC 1	3.11	7.55	3.56	8.96	5.57	11.27	10.31	15.69	14.481	21.25	25.34	24.17
SITC 2	77.441	155.79	100.481	215.43	136.79	317.1	192.16	422.78	182.56	391.553	262.108	535.843
SITC 3	13.15	55.18	18.92	64.94	39.19	99.37	66.47	112.01	69.112	90.77	96.462	121.44
SITC 4	0.49	0.98	1.05	0.87	0.6	1.53	2.1	1.68	1.47	1.87	1.68	2.01
SITC 5	111.051	74.531	183.76	104.53	270.63	177.96	380.98	255.6	408.263	253.89	521.383	355.45
SITC 6	322.792	599.66	449.912	811.31	644.751	1312.17	850.701	1882.07	835.947	1683.591	1037.737	2107.676
SITC 7	848.05	769.97	1399.41	1534.97	1920.83	2872.61	2719.66	4441.59	2615.903	4212.93	3538.073	5596.35
SITC 8	7.22	156.84	11.11	266.7	14.9	371.97	20.75	537.15	21.38	516.93	30.83	610.21
SITC 9	2.36	0.92	2.961	1.18	5.42	7.5	7.27	12.57	6.972	12.971	32.942	12.461
Total	1414.646	1919.021	2216.175	3122.871	3096.341	5327.78	4330.541	7877.8	4296.347	7383.03	5719.772	9605.726

Note: Calculated by the author based on the data from China Foreign Economic Statistical Yearbook, China Trade and External Economic Statistical Yearbook.

Table 7: The Percentage of China's Trade with Major Trading Partners in Commodity Composition

From the World	2001		2003		2005		2007		2009		2010	
Unit %	Import	Export	Import	Export	Import	Export	Import	Export	Import	Export	Import	Export
SITC 0	2.1	5.1	2	3.7	1.9	2.9	1.9	2.5	3.3	2.7	3	2.5
SITC 1	0.2	0.4	0.2	0.3	0.2	0.2	0.2	0.2	0.3	0.3	0.4	0.3
SITC 2	5.5	8.1	4.5	6.9	4.4	6	4.4	5.4	4.3	5.3	4.6	5.6
SITC 3	0.9	2.9	0.9	2.1	1.3	1.9	1.5	1.4	1.6	1.2	1.7	1.3
SITC 4	0	0.1	0.1	0	0	0	0.1	0	0	0	0	0
SITC 5	7.9	3.9	8.3	3.4	8.7	3.3	8.8	3.2	9.5	3.4	9.1	3.7
SITC 6	22.8	31.3	20.3	26	20.8	24.6	19.6	23.9	19.5	22.8	18.1	21.9
SITC 7	60	40.1	63.2	49.2	62	53.9	62.8	56.4	60.9	57.1	61.9	58.3
SITC 8	0.5	8.2	0.5	8.5	0.5	7	0.5	6.8	0.5	7	0.5	6.4
SITC 9	0.2	0.1	0.1	0	0.2	0.1	0.2	0.2	0.2	0.2	0.6	0.1
Total	100	100	100	100	100	100	100	100	100	100	100	100

Table 8: The Percentage of Major Trading Partners trade with China in Commodity Composition

From China	2001		2003		2005		2007		2009		2010	
Unit %	Import	Export	Import	Export	Import	Export	Import	Export	Import	Export	Import	Export
USA												
SITC 0	2.1	8.2	2.1	10.5	1.7	9	1.7	8.9	1.9	15.3	1.8	14.1
SITC 1	0.1	0.5	0.1	0.4	0	0.3	0.1	0.3	0.2	0.6	0.2	1.1
SITC 2	8	7.7	7.3	8.3	6.1	7.9	5.6	8.1	5.5	6.9	5.9	7.8
SITC 3	1.2	0.7	0.8	1	1	2	0.8	2.4	0.4	2.5	0.4	3.3
SITC 4	0	0.1	0	0.2	0	0	0	0.2	0	0.1	0	0
SITC 5	3.4	9.2	3.1	13.1	2.8	11.3	2.6	10.6	3.1	10.2	3.2	10.8
SITC 6	30.3	11.4	24.5	15.3	26.1	17.8	25.7	17.4	25.1	17.1	24.8	16.9
SITC 7	40.3	61.4	49	50.3	51.4	51.3	52.5	51.7	52.9	47.2	53.3	45.6
SITC 8	14.7	0.3	13	0.3	11	0.3	11	0.3	10.7	0.2	10.3	0.3
SITC 9	0	0.6	0	0.5	0.1	0.1	0.1	0.2	0.1	0	0	0
Total	100	100	100	100	100	100	100	100	100	100	100	100
EU												
SITC 0	4	1.3	2.4	1.2	2.2	1.3	2	1.1	2.2	1.3	2	1.4
SITC 1	0.2	0.5	0.1	0.4	0.1	0.5	0.1	0.6	0.2	0.7	0.2	0.8
SITC 2	9	7.1	6.7	6.1	5.8	6.5	5.4	6.4	5.5	5.8	5.5	5.9
SITC 3	1.9	1.1	1.5	0.7	1.6	0.7	1.1	1	0.5	1.1	0.7	1.6
SITC 4	0	0	0	0	0	0	0	0.1	0	0.1	0	0.1
SITC 5	6.4	8.7	4.9	8.9	4.2	9.1	3.8	8.3	4.2	9.9	4.4	9.2
SITC 6	25.3	11.9	21.8	13.2	24.6	16.9	25.6	16.7	25.1	17.2	24.9	16.1
SITC 7	45.2	68.9	50.8	68.8	54.3	64.4	55.1	65.2	54.4	63.2	55.2	64.2
SITC 8	7.9	0.5	11.8	0.7	7.2	0.6	6.8	0.7	7.9	0.7	7.2	0.7
SITC 9	0	0	0	0	0	0	0	0	0	0	0	0
Total	100	100	100	100	100	100	100	100	100	100	100	100

Table 8: Continued

From China	2001		2003		2005		2007		2009		2010	
Unit %	Import	Export	Import	Export	Import	Export	Import	Export	Import	Export	Import	Export
Japan												
SITC 0	12.2	0.5	9.6	0.3	8.9	0.3	7.6	0.3	7	0.3	6.8	0.3
SITC 1	0.4	0	0.4	0	0.4	0	0.4	0	0.7	0	0.5	0
SITC 2	6.9	3	6.1	2.4	5.4	2.6	5.1	2.7	5.5	2.6	5.1	3.1
SITC 3	5.1	0.9	4.7	0.8	4.2	1.5	3.1	1.7	2	1.8	2.1	1.4
SITC 4	0	0	0	0	0	0	0	0	0	0	0	0
SITC 5	3.6	7.5	3.4	7.3	4.3	8.8	5.5	9.3	4.6	9.4	5.6	8.4
SITC 6	38.4	25.6	33.1	20.3	31.1	21.3	30.4	21	31.2	21.9	28.5	20.2
SITC 7	29.4	61.9	38.9	68.3	41.2	64.7	42.7	64.4	42.6	63.3	45.9	65.8
SITC 8	4.1	0.5	3.6	0.5	3.9	0.6	4.4	0.5	5.6	0.6	4.7	0.5
SITC 9	0.1	0	0.1	0.1	0.5	0.2	0.7	0.1	0.9	0.1	0.7	0.3
Total	100	100	100	100	100	100	100	100	100	100	100	100
Korea												
SITC 0	11.5	0.5	11.8	0.3	7.6	0.3	5.9	0.3				
SITC 1	0.9	0	0.6	0	0.3	0	0.4	0				
SITC 2	5.7	7.7	6.2	3.4	5	1.8	5	1.4				
SITC 3	11	8.4	7.7	4.6	8.2	4.7	5.1	6.4				
SITC 4	0.1	0	0.1	0	0.1	0	0	0				
SITC 5	6.4	11.3	5.9	9.2	5.8	10.2	6.2	10.4				
SITC 6	32.8	36.8	32.9	26.4	33.1	22	35.8	18.8				
SITC 7	30.1	34.8	33.1	55.3	38.1	60.7	39.6	62.5				
SITC 8	1.5	0.5	1.8	0.4	1.7	0.3	2.1	0.2				
SITC 9	0	0.1	0	0.3	0	0.1	0	0.2				
Total	100	100	100	100	100	100	100	100				

Table 8: Continued

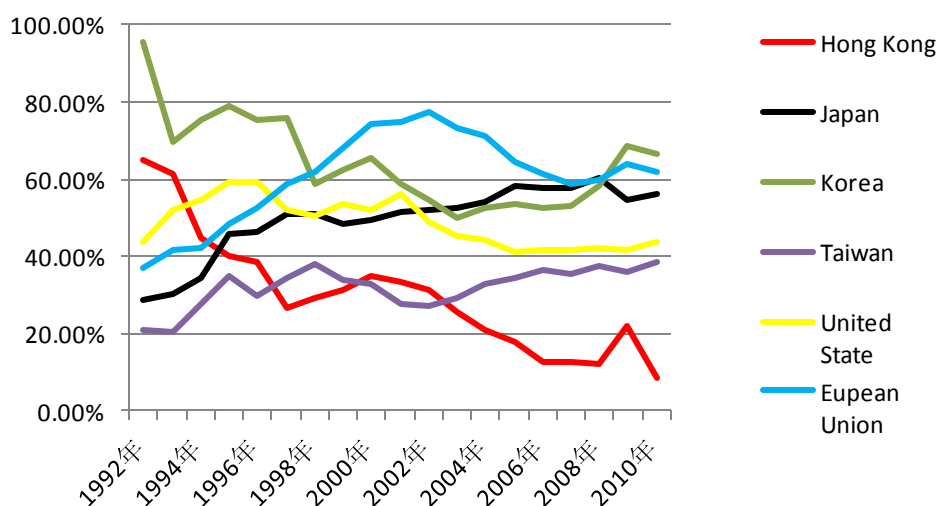
From China	2001		2003		2005		2007		2009		2010	
Unit %	Import	Export	Import	Export	Import	Export	Import	Export	Import	Export	Import	Export
Hong Kong												
SITC 0	2.9	0.2	2.2	0.2	1.6	0.2	1.3	0.4	1.7	0.7	1.6	0.7
SITC 1	1	0	0.6	0	0.5	0.1	0.3	0.2	0.4	0.2	0.4	0.2
SITC 2	8.9	6.8	7.4	5.6	6.5	5.2	5.4	4.8	4.8	5	5.8	4.9
SITC 3	2.8	1.6	1.6	1.7	1.3	2.3	1.5	2.1	2.6	4.1	2.5	2.8
SITC 4	0.2	0.1	0.1	0	0	0	0	0	0	0.1	0	0
SITC 5	2.2	4.5	1.6	4.2	1.9	3.9	1.2	4.3	1.1	5.2	1	4.2
SITC 6	31.6	34.5	27.1	32.3	18.7	35	16	38.9	12.7	33.7	11.3	29.8
SITC 7	45.1	50.7	54.7	54.9	65.2	50.7	70.7	45.1	74.4	45.1	75.8	34.2
SITC 8	5.3	1	4.6	0.8	4.2	0.8	3.6	1.2	2.2	0.8	1.6	0.6
SITC 9	0.1	0.6	0	0.4	0.1	1.9	0.1	3.1	0.1	5.2	0.1	22.6
Total	100	100	100	100	100	100	100	100	100	100	100	100
Taiwan												
SITC 0	2.8	0.2	2.4	0.2	1.9	0.1	2.3	0.1	3.6	0.1	3.6	0.1
SITC 1	0.1	0	0.4	0	0.2	0	0.1	0	0.2	0	0.2	0.1
SITC 2	5.7	4.6	5	3.3	4.4	2.4	3.7	2	4.6	1.9	3.8	2.1
SITC 3	9.8	0.8	6.4	0.7	5.8	0.9	4.1	1.3	3.5	1.1	2.9	0.8
SITC 4	0	0	0.1	0	0.1	0	0	0	0	0	0	0
SITC 5	7.6	7.2	7.6	6.7	7	7.4	9.7	8.2	12.5	8.9	13.2	9.2
SITC 6	23.2	39.6	18.7	28.8	22.4	23.7	22.2	20.3	13	19.7	15.8	17.8
SITC 7	47	47.1	57.1	59.9	55.8	65	55.8	67.8	60.3	67.8	58.5	69.5
SITC 8	3.7	0.5	2.3	0.4	2.2	0.4	1.7	0.3	2.2	0.4	2	0.5
SITC 9	0.1	0	0.1	0	0.4	0	0.4	0	0.2	0	0.2	0
Total	100	100	100	100	100	100	100	100	100	100	100	100

Note: Calculated by the author based on the data from China Foreign Economic Statistical Yearbook, China Trade and External Economic Statistical Yearbook

2.3 China's Intra-Industry Trade with Major Trading Partners

Definition of intra-industry trade (IIT) is that simultaneous export and import of differentiated products are traded within same industry between two trading partners. The purpose of this thesis is the intra-industry trade of China trading with her major trading partners. As a result of overall economic reform and open-up policy in 1987, China's economy has a dramatically development that accompanies growth of international trade. Actually, the openness of the China's trade took place from 1984, and the growth of IIT began to happen in 1990s, as illustrated in the following figure 1. We can find that all of China's major trading partners almost increased share of IIT in total trade which also has a fluctuation when the economic crisis broken in the world. However, share of the IIT between China and Taiwan, Japan in total trade still keep to growth after 2007. And share of IIT between China and Hong Kong in total trade always decreased in spite of world economic crisis.

Figure 1: Chinese Intra-Industry Trade Index with Major Trade Partners



Note: Calculated by the author based on the data from China Foreign Economic Statistical Yearbook, China Trade and External Economic Statistical Yearbook.

Through exploring the case in China, the IIT research area in four aspects will be made a contribution by us. First, in this study of the biggest developing country in

worldwide, new evidence will be added into the intra-industry trade literature. We can explain the circumstances with much important influence that makes intra-industry trade happen. Because of most of literatures of intra-industry trade on IIT among developed countries, there are a limited number of studies to relate with IIT between developed and developing countries. And it is also shortage that empirical evidence focuses on IIT between China and developed countries, including of her major trading partners. Second, a rich data set is applied in this study, between countries or region from 1992 to 2010, which the past references indicated a short of samples in researches. Besides, all trading commodities are incorporated in this study, at the HS level to measure total, vertical and horizontal intra-industry trade index, which earlier cross-country studies including limited set of industries, at 3 or 4 digits SITC, in precision degree of their estimations, are improved. Third, explanatory variables of the models in present study have more broad potential level, compared with earlier paper in the most intra-industry trader research. And some potential determinants of TIIT, VIIT and HIIT take a central stage on the majority of the previous studies. The key explanatory variable in three models is not included, which causes problems of interpretation. However, enough explanatory variables will be introduced in this study, where they also will be identified in the literature. Finally, in this study, different underlying determinants will be introduced in order to help our knowing in the models of the different measurement for TIIT, VIIT, and HIIT respectively. And according to analysis of the different intra-industry trade models, we can focus on the topic clearly and put forward more reasonable suggestion for the growth of international trade in China.

CHAPTER III

CONCEPTUAL FRAMEWORK

In the intra-industry trade study, we will review the definition and the theories about intra-industry trade. In addition, for the measurement of the TIIT, VIIT and HIIT index, Adjusted Grubel-Lloyd Index (GL) and Brulhart Dynamic Index would be introduced what we can choose, depending on the specific problems with trade partners. Furthermore, it is also significant important that VIIT and HIIT should be classified and measured by categorization of trade types.

3.1 Definition and Theory of Intra-Industry Trade

Definition of IIT is that the simultaneous import and export of differentiated products are traded in same industry between two countries or partners. And the decomposition of world trade can be divided into three trade types: inter-industry trade, IIT in vertically and horizontally differentiated products. And this thesis aims to IIT not inter-industry trade, so let us introduce IIT theory and models of IIT in vertically and horizontally differentiated products.

After the second war, there were some significant theories to be proposed by economists, such as new factor-endowment theory, new technology theory, which laid the foundation of intra-industry theory. And these theories introduced human capital, R&D, scale economy, technology innovation, product life cycle and reciprocal demand, and so forth, to expound the significance the intra-industry trade in modern international trade. However, the classical theory about the international trade has been short of explanation on intra-industry trade because of the two assumptions: perfect competition and homogeneous product. But, the new theory has to ignore one or all of hypothesis, so it make happens that there are many different hypothesis and conclusions of intra-industry trade theories and it doesn't exist unique intra-industry trade theoretical framework. As following Table 9.

Firstly, for the perfect competition market of intra-industry trade model, the Falvey's new H-O model is most obvious representativeness. He remained the perfect competition as hypothesis, and added the differentiated product to be another hypothesis simultaneously, which is so called vertical differentiated product. Besides, he assumed capital specificity that capital can't flow among industries. On the contrary, human capital is homogeneous and can flow among industries. Due to the much higher demand of the ratio of the physical capital to human capital, the countries that own abundant physical

capital endowment would take advantages to produce the high quality product, while the countries that possess abundant human capital endowment would like to produce the low quality product. And on the demand, either the consumers in the two countries would like to consume high or low quality products. In the open economy, the abundant physical capital endowment countries would export the higher quality products and import the lower quality products, and another countries would import and export the opposite products compared with the abundant physical endowment countries. Because the international trade happens within one or the same industries that is so called intra-industry trade is satisfied with H-O Theorem.

Table 9: Theoretical Frame work of Intra-Industry Trade

Market	Product Type		
	Homogeneous Product	Vertical Differentiated Product	Horizontal Differentiated Product
Perfect Competition	-	Falvey and Kierzkowski	-
Imperfect Competition	Monopoly	-	Dixit, Stiglitz (1977)
			Krugman (1979, 1980, 1981)
			Hotelling, Lancaster (1979)
			Helpman,
	Oligopoly	Brander and Krugman (1983)	Shaked and Sutton (1984)
			Ayton, Kurtz

Secondly, for the oligopoly market of intra-industry trade model, it is completely different with perfect competition market. And intra-industry trade model mainly focus on horizontal differentiated product that has the same quality and different characteristics. The New Chamberlin Oligopoly model and New Hotelling Oligopoly model are representativeness for the oligopoly market of intra-industry model. In particular,

Krugman and Helpman who employ the Chamberlin Oligopoly theory to explain intra-industry trade model put the New Chamberlin Oligopoly model forward. And Krugman (1979) constructed an intra-industry trade model by analysis method of differentiated product (Dixit and Stiglitz). The hypothesis of this model is that the scale economy doesn't takes place among industries but in corporations which produce horizontal differentiated products, so the market would be oligopoly where every kinds of differentiated products can be produced by only one corporation. Meanwhile, every differentiated product could be produced in unique country in the open economy. On the consumption, consumers need diversifications of demand that they would like to consume more differentiated products, which can gain much more effectiveness within income, constrain. Therefore, the model demonstrates that only the scale economy can make the intra-industry trade happen and don't need to the difference in technology and factor endowment, and so on. However, for the New Hoterlling Oligopoly Model, it is different with the new Chamberlin one that doesn't only apply the scale economy but also difference of demand to analyze IIT.

Finally, for the Oligopoly market of IIT model, it involves to homogeneous product, vertical differentiated product and horizontal differentiated product, of which assume the reciprocal dumping. Brander and Krugman constructed the reciprocal dumping hypothesis that two countries have one corporation that produce homogeneous products. With the difference of demand elasticity, the corporation would like to sell the lower price of products in domestic market than that in foreign market, to get the maximization profits, so the corporations of the two countries would do dumping in foreign market. Even though, the price in domestic market is lower, the corporations could gain the maximization profits. And if the activity of dumping has no effect on the prices of other products, so the total profit level can be improved for the corporation. Meanwhile,

another corporation also would like to do the same activities, so the reciprocal dumping activity just relates to oligopoly strategies not the cost of differentiated products, the difference of factor endowment and the diversifications of demand.

3.1.1 Intra-Industry Trade Model in Vertically Differentiated Products

IIT can be divided into two parts: IIT in vertically differentiated products (differing by quality), accounting for specialization along ranges of quality within one or same industry (The definition of vertical intra-industry trade is the two-way trade in vertically differentiated products, which are distinguished by quality and price), and IIT in horizontal differentiated (similar) products, accounting for different characteristics with one or same industry (the definition of horizontal intra-industry trade is the two-way trade in vertically differentiated products but the qualities and prices of the trading products are similar but the characteristics and properties are different). Firstly, we will introduce IIT models in vertically differentiated products.

Falvey (1981) focused on intra-industry trade model in vertically differentiated products. And he thought that many firms produce different quality goods within one industry, but their production is not influenced by economic scale effect. If the two trading partners take place international trade in different quality goods within one industry, it is the vertical intra-industry trade between two trading partners. In line with this term, vertical intra-industry trade is similar with inter intra-industry trade depending on the H-O model. Kierzkowski Model and F-K model indicated that although there are no imperfect competition and increasing returns, vertical intra-industry trade also exists. On the supply, suppose each country with two departments, and one produces goods with same quality, another produces goods with different quality, of which the trade between two countries is vertical intra-industry trade. In particular, the amount of capital will be used at different level with different quality products. Therefore, the comparative advantages will drive the firm product goods with different qualities. In addition, on the demand, suppose the consumers in two countries have same preference, and they will

prefer to buy higher quality with the income level when the relative prices are constant. Hence, each country has different demand for quality of goods.

Let us introduce a model of IIT in vertically differentiated products to explain why and how vertical IIT happens.

In this section, we briefly review the Natural Oligopolies Model (Shaked and Sutton, 1983) in vertically differentiated products. This model focus on the analysis of price competition in markets where consumers purchase a single unit of some good, the alternative product differentiation is that, were any two of the goods in question offered at the same price, then all consumers would agree in choosing the same one, for example, that of higher quality.

Distinct, substitute, goods are produced by a number of firms produce. We provide a label to represent the varieties of product by an index $k=1, \dots, n$, where firm k sells product k at price p_k .

Assume consumer preference identical but difference in their income; incomes are distributed by some range level, $0 < a \leq t \leq b$.

Consumer will buy products by consumer consumption from among our n substitute goods, in the sense that there are no consumers not buying these products, or else buys one variety product from one of the n firms. We denote by $U(t, k)$ the utility achieved by purchasing one variety of product k and t varieties of other products, and by $U(t, 0)$ the utility derived from consuming t units of income only.

Assume that the utility function takes the form:

$$U(t, k) = u_k * t \quad (k = 1, \dots, n) \quad \text{And} \quad U(t, 0) = u_0 * t$$

With $0 < u_0 < u_1 < \dots < u_n$ for example, the products are labeled in increasing order of quality. Let

$$r_{k-1,k} = \frac{u_k}{u_k - u_{k-1}} > 1.$$

Then we may define the income level t_k such that a consumer with this income will be indifferent between good k at price p_k and good $k-1$ at price p_{k-1} , by setting

$$u_{k-1} * (t_k - p_{k-1}) = u_k * (t_k - p_k)$$

Consider the function

$$\pi_k = (p_k - c_k)(t_{k+1} - t_k)$$

To show that $\hat{\pi}'_k > \pi'_k$ we compare π'_k as define by 3 with

$$\hat{\pi}'_k = (p_k - c_k)(1 - r_{k,k+1} - r_{k-2,k}) + t_{k+1} - t_{k-2}$$

And using $t_k = t_{k-1}$, and since we have $r_{k-2,k} < r_{k-1,k}$, our result follows.

From this we obtain the following proposition: for any set of products $1, \dots, n$ a noncooperation price equilibrium p_1, \dots, p_n exists.

As illustrated the model before, Shaked and Sutton's S-S model don't analyzed the relation between intra-industry trade and factor proportion that F-K has done before. And S-S model focused on the effect of different-quality products with different cost of research to market. They suppose each firms produce different-quality products within one industry (VIIT) since R&D cost. Meanwhile, if different-quality products sale in same price, consumers will prefer higher quality product. In addition, the cost of unit product doesn't increase quickly with the higher quality. Because the cost for improving quality has been speeded as fixed cost in research cost and is not like labor or capital input. Suppose in two same close markets that have monopoly, and one firm produces high-quality product, another one produces low-quality product. When the trade happens in two markets, the high or low quality product of firms will compete with each other. As a result, one of both them will quit from market with zero-profit. Therefore, one firm will

produce goods to demand two markets in different countries, in free trade. It is so called vertical intra-industry trade.

3.1.2 Intra-Industry Trade Model in Horizontally Differentiated Products

We know that IIT in horizontally differentiated products is one type of IIT (the definition of horizontal intra-industry trade is the two-way trade in vertically differentiated products but the qualities and prices of the trading products are similar but the characteristics and properties are different). Let us introduce IIT model in horizontally differentiated products to explain why horizontal IIT happens between two countries.

In 1979, Krugman put forward to horizontally intra-industry trade firstly depending on upgrading the Dixit and Stiglitz Model. So the Dixit-Stiglitz-Krugman Model was created. In this section, we simply introduce the standard Dixit-Stiglitz-Krugman Model of monopolistic competition (Toru Kikuchi, May 2010).

In this model, trade happens with economic scale effect that is internal economic effect of firm and not external one. We know that the market will be perfect competition if the economic scale effect is external, by contrary the market will be monopoly competition. On the supply, there are many firms that produce one or more similar product with increasing returns. On the demand, the preference of consumers is diversification that it means the consumers prefer to better products, like the model shown in the next.

Hypothesis of the model is as follows:

There are two countries: Home and Foreign; Home is endowed with L unit of labor, which is the only primary factor of production; And The countries have similar consumer preferences and production technologies; Each country produces two consumption products, product X and product Y . product X is sold in a monopolistically competitive market, Product Y is produced under constant returns using only labor and while product

Y is sold in a perfectly competitive market; units are chosen such that one unit of labor produces one unit of output; Wage rates are normalized to unity.

In every nation, the utility formula is illustrated as following:

$$u = X^u Y^{1-u}, 0 < u < 1,$$

Where Y is the consumption level of Good Y and X is a Good X aggregate, given by

$$X = \left[\sum_{i=1}^n (c_i)^p \right]^{1/p}, 0 < p < 1,$$

Where consumption of each variety is given by c_i , n is the number of product varieties produced in Home, and $\sigma \equiv \frac{1}{1-p} > 1$ is the elasticity of substitution between every pair of Good X varieties, respectively.

The consumer's utility maximization problem can be solved in two steps. For the first step, one can check that the demand function for variety i can be written as

$$c_i = \frac{p_i^{-\sigma}}{(P_X)^{1-\sigma}} E_X = \left(\frac{p_i}{P_X} \right)^{-\sigma} \left(\frac{E_X}{P_X} \right)$$

Where E_X is total spending on the differentiated products, and P_X is the price index of Good X, which is dual to X:

$$P_X = \left[\sum_{i=1}^n (p_i)^{p/(p-1)} \right]^{(p-1)/p} = \left[\sum_{i=1}^n (p_i)^{1-\sigma} \right]^{1/(1-\sigma)}.$$

By combining these conditions, the equilibrium number of varieties is obtained:

$$n^A = \frac{uL}{\alpha\sigma},$$

Where the superscript A represents the autarky equilibrium value. Thus the autarky equilibrium value of the cost-of-living index becomes:

$$P^A = (n^A)^{u/(1-\sigma)} p = \left(\frac{uL}{\alpha\sigma}\right)^{u/(1-\sigma)} \left(\frac{\sigma\beta}{\sigma-1}\right)^u,$$

$$-\left(\frac{L}{P^A}\right)\left(\frac{dP^A}{dL}\right) = \frac{u}{\sigma-1}.$$

The cost of product index will go down with the labor factor endowment: the abundant factor endowment country can provide a lot of varieties of products within one industry than other country. Meanwhile, the more varieties of differentiated products

In addition, Lancaster provided another model for horizontal intra-industry trade (HIIT). Suppose that firms can enter and exit to market, and choose any products to produce. Hence the cost of all products keeps the same. Meanwhile the firm wants to produce more products in order to get economic scale effect. And the cost of production doesn't depend on the characteristics with the same production function. The amount of sale is getting more with the low price. If the differentiation is less, the sale volume is not for cost. By contrary, the differentiation of the two products is bigger, so new firms will enter in market to produce a goods with characteristics between that of two goods. Since free for enter and exit, same consumer conference and cost function, it makes that the varieties of products will be well distributed and its product volume and price also will be same. Each firm gets normal benefit that price is equal to average cost. Obviously, trade will make that firms get scale effect and consumer get more choices for varieties of product. The horizontal intra-industry trade can happens in similar factor endowment countries, consumer preference and income level. So the same product can find more consumers in similar countries, by contrary, it is impossible to happen for horizontal intra-industry trade in different countries.

3.2 Measurement of Total, Vertical and Horizontal Intra-Industry Trade Index

The measurement of total intra-industry trade could be used the Adjusted Grubel-Lloyd Index (1975), which avoids the bias caused by the imbalance of bilateral trade.

This total IIT index is defined as

$$TIIT = \frac{\sum(X_i + M_i) - \sum|X_i - M_i|}{\sum(X_i + M_i) - |\sum X_i - \sum M_i|} \times 100$$

Where X_i and M_i represent at the values of export and import of product group i , respectively. The IIT index changes from 0 (complete inter-industry trade) to 100 (complete intra-industry trade).

We classify total intra-industry trade index (TIIT) into both components horizontal intra-industry trade index (HIIT) and vertical intra-industry trade index (VIIT) by using a range of relative export to import unit values (UV).

$$\text{ExportUV}_i = \frac{\text{Export Value}_i}{\text{Export Quantity}_i}$$

Where Export Value_i and Export Quantity_i represent at value and quantity of export of product group i .

$$\text{ImportUV}_i = \frac{\text{Import Value}_i}{\text{Import Quantity}_i}$$

Where Import Value_i and Import Quantity_i represent at value and quantity of import of product group i .

In our analysis, we chose to distinguish between vertical intra-industry trade and horizontal intra-industry trade. Firstly, the value recorded in trade statistic is usually influenced by nominal exchange rate fluctuations. Secondly, China's import and export statistics at the Harmonized System 6-digit level describes trade between China and trade partners. In this thesis, the calculation of UV of export and import are seem to cause more

bias, by the groups of different products, than the calculation by Fontagne (1997) who took used to the measurement of the 8-digit classification. In order to test the sensitivity of our outcomes to the extent of relative unit value of export to that of import used, we choose the range from $1/1.25=0.8$ to 1.25 ¹.

Although a lot of latest analysis, for instance, AbdRahaman (1991), Greenaway (1994) and Fontagne (1997), mainly use a 15% threshold to discriminate between horizontally and vertically differentiated products. According to literature of Fontagne, Freudenberg (FF) and Gaulier, we apply a 25% threshold for this analysis. It focused on how to disentangle horizontal and vertical intra-industry trade in the world. As the result, the threshold as 25% is most suitable for analysis of sensitivity of the relative importance of horizontal and vertical two-way trade.

And we could identify HIIT mainly by applying the extent of relative export to import per values of 1 divided by 1.25 to 1.25. That is a particular dispersion factor (a). UV represents unit value of export and import goods; meanwhile we suppose that the product in horizontal intra-industry trade has different characteristics or varieties with similar prices, while product in vertical intra-industry trade is same good with different qualities. Hence, the ratio of export unit value to import unit value in one product is differ less than some percentage as a threshold 25%, which is called two-way trade in horizontally differentiated products. In contrast, we call it as two-way trade in vertically differentiated products.

The definition of vertical intra-industry trade is the two-way trade in vertically differentiated products, which are distinguished by quality and price. And the

¹ The dispersion factor $a=25\%$ comes from Fontagne's Disentangling Horizontal and Vertical Intra-Industry Trade. Fontagne analyzed IIT, VIIT and HIIT of all countries in the world in 2000 that there is no much difference in the aggregate outcome of Greenaway, Hine and Milner (GHM 1994, 1995) and Fontagne and Freudenberg (FF 1997, 1998). And The Table 23 in appendix shows the sensitivity tests how trade types can be influenced by the choice of different thresholds.

classification of vertical intra-industry trade in this thesis will be employed as illustrated in the following formulas.

$$\frac{\text{exportUV}_i}{\text{importUV}_i} \geq 1 + a$$

$$\frac{\text{exportUV}_i}{\text{importUV}_i} < 1 - a$$

Conversely, the definition of horizontal intra-industry trade is the two-way trade in vertically differentiated products but the qualities and prices of the trading products are similar but the characteristics and properties are different. And the classification of horizontal intra-industry trade will be used at the estimations, as shown in the following formulas.

$$1 - a \leq \frac{\text{exportUV}_i}{\text{importUV}_i} \leq 1 + a$$

That is FF approach for measurement of intra-industry trade index, which is based on a simple algorithm. First of all, we should make sure that reciprocal trade flows exists at least some ratio of import value to export value. Second, if the first situation is positive, the unit values of elementary trade flows are similar or not. The difference in unit values is up to some percentage that will belong to vertical intra-industry trade. In contrast, if the difference in unit values is less than some percentage, it is called horizontal intra-industry trade.

And the measurement of vertical intra-industry trade in this thesis will be employed as illustrated in the following formulas.

$$\text{VIIT}_{it} = 1 - \frac{|\sum_{i=1}^n \Delta X_{it} - \sum_{i=1}^n \Delta M_{it}|}{\sum_{i=1}^n |\Delta X_{it}| + \sum_{i=1}^n |\Delta M_{it}|}$$

And the measurement of horizontal intra-industry trade will be used at the estimations, as shown in the following formulas.

$$\text{HIIT}_{ijt} = \text{IIT}_{ijt} - \text{VIIT}_{ijt}$$

As a result of IIT divided into two types of trade: VIIT and HIIT, we can get HIIT index from IIT index minus VIIT index directly.

CHAPTER IV

LITERATURE REVIEW

In the years 1950s, there were literatures about intra-industry trade that find out the evidence of dramatically growth. Balassa (1966) can be first economist that put forward the definition of intra-industry trade. That is simultaneous import and export of product within one and same industry between two countries. After that, for this phenomenon started to be analyzed through theoretical and empirical literatures, which will be reviewed as following

Table 10: List of Theoretical and Empirical Literatures of Intra-Industry Trade

Literature [↵]	Explanation [↵]
Grubel and Lloyd (1975) [↵]	The research focused on IIT of horizontal differentiated product through using the traditional monopolistic competition approach, which emphasized the major role of product differentiation and scale economics in horizontal intra-industry trade. [↵]
Helpman (1981, 1987); [↵]	The research suggests that the IIT is driven primarily by economics of scale and occurs when consumers express preferences for product variety and products are differentiated. [↵]
Falvey (1981); [↵] Greenaway (1994, 95, 99) [↵] Fontagne and Freudenberg (1997); Aturupane (1999); [↵]	The research suggests that different comparative advantage and skill intensities cause the exchange of similar goods of different quality. [↵]
Thom and McDowell (1999) [↵]	The result implies that an alternative consideration involves a focus on the organization of the production process rather than the end-use characteristics of a final good. [↵]
Balassa (1986); [↵]	The notion of vertical product specialization, two-way trade may include trade between countries of intermediate goods at different stages of production or trade including components being exported for processing, with the final good being imported. [↵]
Nielsen and Luthje (2002); Greenaway (1994); [↵] Bruhart and Elliott (2002) [↵]	The theories suggest that vertical and horizontal intra-industry trades are driven by different factors, so the implication for a country associated with an expansion in trade by assessing the adjustment costs. [↵]

Thom and McDowell (1999); ⁴²	The vertical intra-industry trade reflects resources reallocation between different stages of production rather than across different industries, factor market adjustment costs of inter-industry trade are possible to be more than that in case of vertical intra-industry. ⁴²
Greenaway and Torstensson (1997, 2000); ⁴²	The two-way trade is not to separate out the different forms of intra-industry trade by the econometric analyses, likely to be one reason for variation. ⁴²
Aturupane (1999); ⁴² Hu and Ma (1999); Martin-Montaner and Rios and Gullstrand (2002); ⁴²	Measurements of both vertical and horizontal as the dependent variable are introduced in Several recent theory studies and econometric research. ⁴²
Hamilton and Kniest (1991); ⁴² Oliveras and Terra (1997); ⁴² Brulhart (1994, 2000) ⁴²	In the published literatures, they have been focusing on traditional static measures of intra-industry trade fail to reflect the fact that adjustment is a dynamic process and needs measure of IIT that reflects the changes the structure of flows at discrete intervals at different points of time. ⁴²

Note: These theories are concluded by the literatures.

4.1 Theoretical Research of Intra-industry Trade

AbdRahman (1991) and Greenaway (1995) emphasized that the distinction of the two types of IIT is very important, which are horizontal IIT and vertical IIT. With the development of the theories of horizontal intra-industry trade and vertical intra-industry trade, these economists agree on the hypotheses of intra-industry trade. According to previous literatures, lots of economists adjusted the OECD's classification of IIT. Horizontal IIT is two-way trade in differentiated products with different varieties of one industry, for example products of a similar degree in a similar range of prices. Vertical IIT is also two-way trade in differentiated products with different qualities and prices, such as China exports low-quality product to developed country and imports high-quality product from developed country, and meanwhile, the vertical characteristics of production are changed to differentiated product with one and the same industry. For instance, China imports some parts of manufactured product (intermediate product), but exports manufactured product (final product). That is also called inter-product trade. After comparison, horizontal IIT makes country that get benefit from economic scale by their similar factor endowments. In particular, vertical IIT may indicates comparative

advantage with different factor endowment, research and development of technology and labor resources

Grubel and Lloyd (1975); Dixit and Stiglitz (1977); Krugman (1979, 1980, 1981) and Lancaster (1979, 1980)², finished the research work and make the models on IIT focus on the horizontal differentiated product through using the classic economic imperfect competition method. The models analyze the function and effect of economic scale and differentiated product on horizontal IIT. And they imply that more similar trading partners with factor-endowment, per-capita income, the greater the ratio of horizontal IIT can take place since economic scale effect and differentiated product.

Helpman and Krugman (1985) pay attention to similar model by international trade theory that is called as Chamberlin-Heckcher-Ohlin (CHOS) model. Including factor-ratio, costs decrease and differentiated product horizontally in a global trade system that produces inter and intra industry trade. The CHOS indicates a greater percentage of IIT in TWT when the relative advantages of two trading partners are so similar with each other. And meanwhile, the horizontal IIT will be getting higher when the trading partner are not too much different.

Bergstrand (1990) developed the previous theories through employing a gravity theory to introduce horizontal IIT. And He found out the relationship between horizontal IIT and factor-ratio and consumer income. By the method, the ratio of Horizontal IIT to total trade is decided by the different conditions in two trading partners including growth domestic production, factor endowment, income level and the differences between two

² Krugman, P.R. Intra-Industry Specialization and the Gains from Trade. Journal of Political Economy 89 (Oct. 1981) : 959-973.

trading partners with their economic development level, factor endowment and open degree level and so on.

Linder's theory (1961) explained the definition of horizontal IIT and analyzes the determinants of horizontal IIT that are similar in two trading partners, like economic size and capital-labor endowment. If the two trading partners are similar that they would like to produce more differentiated commodities to demand their similar consumption preferences, the two-way trade about horizontal is getting higher. Meanwhile the two trading partner would like to pursuit economic scale effect to get lower cost and more market sales with differentiated commodities and same qualities, but not similar types, colors and functions and so forth. Therefore the geographic also can be a factor determinant of horizontal IIT with similar consumer preferences. That is more similar in two trading partners and more share of horizontal IIT in total trade. Indeed, the development of China's economy can drive their IIT up in differentiated commodities by reducing the different between developed countries and it.

The Falvey (1981), Shaked and Sutton (1984), Flam and Helpman (1987) and Falvey and Kierzkowshi (1987) explained the vertical IIT happening between two trading partners with different income level and capital-labor endowment ratio, following the international trade theories. They thought that the determinants of vertical IIT are difference with two trading partners factor endowment. Because the capital abundant country would like to produce high-quality commodities, while the labor abundant country would like to produce low-quality commodities. And if the two trade partners happen in two-way trade, the share of vertical IIT in total trade is getting higher. On the other hand, the more similar countries will reduce the ratio of vertical IIT with their income lever and economic size. Different income of consumers would like to demand

different quality products. The Falvey's model (1981) explained that the difference between two trading partners drives they would like to produce different quality products and most of their commodities focused on manufactured industry. Therefore, the capital abundant usually export high-quality product and the labor abundant usually export low-quality product. Besides, their models pay attention to the effect of technological development level. And they indicate the different qualities between developing country like China and developed countries with their difference of technological development levels. Hence vertical IIT is decided through comparative advantages, according to the traditional international trade model.

Linder's theory (1961) emphasized the determinant of vertical IIT, because their distribution of income is not balance in two trading partners. This theory explained that the trading partner's domestic demand decided the production of differentiated product. Therefore, the capital abundant of developed countries would like to export high-quality commodities with their income level. However, the labor abundant of developing countries would like to export low quality commodities with their low-income level. But with the consumer's demand of differentiated products, the share of intra-industry trade in total trade will be getting higher for vertically differentiated products.

The Vernon's product life cycle theory (1966) indicates that the FDI has an effect on vertical IIT. According to the theory, the developed countries will produce the newest characteristics of products and then the developing countries also will produce that product after some period with developed countries transferring them. Some it makes that developed countries usually produce new characteristics and export them to developing countries with varieties of consumer demand. And developing countries would like to product them to export to developed countries when developed countries start to produce

newer product. On the other hand, developing countries will be short of technology support; so developed countries will provide the technology support with FDI. And this time, the “old” product is produced in developing countries from developed countries; meanwhile the “new” product is produced in developed countries with the advantage of capital and technology. According to the theory of Fukasaku (1992), the share of IIT in total trade depends on the speed of commodities transferring from developed countries to developed countries. According to Vernon’s theory, it indicates that there is a positive relation between vertical IIT and FDI. Because the multi-national enterprises would like to produce the products in foreign countries like developing countries with their low cost, labor abundant, and natural resources. After that, they shipped these commodities back to home countries like developed countries. So the multi national enterprises would like to reach the lower cost in foreign countries. However, the multinational enterprises would like to pursuit the market expansion since the economic scale effect that means the multinational enterprises could decrease the cost and increase the number of sales in order to get higher benefit. That is, the multinational enterprises produce products in foreign countries in line with the relative comparative advantages in the foreign countries, so the products will be consumed in foreign countries according to the economic scale effect. Hence, the IIT will get lower in total trade with the FDI from developed countries to developing countries, like USA and China. The FDI has a negative relationship with IIT. So the motivation of Multinational Corporation and the capital-labor endowment ratio between trading partners decide the share of IIT in total trade. And meanwhile, in particular, the horizontal IIT has a significant influence with number of Multinational corporations and vertical IIT has a significant influence with amount of FDI. Because, in line with the definition of horizontal IIT, the differentiated product with similar quality but different characteristics happens in two-way trade, which represents more firms in

market more varieties of differentiated product. Hence multinational corporations have a more significant effect on horizontal IIT. However, in line with vertical IIT, the differentiated product with different qualities in one or same industry takes place in two-way trade, which reflects that more capital in one country that would like to produce high quality differentiated product, while less capital in another country that would like to produce low quality differentiated product.

In addition, Helpman (1981) and Krugman (1981) emphasized the trade structure and open degree of trading partner that play a significant role on IIT. First, the degree of varieties of differentiated products is the original basement of IIT. More varieties of differentiated products in market indicate that the higher probability of IIT in two-way trade. Generally speaking, the IIT takes place in manufactured industry with the varieties of characteristic of industry. If the ratio of manufactured product in total product between two-way trades is high, the IIT also will be getting higher. However, the share of that in total product in international trade has different effect on vertical and horizontal IIT. According to the IIT theories, we expected that share of the manufactured product in export value has significant relationship with vertical IIT, while the share of primary product in export value has more significant relationship with horizontal IIT than manufactured products of that.

Moreover, literatures of Falvey (1981) and Matthews (1998) indicated that the open degree has an influence on IIT, while the sign of expected of open degree cannot be decided clearly. And we just can make sure that the open degree could stimulate the international trade not two-way trade. But the more international trade reflects much more amounts of two-way trade and one-way trade together. So the share of two-way trade in

total trade is not clear to be expected. However, it is true that the open degree of trade should have an effect on international trade as well as two-way trade.

Loertscher and Wolter (1980), Balasa (1986), Culem and Lunberg (1986), Balassa and Bauwens (1987, 1988), Hummels and Levinsohn (1995), Stone and Lee (1995), Blanes and Martion (2000) focused that the share of IIT in total trade depends on the speed of commodities transferring from developed countries to developed countries. According to Vernon's theory, it indicates that there is a positive relation between vertical IIT and FDI. Because the multi-national enterprises would like to produce the products in foreign countries like developing countries with their low cost, labor abundant, and natural resources. After that, they shipped these commodities back to home countries like developed countries. So the multi national enterprises would like to reach the lower cost in foreign countries. However, the multinational enterprises would like to pursue the market expansion since the economic scale effect that means the multinational enterprises could decrease the cost and increase the number of sales in order to get higher benefit.

Grimwade (1989) put forward that the labor abundant of developing countries would like to export low quality commodities with their low-income level. But with the consumer's demand of differentiated products, the share of intra-industry trade in total trade will be getting higher for vertically differentiated products.

Moreover, Rice (2002) emphasized that the geographic factor play an important role in IIT. Because the geographic factor can be a trade barriers in two-way trade that if the distance between two trading partners is far, the similar of consumer preference and other factor can be more different. According to the IIT theories, the share of IIT in total can be getting lower if the trading partners are not similar. However, for the vertical IIT, we expected that vertically differentiated product has a positive effect on geographic

distance. And for the horizontal IIT, we expected that horizontally differentiated product has negative effect on geographic distance. Because the key determinant of IIT is difference between two trading partners, like economic size, consumer preference and so forth.

4.2 Empirical Research of Intra-industry Trade

In 1960s, a number of economists found evidence of rapidly increasing intra-industry trade, since customs-union formation in Western Europe was established. Some of them primarily emphasized differentiated goods produced with increasing returns to scale; and another focused on examine the empirical determinants of intra-industry trade by econometric methods. This part belongs to the later one and will review previous econometric studies of intra-industry trade.

Joe A. Stone and Hyun-Hoon Lee (1995) investigated the determinants of intra-industry trade, emphasizing manufacturing and nonmanufacturing countries and changes over time; and they also employed dynamic specification in the model that added a dynamic dimension to the study, partial adjustment model. First of all, the authors apply a logistic function, whose predicted values are always between 0 and 1 for the following estimations by Balassa (1986) and Balassa and Bauwens (1987)³. The appropriate equation is

$$\text{IIT} = 1/[1 + \text{EXP}(-\beta Z)]$$

Where Z is the vector of explanatory variables including a constant and β is the corresponding vector of coefficients.

³ Balassa, B., and Bauwens, L. Inter-Industry and Intra-Industry Specialization in Manufactured Goods. WeltwirtschaftlichesArchiv 124 (Mar. 1988) : 1-13.

$$\text{LN}[\text{IIT}/(1 - \text{IIT})] = \beta Z$$

The authors denoted the dependent variable in above equation as TIIT. The range of TIIV is from minus infinity to plus infinity. Furthermore, for IIT we can control the range of values.

$$(\text{TIIT}_t - \text{TIIT}_{t-1}) = \delta(\text{TIIT}_t^* - \text{TIIT}_{t-1})$$

Next, suppose the desired level of TIIT at time t is TIIT_t^* , and for the partial adjustment model, they expressed the relationship between the actual and the desired level of TIIV as above equation. Where δ is rate of adjustment and is bounded by 0 and 1. Since TIIT_t^* is not observed, they assumed that TIIT_t^* is determined by the levels of TIIT_{t-1} , as well as the first differences. Thus, the equation for TIIT is

$$(\text{TIIT}_t - \text{TIIT}_{t-1}) = -\delta\text{TIIT}_{t-1} + a_1 Z_{t-1} + a_2 (Z_t - Z_{t-1})$$

And if the errors between t and $t-1$ are not correlated, then a coefficient on each level variable divided by the rate of adjustment parameter, δ , equals the corresponding long-run coefficient β . A special case of above equation is where $a_1 = a_2$. This specification embodied the assumption that changes in the determinants of TIIT are correctly predicted, on average. In this restricted condition, the above equation becomes

$$(\text{TIIT}_t + \text{TIIT}_{t-1}) = -\delta\text{TIIT}_{t-1} + aZ_t$$

Thus, if the dynamic structure of estimation can pass the test of null hypothesis that is $a_2 = 0$, then it also should be tested another null hypothesis that $a_1 = a_2$. If both of the null hypotheses are not rejected, the above equation can be estimated.

$$\text{IIT} = \beta_0 + \beta_1 \text{PCGDP} + \beta_2 \text{GDP} + \beta_3 \text{WDIST} + \beta_4 \text{TO} + \beta_5 \text{TIMB} + e$$

$$\text{TIIT}_t = \beta_0 - \delta\text{TIIT}_{t-1} + \beta_1 \text{PCGDP} + \beta_2 \text{GDP} + \beta_3 \text{WDIST} + \beta_4 \text{TO} + \beta_5 \text{TIMB} + e$$

All the explanatory variables are per capital gross domestic product (PCGDP), gross domestic product (GDP), and constructed measure of trade orientation, weighted distance to market (WDIST) and trade imbalances (TIMB).

Donald R. Davis (1995)⁴ employed the Heckscher-Olin-Ricardo that introduced element of Ricardian trade theory within the Heckscher-Olin framework to analyze intra-industry trade. The product of study is that increasing returns as essential characteristic of intra-industry trade (technical differences matter) are not necessary for intra-industry trade. According to both Ricardian and Heckscher-Olin, the essential insight is that international trade based on comparative advantage. So, the author developed the theory in a setting that allows for both Ricardian and Heckscher-Olin influences, proving a unified account of intra-industry trade and inter-industry trade. The key to inducing intra-industry trade is to have intra-industry specialization across countries and regions. Scale economics provide one reason for such specialization, and another is technical differences, as a reason for trade requires some motivation specific to the study of intra-industry trade. He also gave verification that intra-industry trade could arise, even if returns to scale are constant and markets perfectly competitive.

Country one:

$$X_1 = AF(K_{X1}, L_{X1}) X_2 = F(K_{X2}, L_{X2}) Y = G(K_Y, L_Y)$$

Country two:

$$X_1 = F(K_{X1}, L_{X1}) X_2 = F(K_{X2}, L_{X2}) Y = G(K_Y, L_Y)$$

⁴ Davis, D.R. Intra-Industry trade: A Heckscher-Ohlin-Ricardo Approach. Journal of International Economics 39 (Nov. 1995) : 201-226.

Where it assume $A > 1$, let preferences be identical and homothetic. Good 2 is the numeracies. And $\bar{V}(i) = [\bar{K}(i), \bar{L}(i)]$ is integrated equilibrium use of factor in sector i .

Donald R. Davis (1995) developed the simplest possible that gives a unified account of inter-industry trade and intra-industry trade, while compare with the standard factor proportions results. So, this requires a model with three goods: two to represent intra-industry goods, and one is for other industry. For comparability with standard results, it needs a mode with two factors, like capital and labor. Meanwhile, it allow there to exist arbitrarily small cross-country technological differences.

Lisbeth Hellvin (1996) emphasized the determinants of intra-industry trade in bilateral trade between China and OECD countries with respect to country and industry variables. The dependent variable concerns the share of total intra-industry trade divided by vertical intra-industry trade and horizontal intra-industry trade.

$$\text{Ln} \left(\text{IIT}_{iCh}^i / (1 - \text{IIT}_{iCh}^i) \right)$$

The index of intra industry trade (TIIT) is defined by above equation. And the estimation equation is as follows:

$$\text{Ln} \left(\text{IIT}_{iCh}^i / (1 - \text{IIT}_{iCh}^i) \right) = a_0 + a_1 \text{LnGDP}_j + a_2 \text{LnPC}_j + a_3 \text{LnQD}_{Ch}^i + a_4 \text{LnTARIFF}_{Ch}^i$$

Where GDP_j denotes the size of country j ; and PC_j the average level of per capita-income. There are also two industry variables: QD_{Ch}^i represents the degree of quality differences in product group i ; LnTARIFF_{Ch}^i the degree of China's import and export charges in product group i .

Don P. Clark and Denise L. Stanley (1999) identified countries and industry-level determinants of intra-industry trade between the US and developing countries. And the study found the intra-industry trade that declines with greater differences in relative factor

endowments has a significant relationship with economic size and trade orientation of developing countries, besides geographic distance. Meanwhile the theoretical and empirical models of North-South trade should focus on sources of IIT related to country characteristics, vertical product differentiation based on quality differences, the level of product standardization, and labor cost differences between the North and South.

$$\begin{aligned} IIT_{ij} = & a_{ij} + \text{Ln DIFF}_{ij} + \text{Ln GDP}_{ij} + \text{Ln DIST}_{ij} + \text{TO}_{ij} + \text{TIMB}_{ij} + \text{MES}_{ij} + \text{CR4}_{ij} \\ & + \text{ESTAB}_{ij} + \text{DSPH}_{ij} + \text{AS}_{ij} + \text{KL}_{ij} + \text{OAP}_{ij} + \text{Ln VS}_{ij} \end{aligned}$$

Where DIFF denotes differences in factors endowments, instead of per capita GDP, and GDP represents gross domestic production of developing countries, DIST distant between U.S. and a trading partner, TO developing countries' trade orientation, TIMB trade imbalance, MES minimum efficient scale, CR4 four-firm seller concentration ration, ESTAB the number of establishments, DSPH sectorial dispersion index, AS advertising to sale, KL capital to labor, OAP industrial participation under offshore assembly provision, VS industry shipments.

CHAPTER V

REREARCH METHODS

5.1 Construction of Intra-Industry Trade Models

This thesis doesn't only analyze the determinants of vertical IIT and horizontal IIT, but total IIT also could be employed as the dependent variable that will be measured in this section. And we will try to convert variables from theories to "operational" variables as the following table illustrated.

Table 12: Previous Empirically Evidence about Determinants of Total, vertical and Horizontal IIT Models

Independent Variable [↵]	Major Dependent Variable [↵]	Explanation [↵]
TIIT [↵]	DIMB [↵] EXCH [↵] OPEN [↵]	Heolaan (1981) and Krugman (1981) indicated that trade structures (DIMB) and trade barriers (EXCH and OPEN) are key determinants of intra-industry trade since the potential demand and product differentiation could be stimulated. [↵]
	PIN [↵]	The Chamberlin-Heckscher-Ohlin (1985) Model suggests that vertically differentiated products take place between countries with different per capita incomes (PIN) and factor endowments. [↵]
	DIST [↵]	Loertscher and Wolter (1980); Balassa and Bauwens (1987); Blanes and Martin (2000)'s researches talk about Geographical distance (DIST) as a natural trade barrier has been considered to be an important determinant of intra-industry trade. [↵]
	DGDP [↵] DIMB [↵]	Rice (2002) theory suggests that The production, demand patterns and economic structure (DGDP and DIMB) in a pair of neighboring countries are more similar than those of distant countries (DIST). [↵]
	MR2 [↵]	Witteloostuijn (2005)'s empirically evidence indicated that manufacturing goods (MR2) are associated with higher degrees of product differentiation than are primary commodities. [↵]
VIIT [↵]	DGDP [↵] DPIN [↵]	The H-O Model says that VIIT is determined by the both countries' comparative advantage, such as labor and capital endowment (FDI, DGDP and DPIN). [↵] And The Chamberlin-Heckscher-Ohlin Model (1985) suggests that vertically differentiated products take place between countries with different per capita incomes (DPIN) and factor endowments. [↵]
	DGDP [↵] DPIN [↵]	And Falvey (1981), Shaked and Sutton (1984), Flam and Helpman's Models (1987)'s literatures indicated that more

	DIMB [↗]	similar country (DGDP, DIMB, DPIN), less share of VIIT in total trade. [↗]
	DPIN [↗]	And the Linder's theory (1961) suggests that the domestic demand determines the production and trade (DPIN). [↗]
	FDI [↗]	Vernon's Product Life Cycle Theory (1966) explained that FDI impact on VIIT. Capital abundant country would like to produce high quality product. Labor abundant country would like to produce low quality product. [↗]
	MR2 [↗]	Witteloostuijn (2005)'s empirically evidence indicated that the share of manufacturing goods in trade (MR2) indicated the trade structure and most of VIIT happens in manufacturing industry that produce more different quality products. [↗]
HIIT [↗]	DGDP [↗] DPIN [↗]	Grubel and Lloyd (1975); Dixit and Stiglitz (1977); Krugman (1979, 1980, 1981); Lancaster (1979,1980)'s literatures implied that the more similar countries are in terms of their incomes (like DGDP and DPIN), the greater the share of HIIT will be that is influenced by the scale economics (GDP) and product differentiation. [↗]
	FDI [↗] OPEN [↗]	Bergstrand's Gravity-Like Model (1990) suggests that the share of HIIT is related to factor endowments (like FDI), income level (PIN), and both countries' with economic size (DGDP) and tariff levels (OPEN) [↗]
	DPIN [↗]	And the Linder's theory (1961) suggested when the two countries are similar in their income level and consumer preference (DPIN), they would produce more products and simulate serve consumers. [↗]
	MR1 [↗]	Witteloostuijn (2005)'s empirically evidence indicated that primary industry is more associated with HIIT that means different characteristics of products within one industry. [↗]

Source: The details of theories from previous literature review.

According to these theoretical and empirical researches, the total IIT, vertical IIT and horizontal IIT models can be constructed and meanwhile these models also should emphasize the Chinese economic environment and situation. In addition, the construction of models will be panel data model since the different regions and countries as the major trading partner of China. The purpose of using this regression method is to keep higher precise in estimations of the three models. Therefore, the affect of the independent variables will be different to the TIIT, VIIT and HIIT in the three models, which of expectation is also related with these theoretical and empirical researches.

5.1.1 Model of Total Intra-Industry Trade

According to the theoretical foundation of total IIT model, we put forward a series of independent variables into TIIT model.

On finding the determinants of China's Total intra-industry trade, we will estimate the following model:

$$\begin{aligned} \text{TIIT}_{it} &= \beta_0 + \beta_1 \text{LOG}(\text{FDI}_{it-1}) + \beta_2 \text{LOG}(\text{DGDP}_{it}) + \beta_3 \text{DPIN}_{it} + \beta_4 \text{DIMB}_{it} + \beta_5 \text{MR2}_{it} \\ &\quad + \beta_6 \text{EXCH}_{it} + \beta_7 \text{OPEN}_{it} + \beta_8 \text{DIST}_{it} + \varepsilon_{it} \\ \text{TIIT}_{it} &= 1 - \frac{|\sum_{i=1}^n \Delta X_{it} - \sum_{i=1}^n \Delta M_{it}|}{\sum_{i=1}^n |\Delta X_{it}| + \sum_{i=1}^n |\Delta M_{it}|} \end{aligned}$$

Where TIIT = Total Intra-Industry Trade

FDI = Foreign Direct Investment from Major Trader in China

DGDP = Difference of GDP between China and Major Trader

$$= 1 + \frac{[w \ln(w) + (1-w) \ln(1-w)]}{\ln 2}$$

$$w = \text{GDP}_a / (\text{GDP}_a + \text{GDP}_b)$$

DPIN = Difference of Per Capital Income between China and Major Trader

DIMB = Balance of Payment between China and Major Trader

MR2 = Share of Trading Value of Manufactured Products in Total Trade

EXCH = Exchange Rate between China and Major Trading Partner

OPEN = Open Degree of Trade

$$= (X_{it} + M_{it}) / \text{GDP}_{it}$$

DIST = Geographic Distance between China and Major Trader.

In the model of total IIT, we chose MR2 because vertical IIT takes a large central stage in total IIT and MR2 is more associated with vertical IIT. And there are different voices on the sign between foreign direct investment and IIT, since the FDI in China

focuses on the manufacturing industry. For this matter, some foreign economists think that the FDI has a negative effect on intra-industry trade in a resource and cost driver of country, however it has a positive effect on IIT in a seeking economic scales and differentiated products of country. Meanwhile, factor endowment and economic scales are also one of determinants for intra-industry trade. Because, the enterprise that is close to perfect competition in market implies that it can do differentiated commodities. That means high level in intra-industry trade. So I pick the GDP, per capita income as independent variables to test the factor endowment how to play roles in the intra-industry model by the comparative advantage theory. According to the economic globalization, the model must involve the open degree in a country, like tariff levels, exchange rate, trade barriers and so forth. Hence, the EXCH and OPEN as independent variables in total intra-industry model are used. Specifically, we choose the annual exchange rate date of China to represent the EXCH. And for another one, and it exists some different kinds of measurement about open degree in a country, for example, the ratio of export and import values to growth domestic production of a country, the tariff or non-tariff index, and the free degree from the international database. In our three intra-industry trade models, I will try to put different data about the measurement of the OPEN into our estimations, respectively. Finally, choose the best fitting one. And the data of all variables in the total IIT model comes from the OECD database, the World Bank database, the China Statistics Yearbook, the China Foreign Economic Statistical Yearbook, the China Trade and External Economic Statistical Yearbook and the China Foreign Merchant Investment Report.

5.1.2 Model of Vertical Intra-Industry Trade

According to the theoretical foundation of vertical IIT model, we put forward a series of independent variables into VIIT model.

On finding the determinants of China's intra-industry trade, we will estimate the following models:

$$\text{VIIT}_{it} = \beta_0 + \beta_1 \text{LOG}(\text{FDI}_{it-1}) + \beta_2 \text{LOG}(\text{DGDP}_{it}) + \beta_3 \text{DIMB}_{it} + \beta_4 \text{DPIN}_{it} + \beta_5 \text{MR2}_{it} \\ + \beta_6 \text{EXCH}_{it} + \beta_7 \text{OPEN}_{it} + \beta_8 \text{DIST}_{it} + \varepsilon_{it}$$

$$\text{VIIT}_{it} = 1 - \frac{|\sum_{i=1}^n \Delta X_{it} - \sum_{i=1}^n \Delta M_{it}|}{\sum_{i=1}^n |\Delta X_{it}| + \sum_{i=1}^n |\Delta M_{it}|}$$

$$1 - a \leq \frac{\text{exportUV}_i}{\text{importUV}_i} \leq 1 + a$$

Where VIIT= Vertical Intra-Industry Trade

FDI = Foreign Direct Investment from Major Trader

DGDP = Difference of GDP between China and Major Trader

$$= 1 + \frac{[w \ln(w) + (1 - w) \ln(1 - w)]}{\ln 2}$$

$$w = \text{GDP}_a / (\text{GDP}_a + \text{GDP}_b)$$

DPIN = Difference of Per Capital Income between China and Major Trader

DIMB = Balance of Payment between China and Major Trader

EXCH = Exchange Rate between China and Major Trader

MR2 = Share of Trading Value of Manufactured Product in Total Trade

OPEN = Open Degree of Trade

$$= (X_{it} + M_{it}) / \text{GDP}_{it}$$

DIST = Geographic Distance between China and Major Trader.

In the vertical intra-industry trade model, we chose MR2 that is more associated with vertical IIT that means different quality products within one industry, in two-way

trade. The most of products in manufactured industry will be satisfied with the definition of vertical IIT, such as electronic equipment and vehicle. And there are no different with total intra-industry trade model. Because, the amount of vertical intra-industry trade takes a central stage in that of total intra-industry trade. But we try to put the DIST, GDP of China, and per capita income of China in the estimation of the vertical intra-industry trade model. After testing the fitting of these independent variables, we find that they are not significant in the regressive model, which of details will be explained in the next part. In line with comparative advantage, different countries should product different products that a country has enough factors for to compare with each other. With the development of factor endowment, it explains deeply the reason why the bilateral international trade happens. However, for the intra-industry theories, there are demand preference, differentiated production, economic scale and so forth. Hence, the demand for variety is core conception.

5.1.3 Model of Horizontal Intra-Industry Trade

According to the theoretical foundation of horizontal IIT model, we put forward a series of independent variables into HIIT model.

On finding the determinants of China's intra-industry trade, we will estimate the following models:

$$\text{HIIT}_{it} = \beta_0 + \beta_1 \text{LOG}(\text{MNE}_{it}) + \beta_2 \text{LOG}(\text{DGDP}_{it}) + \beta_3 \text{DIMB}_{it} + \beta_4 \text{DPIN}_{it} + \beta_5 \text{MR1}_{it} \\ + \beta_6 \text{EXCH}_{it} + \beta_7 \text{OPEN}_{it} + \beta_8 \text{DIST}_{it} + \varepsilon_{it}$$

$$\text{HIIT}_{it} = 1 - \frac{|\sum_{i=1}^n \Delta X_{it} - \sum_{i=1}^n \Delta M_{it}|}{\sum_{i=1}^n |\Delta X_{it}| + \sum_{i=1}^n |\Delta M_{it}|}$$

$$\frac{\text{exportUV}_i}{\text{importUV}_i} \geq 1 + a$$

$$\frac{\text{exportUV}_i}{\text{importUV}_i} < 1 - a$$

Where HIIT= Horizontal Intra-Industry Trade

MNE= Amount of Multi-national Enterprise of Major Trader in China

DGDP = Difference of GDP between China and Major Trader

$$= 1 + \frac{[w \ln(w) + (1 - w) \ln(1 - w)]}{\ln 2}$$

$$w = \text{GDP}_a / (\text{GDP}_a + \text{GDP}_b)$$

DPIN =Difference of Per Capital Income between China and Major Trader

DIMB = Balance of Payment between China and Major Trader

EXCH = Exchange Rate between China and Major Trader

MR1 = Share of Trading Value of Primary Products in Total Trade

OPEN = Open Degree of Trade

$$= (X_{it} + M_{it}) / \text{GDP}_{it}$$

DIST = Geographical Distance between China and Major Trader.

In the horizontal IIT model, we chose MR1 that is more related with horizontal IIT that represents different characteristics within one or same industry, in two-way trade. The most of products in primary industry focus on the definition of horizontal IIT, such as natural resources. And there is one independent variable as geographic distance to be different with vertical IIT and total IIT model. And the some signs of the expectation for the horizontal IIT model are also different to compare with the total and vertical intra-industry trade models. And it is most obvious difference of independent variable that the MNE and FDI have an effect on horizontal IIT and Vertical IIT respectively. In detail, the multi-national enterprise is more significant for horizontal IIT. Because, the multi-national enterprise reflects the varieties of differentiated product in two-way trade and more varieties of two-way trade in one industry means more horizontal IIT. In contrast, the FDI implies the amount of capital flows between two countries. In line with IIT theory, the relative abundant capital-endowment country would like to produce high-quality differentiated product and the relative shortage of capital endowment country would like to produce low-quality differentiated product. Hence the more capital flow may make different to the capital endowment distribution between two countries and has an effect on the number of differentiated product with different qualities in one industry. Besides, we will give an expectation sign for the relation between total, vertical, horizontal IIT and independent variables, in line with the previous literatures. And the data of all variables in the horizontal IIT model comes from the OECD database, the World Bank database, the China Statistics Yearbook, the China Foreign Economic Statistical Yearbook, the China Trade and External Economic Statistical Yearbook and the China Foreign Merchant Investment Report.

5.2 Explanation of Determinants of Total, Vertical and Horizontal IIT Models

According to the construction of total IIT model, we will expect the effect of all independent variables to total IIT index and explain the reason via IIT theories. Meanwhile, these theories also could be hypothesis for the estimation of the total IIT model in the next chapter.

Table 13: Description of Independent Variables in Total IIT Model

Dependent Variable [↵]	Independent Variable [↵]	Sign [↵]	Explanation [↵]
TIIT [↵]	FDI [↵]	+ [↵]	Vernon's production life cycle theory implies that FDI combine their superior technology with local endowments to produce goods that are subsequently shipped back to the home country. [↵]
		- [↵]	However, if FDI is a market-oriented nature, then FDI may substitute for the import of the goods that were previously produced in the investing firms' home countries, since the market extension of host country. [↵]
	DGDP [↵]	- [↵]	Helpman and Krugman (1985) say that a negative relationship between DGDP and both TIIT and HIIT. A positive relationship is with VIIT. So that is the added value of VIIT is greater than decreased value of HIIT. [↵]
	DPIN [↵]	- [↵]	Linder (1961) reflects similar consumer tastes in two countries will create wider markets for the exchange of differentiated products. And less of DPIN represents similar consumer tastes. So it has a negative effect on TIIT. [↵]
	DIMB [↵]	- [↵]	Grubel and Lloyd (1975), the size of any trade imbalance may reduce the value of two-way trade (TIIT). [↵]
	MR2 [↵]	+ [↵]	The share of VIIT is greater than the share of HIIT, since the share of trading value of manufacturing products in total trade is related with VIIT more than HIIT. [↵]
		- [↵]	The share of HIIT is greater than the share of VIIT, since the HIIT is affected more by the share of trading value of manufacturing products in total trade. [↵]
	EXCH [↵]	+ [↵]	By the theories, the impact of EXCH is not clearly. But depreciation can make export more and import less. So a positive relationship implies that a weakening currency will encourage two-way trade. [↵]
	OPEN [↵]	+ [↵]	Greenaway (1989) think that reduced barriers to trade will affect the opportunities for inter and TIIT, but there is considerable opinion that TIIT will be positively related to a lowering of protection levels. [↵]
	DIST [↵]	- [↵]	As Balassa and Bauwens (1987) explain, long distance will increase information cost, and the transaction costs of VIIT will increase quicker than that of inter-industry trade when the distance between a pair of countries increases. In addition, geographic distance acts as a natural trade barrier and neighboring countries are more similar than distant countries. [↵]

From the construction of vertical IIT model, we will put forward expected sign for all independent variables to vertical IIT index and give explanation through IIT theories. Meanwhile, these theories also could be hypothesis for the estimation of the vertical IIT model in the regression of panel data.

Table 14: Description of Independent Variables in vertical IIT Model

Dependent Variable [↗]	Independent Variable [↗]	Sign [↗]	Explanation [↗]
	FDI [↗]	+ [↗]	Based on Vernon's production life cycle theory, FDI is positively associated with VIIT. Those foreign firms combine their superior technology with local endowments to produce goods that are subsequently shipped back to the home country. [↗]
		- [↗]	However, if FDI is a market-oriented nature, then FDI may substitute for the import of the goods that were previously produced in the investing firms' home countries, since the market extension of host country. [↗]
	DGDP [↗]	+ [↗]	Following the CHOS theory, the models show VIIT takes place between countries with difference of GDP and factor endowment, since the relatively capita-abundant countries specialize in and export high-quality products, whereas the relatively labor-abundant countries focus on and export the production of low quality product. [↗]
VIIT [↗]	DPIN [↗]	+ [↗]	The more difference of per capita income, the less similar consumer preference. Helpman (1987) explains that the greater the opportunity for vertical differentiated disintegration of the production process. [↗]
	DIMB [↗]	- [↗]	Grubel and Lloyd (1975), the size of any trade imbalance may reduce the value of two-way VIIT. [↗]
	MR2 [↗]	+ [↗]	In general, manufacturing products are associated with high degrees of vertical differentiated production than are primary products, since the high processing trade. So high VIIT will emerge when the share of manufacturing products of trading partner in total trade is high enough. [↗]
	EXCH [↗]	+ [↗]	Depreciation can make export more and import less. So a positive relationship implies that a weakening currency will encourage two-way trade of VIIT. [↗]
	OPEN [↗]	+ [↗]	Generally speaking, trade barriers tend to be low, so the share of manufacturing products of trading partners in total trade is larger. And the VIIT will be getting higher. [↗]
	DIST [↗]	- [↗]	As Balassa and Bauwens (1987) explain, long distance will increase information cost, and the transaction costs of VIIT will increase quicker than that of inter-industry trade when the distance between a pair of countries increases. In addition, geographic distance acts as a natural trade barrier and neighboring countries are more similar than distant countries. [↗]

As illustrated at following table, the expectation of independent variables of horizontal IIT model to the horizontal IIT index indicated the hypothesis of its model.

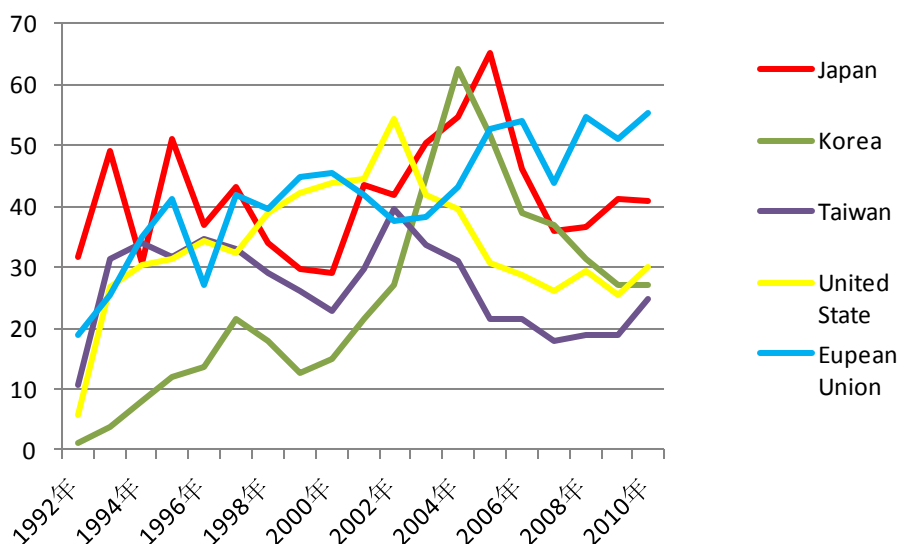
Table 15: Description of Independent Variables in HIIT Model

Dependent Variable [↵]	Independent Variable [↵]	Sign [↵]	Explanation [↵]
HIIT [↵]	MNE [↵]	+ [↵]	The relationship between MNE and HIIT also depends upon the motivation of multinational enterprises (MNEs). And the more MNEs produce horizontally differentiated products in China and substitute for the import of the products that are previously produced in the MNEs' home countries, the higher HIIT is. [↵]
		- [↵]	The more MNEs produce horizontally differentiated products in China and ship them back to MNEs' home countries, the lower HIIT is. [↵]
	DGDP [↵]	- [↵]	In Berstrand approach (1990), the less is difference of GDP, the relative factor endowments of both trade partners becomes more similar. So the more similar countries, the greater the share of HIIT will be driven by scale economics and production differentiation. [↵]
	DPIN [↵]	- [↵]	Linder's theory (1961) can explain they can produce more horizontal differentiated products (HIIT) that can simultaneously serve consumers in both countries with economic scale effect, when the two countries are less in difference of income level and consumer preference set. [↵]
	DIMB [↵]	- [↵]	Grubel and Lloyd (1975), the size of any trade imbalance may reduce the value of HIIT. [↵]
	MR1 [↵]	+ [↵]	In general, primary products are associated with high degrees of horizontal differentiated production than are primary products. So high HIIT will emerge when the share of primary products of trading partner in total trade is high enough. [↵]
	EXCH [↵]	+ [↵]	Depreciation can make export more and import less. So a positive relationship implies that a weakening currency will encourage two-way trade of HIIT. [↵]
		- [↵]	Appreciation will make export less and import more, so a negative relationship reflects that a weakening currency will discourage two-way trade of HIIT. [↵]
	OPEN [↵]	+ [↵]	Trade barriers tend to be low, so the share of primary products of trading partners in total trade is larger. And The HIIT will be getting higher. [↵]
		- [↵]	The higher tariff drives the more FDI to flow into host countries. The less HIIT is associated with the more FDI that may substitute for the import of the products from the investors' home countries. [↵]
DIST [↵]	- [↵]	As Balassa and Bauwens (1987) explain, long distance will increase information cost, and the transaction costs of VIIT will increase quicker than that of inter-industry trade when the distance between a pair of countries increases. In addition, geographic distance acts as a natural trade barrier and neighboring countries are more similar than far country. [↵]	

And the data of all variables in the total, vertical and horizontal IIT model comes from the OECD database, the World Bank database, the China Statistics Yearbook, the China Foreign Economic Statistical Yearbook, the China Trade and External Economic Statistical Yearbook and the China Foreign Merchant Investment Report.

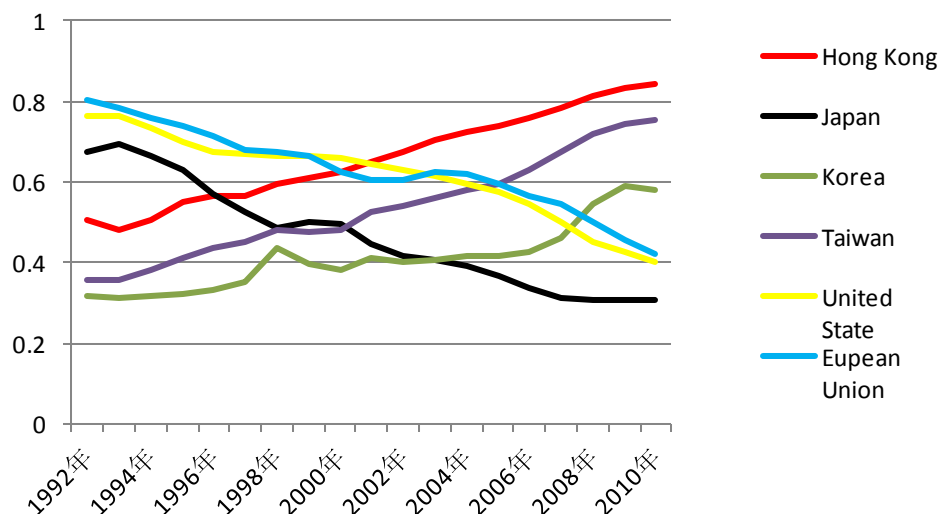
According to Vernon's (1966) theory, it suggested that foreign direct investment is related with total IIT, vertical IIT models as well as horizontal IIT. But in this thesis, we introduce number of multi-national enterprises instead of FDI. According to IIT theory, the multi-national enterprises provide direct capital and high production or management technology into other countries especially in developing countries and regions. After that, they delivery back these products that produced in foreign country to home country. Hence, in China, foreign investor also introduce their capital into China market to get higher benefit (wider market), economic scale effect, and low cost of production, Like Hong Kong that was and still be biggest investor and FDI flows in China.

Figure 2: FDI of Chinese Trade Partners in China



Note: Calculated by the author based on the data from China Foreign Economic Statistical Yearbook, China Trade and External Economic Statistical Yearbook.

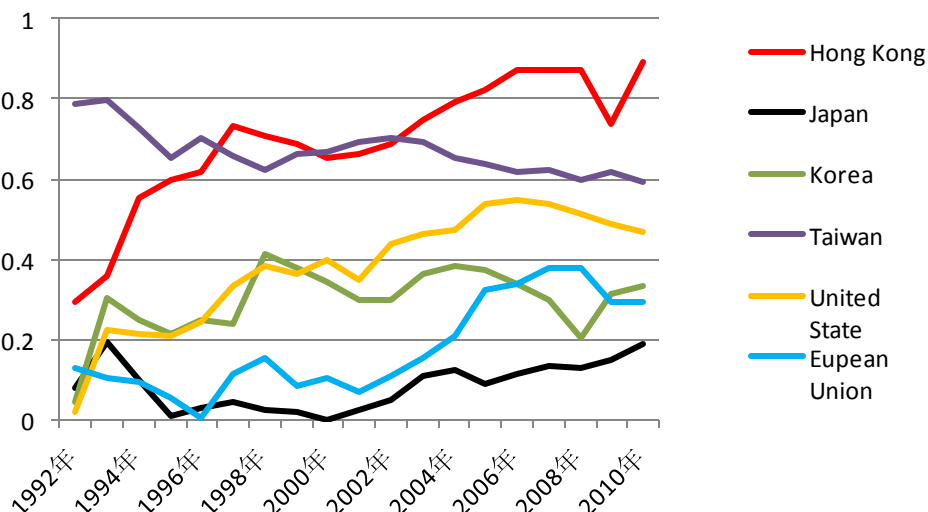
Figure 3: Difference of GDP between China and Its Major Trade Partners



Note: Calculated by the author based on the data from China Foreign Economic Statistical Yearbook, China Trade and External Economic Statistical Yearbook.

As illustrated at figure 3, there is a fluctuation about DGDP between China and her major trading partners. In addition, Helpman and Krugman (1985) expected the economic size and factor-endowment of country will has a negative effect on the two-way trade including vertical and horizontal IIT.

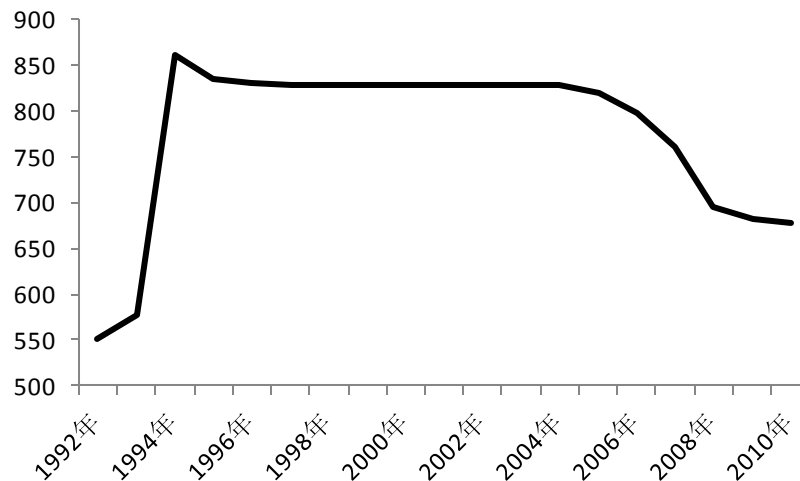
Figure 4: Trade Imbalance between China and Its Major Trade Partners



According to figure 4, the difference of trade imbalance between China and most major trade partners has a fluctuation during 1990s and 2000s. In particular, There is a

dramatically increase that happens in HK, Taiwan and Korea, and for Japan, US and EU, they go down significantly during 2000s.

Figure 5: Exchange Rate between CNY and USD

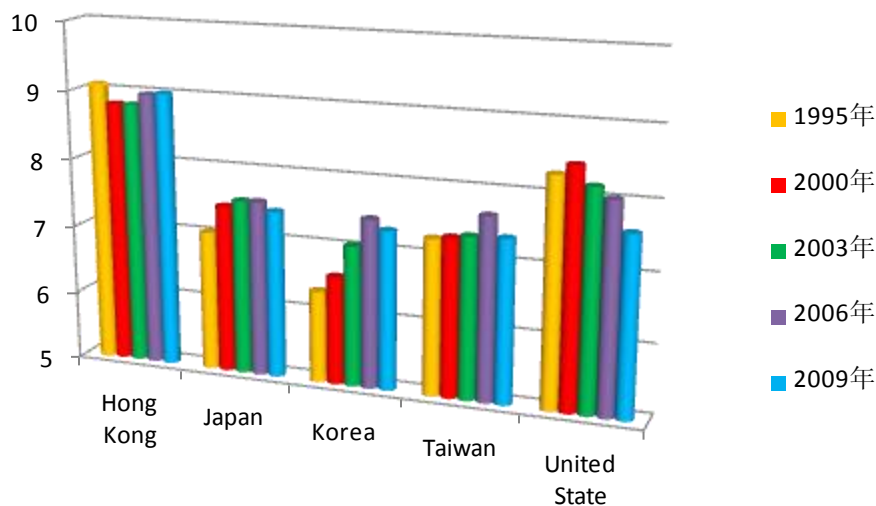


Source: Collected by the author based on the data from China Foreign Economic Statistical Yearbook, China Trade and External Economic Statistical Yearbook.

Based on intra-industry trade theories, the power of any influence of EXCH variable changes on total, vertical and horizontal IIT is not clear. Although appreciation or depreciation is expected to reduce export competitive, import also can be decrease. The Chinese bilateral EXCH with principal trade partners is introduced to make difference of trade payment balance. A decrease in EXCH variable indicated an appreciation. Therefore, a weakening currency is associated positively with the bilateral trade, but VIIT and HIIT. As illustrated in figure 5, the value of bilateral exchange rate of China has remained same before 2004. But after that it goes down gradually from 8.0 to 6.5 approximately with the flexible exchange rate policy. And in our estimation, we would expect all values of the bilateral trade to positively relate with the exchange rate variable. That is, the signs of coefficients for the IIV, VIIT and HIIT variables will be positive. We know that the more open is economy, the greater is trade value.

Although reduced trade open degree will impact on trade patterns, there is obvious option that intra-industry trade will be positively relationship with open market or free trade.

Figure 6: Free Degree of Trade in Chinese Major Trade Partners



Source: Collected by the author based on the data from OECD database

According to the figure 6, there is a downward trend of trade open degree with the 2007 economic crisis in Chinese major trade partners except form Hong Kong. However, before that, all of them have an increase in the free degree of trade from 1995. Following Stone and Lee (1995), we expect that trade free degree index as the residuals from a regression which will be positively related to IIT, VIIT and HIIT.

In addition, the definition of primary product (MR1) is a natural resource or a simple process product, which often used in other products, for example, wood, milk, or fish. However, the notion of manufactured product (MR2) is goods made by machinery in large quantities. Manufactured goods are made from primary product such as oil, steel, textiles and baked goods. Both the MR1 and MR2 have a negative and positive effect on the VIIT, respectively. And the MR1 impacts negatively on HIIT. Besides, for the amount of multi-national enterprises (MNE), it has a positive effect on the TIIT, VIIT and HIIT.

CHAPTER VI

ESTIMATION RESULTS

In this chapter, we will estimate the total, vertical and horizontal IIT models that are constructed in last chapter. And the methodology of regression will be panel data (pool time series and cross-section data) by least square technology for each industries in seven countries and regions. Before estimation, it is necessary to test correlation against multi-collinear problem, in addition heteroscedasticity and auto-regression problem also happen easily in panel data regression. And construction of the total, vertical and horizontal models is depending on the IIT theories or previous literatures and empirical evidences, while a case of China with her major trading partners may cause some independent variables no significant. Hence, the adjustment for the total, vertical and horizontal models will be done to analyze the two-way trade between China and her major trading partners precisely. After that, it needs to make an analysis for the result what the effect of independent variables to Chinese bilateral intra-industry trade, depending on the particular economic environment.

6.1 Analysis on the Result of Total Intra-Industry Trade Model

In this section, the dependent variable TIIT in the model, measured at the 3-digit HS level, is calculated by import and export data of individual industries. And the intra-industry trade model will be estimated by the panel data as the following formula:

$$\begin{aligned} \text{TIIT}_{it} = & \beta_0 + \beta_1 \text{LOG}(\text{FDI}_{it-1}) + \beta_2 \text{LOG}(\text{DGDP}_{it}) + \beta_3 \text{DPIN}_{it} + \beta_4 \text{DIMB}_{it} + \beta_5 \text{MR2}_{it} \\ & + \beta_6 \text{EXCH}_{it} + \beta_7 \text{OPEN}_{it} + \beta_8 \text{DIST}_{it} + \varepsilon_{it} \end{aligned}$$

$$\text{TIIT}_{it} = 1 - \frac{|\sum_{i=1}^n \Delta X_{it} - \sum_{i=1}^n \Delta M_{it}|}{\sum_{i=1}^n |\Delta X_{it}| + \sum_{i=1}^n |\Delta M_{it}|}$$

In this thesis, we will analyze the nature of three forms of intra-industry trade between China and 6 trade partners during the 1992-2010 period, when China has accelerated the implementation of policies to liberalize international trade and attract investment. And we know that the interior of China and Hong Kong are always primary trade partners each other. According to their different trading characteristics and developing tendency, it presents that improving the bilateral trade to higher level and bigger scale will be significant to them. However, for empirical analysis from 1992 to 2010, the speed of development of the intra-industry trade between interior of China and Hong Kong decrease generally compared with other primary trading partners and has been a low level. From the structure of IIT of them, it focus on vertical IIT and horizontal IIT and meanwhile it reflects that it is a low level to the international division in the domestic of China. My empirical analysis separates intra-industry trade to horizontal IIT and vertical IIT to be better for test the bilateral intra-industry trade. From 1997 to 2002, the index of IIT of Hong Kong and China increased from 27% to 34% but after that it started a downward tendency from 25% to 8%.

Table 16: Total Intra-Industry Trade Index of China

TIIT Unit %	H.K.	Japan	Korea	Taiwan	U.S.	E.U.
1992	52%	18%			31%	27%
1993	51%	22%	70%	20%	37%	35%
1994	40%	26%	75%	27%	35%	36%
1995	36%	35%	79%	35%	37%	41%
1996	38%	36%	75%	30%	38%	46%
1997	27%	41%	76%	34%	40%	52%
1998	29%	41%	59%	38%	41%	55%
1999	31%	39%	62%	34%	44%	59%
2000	34%	40%	65%	33%	43%	65%
2001	33%	43%	59%	28%	46%	63%
2002	31%	45%	55%	27%	39%	62%
2003	25%	46%	50%	29%	34%	62%
2004	21%	48%	52%	33%	35%	63%
2005	17%	52%	53%	34%	33%	56%
2006	13%	52%	53%	37%	33%	54%
2007	13%	53%	53%	36%	33%	50%
2008	12%	56%	58%	38%	35%	51%
2009	9%	51%	69%	36%	34%	53%
2010	8%	53%	66%	39%	35%	51%

Note: Calculated by the author based on the data from China Foreign Economic Statistical Yearbook, China Trade and External Economic Statistical Yearbook.

According to table 17 and 18, the index of vertical IIT is always bigger than that of horizontal IIT between China and her major trading partners. Generally speaking, index of intra-industry trade more than 50% means a strong IIT, but it is less than 50% that means a low IIT.

The total IIT between China and Hong Kong has a dramatically decrease from 51% to 40%, from 1993 to 1994, for problem with return of Hong Kong to China. And the 1997 and 2007 economic crisis also made a fluctuation for IIT between China and her major trading partners. In details, IIT index between Hong Kong, Taiwan, US and EU had an increase after 1997. And IIT index between China and her major trading partners except for Hong Kong also had an increase after 2007. And in 2002, China's accession to

WTO played an significant role on growth of IIT index between China and her trading partners except for Hong Kong.

Firstly, the index of IIT between China and Hong Kong reflects that the capital accumulation, technology level, management ability and human resource limit their growth of bilateral IIT for the low level of international division in China. Secondly, for the tendency of IIT, China and Hong Kong has a downward tend from 2003 to 2010 and it has an obvious decrease at last decade. Generally speaking, the small difference of factor endowment and technology development level lead to increase in IIT index.

Table 17: Determinants of Total Intra-Industry Trade Using Panel Date

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.493454	0.136642	3.611278	0.0007
LOG(FDI(-1))	-0.075116	0.010573	-7.104746	0.0000
DGDP	-0.200218	0.066848	-2.995155	0.0044
DPIN	-0.513616	0.119437	-4.300290	0.0001
DIMB	-0.444254	0.029882	-14.86656	0.0000
MR2	0.408443	0.074787	5.461463	0.0000
EXCH	0.023250	0.009148	2.541602	0.0144
OPEN	0.076281	0.002069	3.686732	0.0006
Statistics				
R-squared	0.854112	Mean dependent var	16.52659	
Adjusted R-squared	0.847277	S.D. dependent var	12.96129	
S.E. of regression	1.004293	Sum squared resid	47.40444	
F-statistic	139.6032	Durbin-Watson stat	1.964403	
Prob(F-statistic)	0.000000			

Notes: we choose the significance at the 5% level. All variables except for FDI are not in logarithms. Besides, the variable FDI is used at time t-1.

The FDI has a negative effect on total IIT because FDI substitutes for the import of the goods that were previously produced in the investing firms' home countries. And the DGDP, DPIN and DIMB also has a negative on total IIT because more difference between bilateral trading partners like factor endowment and consumer preference less

total IIT index. And the OPEN, EXCH and MR2 have a positive effect on total IIT that is same with our expectation.

Conversely, the inter-industry trade occupies a commanding position. For the decrease of IIT of China and Hong Kong, it reflects that the gap of factor endowment and technology development is wider than before 1997. And because Hong Kong returns to China in 1997, which causes Hong Kong's direct investment (a amount of capital) to inflow into domestic of China. And Hong Kong brings 13.9617 billion dollar into the interior of China and commands the biggest investment position in China. And Hong Kong's investment in China trends to capital intensive and technology intensive industries, so the intra-industry trade becomes smaller and smaller depending on the traditional factor endowment difference theory.

Meanwhile, after 2003 CEPA was implemented to decrease cost of trading each other. So, it create more trading values and leads a lot of trade creation and trade diversion that is the most import reason for the development of inter-industry trade and total trade values. According to the argument before, we think that the inter-industry trade is most part between interior of China and Hong Kong and the intra-industry trade still stays a low level in recent decade. But the values of total bilateral trade and index of inter-industry trade increasing reflects that the international division generally develops and separates to research and production division, and vertical division transfers to horizontal division. It forms a division system of horizontal labor division and vertical labor division to coexist.

However, in the IIT, the vertical IIT takes the central stage that exists wide gap of technology and management of corporations between the China and Hong Kong, as illustrated at section 6.2, so China must encourage research innovation and application,

and improves the quality of production and additional value of products, meanwhile the rational adjustment to attract foreign capital, improvement of investment environment and introduction foreign investor investing in technology intensive industries and high connected industries. Last, they should take advantage of CEPA depending on market leading and perfect legal insurance to promote more scale and level of the bilateral IIT and inter-industry trade development.

6.2 Analysis on the Result of Vertical Intra-Industry Trade Model

In second section, the dependent variable vertical IIT in the model, measured at the 3-digit HS level, is measured by export and import value of individual industries. And the vertical IIT model will be estimated by the panel data as the following formula:

$$VIIT_{it} = \beta_0 + \beta_1 \text{LOG}(\text{FDI}_{it-1}) + \beta_2 \text{LOG}(\text{DGDP}_{it}) + \beta_3 \text{DIMB}_{it} + \beta_4 \text{DPIN}_{it} + \beta_5 \text{MR2}_{it} \\ + \beta_6 \text{EXCH}_{it} + \beta_7 \text{OPEN}_{it} + \beta_8 \text{DIST}_{it} + \varepsilon_{it}$$

$$VIIT_{it} = 1 - \frac{|\sum_{i=1}^n \Delta X_{it} - \sum_{i=1}^n \Delta M_{it}|}{\sum_{i=1}^n |\Delta X_{it}| + \sum_{i=1}^n |\Delta M_{it}|}$$

$$1 - a \leq \frac{\text{exportUV}_i}{\text{importUV}_i} \leq 1 + a$$

Since 1990, the development of economic globalization and integration of regional economics has brought much more opportunities and challenges for Chinese bilateral trading with Japan. In line with the determinants of total IIT, vertical IIT and horizontal IIT, it analyzes the characteristics and trading divisions.

First, the total and vertical IIT has an obvious negative effect on PIN between China and Japan that reflects that the wider gap of PIN between Sino-Japan will limit the development of the total and vertical IIT. According to the 2006 statistics of World Bank, the difference of per capita income between Sino-Japan increased from 26,640 in 1990 to 41,230 dollar in 1996, while it decreased to 32,810 dollar in 2005. That is to say, the improvement of people's live standard has a positive effect on total and vertical IIT development. Second, for Chinese the total and vertical IIT with Japan has an impact on economic scale effect but not obviously.

Table 18: Vertical Intra-Industry Trade Index of China

TIIT Unit %	H.K.	Japan	Korea	Taiwan	U.S.	E.U.
1992	33%	12%			21%	14%
1993	32%	15%	47%	14%	22%	13%
1994	27%	17%	51%	19%	22%	22%
1995	24%	22%	54%	24%	23%	26%
1996	25%	23%	51%	20%	22%	21%
1997	18%	26%	52%	23%	19%	27%
1998	20%	28%	40%	26%	26%	30%
1999	21%	26%	42%	23%	20%	38%
2000	22%	26%	45%	22%	26%	18%
2001	22%	28%	40%	19%	30%	34%
2002	21%	30%	37%	18%	26%	41%
2003	17%	31%	34%	20%	23%	31%
2004	14%	32%	36%	22%	23%	32%
2005	12%	35%	36%	23%	20%	36%
2006	9%	35%	36%	25%	20%	34%
2007	9%	35%	36%	24%	20%	32%
2008	8%	36%	39%	26%	21%	32%
2009	6%	34%	47%	25%	19%	36%
2010	5%	35%	45%	26%	20%	32%

Note: Calculated by the author based on the data from China Foreign Economic Statistical Yearbook, China Trade and External Economic Statistical Yearbook.

It means that the reason of creation of the Chinese bilateral intra-industry trading with Japan is almost related with the economic scale effect but the difference of economic development level and factor endowment in two countries, which are comparative advantages. Because, after 1990 Chinese economic scale has an improvement generally, but the effect also is litter. So, we can say that the Chinese economic development has an unobvious effect on bilateral intra-industry trading with Japan. Third, Chinese total and vertical IIT also has a negative relationship with foreign direct investment from Japan. That means foreign direct investment improves the trade values special for inter and intra-industry trade. Because, the domestic demand difference between China and Japan, the

most products from Japan direct investment in China almost sale in domestic of China not export to Japan.

Meanwhile, with the low speed of economic development in Japan, the domestic demand of Japan has decreased generally since economic crisis in 1997 and 2007. Lastly, the Chinese intra-industry trade and vertical intra-industry trade with Japan, is positively related with the degree of Chinese free trade to Japan. Because, the higher degree of Chinese trade freedom provide more conveniences to bilateral trade with Japanese international trade and decreases the trade barriers. So, we can explain why the economic crisis will affect the intra-industry trade.

Table 19: Determinants of Vertical Intra-Industry Trade Using Panel Date

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.168825	0.156908	1.075949	0.0881
LOG(FDI(-1))	-0.070615	0.012118	-5.827274	0.0000
DGDP	0.291773	0.070467	-4.140582	0.0002
DPIN	0.806153	0.100323	-8.035577	0.0000
DIMB	-0.324935	0.038533	-8.432685	0.0000
MR2	0.214568	0.067754	-3.166881	0.0029
EXCH	0.000487	0.000113	4.321997	0.0001
OPEN	0.122810	0.026800	4.582529	0.0000
Weighted Statistics				
R-squared	0.896083	Mean dependent var	11.85389	
Adjusted R-squared	0.878764	S.D. dependent var	7.675570	
S.E. of regression	0.989160	Sum squared resid	41.09434	
F-statistic	51.73862	Durbin-Watson stat	1.974187	
Prob(F-statistic)	0.000000			

Notes: we choose the significance at the 5% level. All variables except for FDI are not in logarithms. Besides, the variable FDI is used at time t-1.

The FDI and DIMB have a negative effect on vertical IIT. The reason of effect of FDI and DIMB to vertical IIT is same with that of effect to total IIT. The rest of independent variables have a positive effect on vertical IIT because the definition of vertical IIT is different quality products within one industry. And MR2 and DGDP take a

central stage on effect of independent variables on vertical IIT, since China's industry structure that manufactured industry occupied most and rapid output growth in recent decade.

The free trade policy and economic environment will promote the international trade including the bilateral intra-industry trade.

In recent years, it takes central stage in Chinese bilateral trade with Japan that China primarily exports the low quality products and imports high quality products from Japan. However, the structure of trade adjusts the industrial and consumption structure that expands the difference of technology each other. So, in the long run, it is not in favor of development and growth of industries. But, the similar quality can promote that Chinese corporations learn the advanced technologies from Japan like technology spillover and add product values and international competition abilities to product high quality commodities to export. First, related policy to promote industrial development can improve the effect of economic scales. Second, the technology innovation strategy can raise the technology level and additional value for the products importing from Japan. Third, Chinese corporations must encourage differentiated commodities to product and be aware of importance of national brand creation. Fourth, we should take advantage of foreign direct investment to promote Chinese industrial structure. Last, it is win-win strategy to extent the cooperation and communication at more areas and eliminate trade barriers each other.

With global multilateral trade slowing down, FTA is beginning to develop in the world. China and South Korea hope highly building bilateral cooperation and free trade area specially being after economic crisis 2007.

6.3 Analysis on the Result of Horizontal Intra-Industry Trade Model

In third section, the dependent variable VIIT in the model, measured at the 3-digit HS level, is measured by export and import value of all industries. And the horizontal IIT model will be estimated by the panel data as the following formula:

$$\text{HIIT}_{it} = \beta_0 + \beta_1 \text{LOG}(\text{MNE}_{it}) + \beta_2 \text{LOG}(\text{DGDP}_{it}) + \beta_3 \text{DIMB}_{it} + \beta_4 \text{DPIN}_{it} + \beta_5 \text{MR1}_{it} \\ + \beta_6 \text{EXCH}_{it} + \beta_7 \text{OPEN}_{it} + \beta_8 \text{DIST}_{it} + \varepsilon_{it}$$

$$\text{HIIT}_{it} = 1 - \frac{|\sum_{i=1}^n \Delta X_{it} - \sum_{i=1}^n \Delta M_{it}|}{\sum_{i=1}^n |\Delta X_{it}| + \sum_{i=1}^n |\Delta M_{it}|}$$

$$\frac{\text{exportUV}_i}{\text{importUV}_i} \geq 1 + a$$

$$\frac{\text{exportUV}_i}{\text{importUV}_i} < 1 - a$$

As illustrated at following table, it shows the horizontal IIT index of China with her major trading partners. Us, Japan, Korea and Taiwan have an increase in horizontal IIT trade with China. In contrast, for Hong Kong and EU, their index has a decrease with China. In particular, Hong Kong has a fluctuation obviously from 1993 and 1994. Because, at that time, governor of HK went against HK back China. Hence, the relationship between interior of China and HK changed to bad that influenced the bilateral trade. But the situation went well quickly when HK came back to China in 1997. After that, there is a growth for horizontal IIT between interior of China and HK. And for the EU, China joined to WTO in 2002. Therefore, there is obvious development for the horizontal IIT between EU and China. Meanwhile, the FDI from EU also increased dramatically from 2002 that is the reason why the index goes up. And for the japan, we can find that the index begins to go down from 2008. Japan starts to invest more in the ASEAN countries, and the domestic market of China become wider and wider.

Meanwhile, the domestic demand of Japan begins to decrease gradually since the economic and political problems.

Table 20: Horizontal Intra-Industry Trade Index of China

TIIT Unit %	H.K.	Japan	Korea	Taiwan	U.S.	E.U.
1992	19%	6%			10%	13%
1993	19%	7%	23%	6%	15%	22%
1994	13%	9%	24%	8%	13%	14%
1995	12%	13%	25%	11%	14%	15%
1996	13%	13%	24%	10%	16%	25%
1997	9%	15%	24%	11%	21%	25%
1998	9%	13%	19%	12%	15%	25%
1999	10%	13%	20%	11%	24%	21%
2000	12%	14%	20%	11%	17%	22%
2001	11%	15%	19%	9%	16%	29%
2002	10%	15%	18%	9%	13%	21%
2003	8%	15%	16%	9%	11%	31%
2004	7%	16%	16%	11%	12%	31%
2005	5%	17%	17%	11%	13%	20%
2006	4%	17%	17%	12%	13%	20%
2007	4%	18%	17%	12%	13%	18%
2008	4%	20%	19%	12%	14%	19%
2009	3%	17%	22%	11%	15%	17%
2010	3%	18%	21%	13%	15%	19%

Note: Calculated by the author based on the data from China Foreign Economic Statistical Yearbook, China Trade and External Economic Statistical Yearbook.

For the Korea and Taiwan, they take advantage of their technology and geographic condition with China. The index of horizontal IIT increase from 2002 when China joined into WTO. In addition, the domestic demand of China become huge and the China's labor resources, production improvement to make the two-way trade growth gradually. Especially after 2007 the economic crisis, the economic integration is also developed that the open degree in area trade goes well. No matter the trade volume, the IIT also has an obvious development between China and these trading partners. At next, we will analyze the determinant of the horizontal IIT model. And by the empirical evidence, it finds out what the effect of the independent variables to the horizontal IIT index between China

and her trading partners. Meanwhile, test whether the expected sign match with the result of estimation.

Table 21: Determinants of Horizontal Intra-Industry Trade Using Panel Date

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.454362	0.011440	-3.971764	0.0002
LOG(MNE)	0.125634	0.000476	26.37447	0.0000
DGDP	-0.080653	0.002804	2.876614	0.0060
DPIN	-0.194836	0.008007	-2.433316	0.0187
DIMB	-0.057482	0.001581	-3.636429	0.0007
DIST	-0.024983	0.000652	-3.830545	0.0004
MR1	0.374437	0.053505	-6.998203	0.0000
EXCH	0.000048	0.000002	18.56849	0.0000
OPEN	0.0173382	0.000520	-33.36429	0.0000
Weighted Statistics				
R-squared	0.937401	Mean dependent var	1.303017	
Adjusted R-squared	0.926967	S.D. dependent var	3.955946	
S.E. of regression	0.811720	Sum squared resid	31.62666	
F-statistic	89.84746	Durbin-Watson stat	2.081572	
Prob(F-statistic)	0.000000			

Notes: we choose the significance at the 5% level. All variables except for FDI are not in logarithms. Besides, the variable FDI is used at time t-1.

We can find the result of estimation that all independent variables match with the expected sign through the theoretical foundation of the construction of horizontal IIT model. The multi national enterprises have a positive effect on the horizontal IIT index. And the DPIN, DGDP, DIMB, and DIST have a negative effect on the horizontal IIT index. In addition, for EXCH and Open, they influence positively on horizontal IIT index. And the effect of MR1 is most significant for the horizontal IIT index. That is, it plays most important role in growth of horizontal IIT index because the feature of products of primary industry within one industry is different characteristics and similar quality and most parts of horizontal IIT takes place in primary industry. And the effect of EXCH, DGDP and OPEN also is very small. But the result is related with the theoretical analysis

that the effect of them is not clear since both of them have an influence on the direction of export and import. For DGDP, it is not clear to represent the consumer consumption and preference, and the factor endowment between two countries and ignore China's huge number of labor capital. Even though the China's GDP grow fast, it is slow for growth of the per capita GDP so the influence is not too significant.

CHAPTER VII

CONCLUSION

According to the analysis of TIIT, VIIT and HIIT by G-L measurement, we find that the primary determinants: DGDP, FDI and DIMB have a significant negative effect on the TIIT by the panel data regression. And DGDP has a positive effect on TIIT and HIIT, while it has a negative effect on VIIT with different quality and technology. In particular, economic scale has a positive relationship with intra-industry trade in horizontal intra-industry trade. With transition of Chinese international trade, industrial structure, geographical distance, political and cultural factor has taken a prominent position in Chinese intra-industry trade.

Economic scale is the important determinant on total IIV. On the demand size, Chinese government should drive to improve people per capita income and encourage them to do consumption in differentiated commodities, which could help to wide market scale and potential. On the supply size, it must be implemented that industrial structure upgrading, rational merger and establishment of modern enterprise system to lead much more enterprises to focus on economic scale affect more. Meanwhile changing the super national tax treatment raises quality of foreign direct investment and the Chinese government should lead it into process of production to increase the additional production values and export ability, which adjusts the unfavorable position of China in international division. Thus, it could help it to develop the level of intra-industry trade. Besides, we find that the imbalance of international payment has a negative impact on Chinese intra-industry trade. Therefore, they must strength themselves in export abilities to make differences and rationalization for international market. Meanwhile, it should be

decreased in different tariffs and non-trade barriers to eliminate the imbalance of international payments in China.

Our examinations of the intra-industry trade models, suggests that the effect of FDI is relatively small. It implies that firms choose to become multi-national enterprises and exploit the factor price gap between the domestic and foreign countries. As a result, MNE's home country specializes more in the production of capital-intensive high-quality products because the MNE is capital abundant one and needs more low-cost labor capital, while the host country specializes more in the production of labor-intensive and low quality products. The difference of MNE and FDI variable is that MNE represents the number of multi-national firms and FDI represents the amount of capital. And the number of multi-enterprises reflects number of differentiated commodities. The amount of capital influences the factor-endowment among trading partners. Because, products in horizontal IIT has different characteristics and similar prices within one industry, while products in vertical IIT has different qualities and prices within one industry. So MNE variable has a more significant positive effect on HIIT, however, FDI variable has a more obvious negative effect on VIIT. Similarly, the lower the trade barrier level (OPEN variable), the more vertical IIT will occur between the home and the host countries. And the long geographic distance (DIST variable) as trade barrier also has a negative effect on horizontal IIT. Hence, the analysis reflects that lower costs of foreign direct investment and trade enable enterprises to benefit from the international vertical division of labor, resulting in an increase in vertical IIT. Lastly, the Chinese Government should take advantages of geographic distance (DIST variable), different factor-endowment and similar consumer preference (DGDP, DPIN) with Japan, Korean, Taiwan and Hong Kong to promote the total IIT. And with research the market each other, it will has a positive

impact to exploit market and deepen the communication and cooperation of policies and cultures.

7.1 Free and Protection Trade Policy Implication of China

In this section, we will talk about what China's government should do in international trade. In general, for the policy of free trade, developed countries trade each other that are foundation of free trade. And degree of free trade has a positive relation with international division. The degree of free trade is much higher; the international division is getting wider and deeper. Therefore, the intra-industry trade as a result of international division needs to more free trade policies to support it. Meanwhile, for the open market of developed countries, it comes true that economic scale effect, technology integration, optimized consumption and allocation of resources. That is an important force to drive free trade up after second war.

In addition to balanced distribution of benefit, free trade is a win-win strategy. And horizontal differentiated product takes a central stage on international trade among developed countries. In total, there is not obviously difference of factor ratio, technology level and additional value. And it is balanced distribution for benefit of IIT. Hence, developed countries can reach a consensus on division of intra-industry. On the other hand, for the similar factor endowment, production and consumption structure, IIT's allocation of resources takes a little bit of cost. So the domestic policy doesn't avoid supporting IIT. In one word, the distribution of benefit is balanced in developed countries; meanwhile the free trade improves the well being of total and individual that is good for the development of IIT. In contrast, it is not equally for trade that happens between developed and developing countries or regions, like China and her major trading partners. In particular, developed countries usually export technology intensive and high additional value consumable and capital product that has characteristics of high of income elasticity and wide market potential. However, China exports product with labor intensive and low

additional value that has low of elasticity of income and market potential. So developed countries always benefit from free trade but it is not for China. And China also need to take advantage of difference of technology with other developed countries that pay attention to develop own technology and industry. Meanwhile, it is necessary to get technology advantage at differentiated product and factor endowment when developed country starts to adjust its structure of industry, which promote the quality and quantity of IIT between China and her major trading partners.

Tariff and trade agreement and WTO protect for free trade, especially growth of intra-industry trade. And the degree of free trade among developed countries is higher than that among developing countries. Besides, the degree of free trade in manufactured product is higher than that in primary product. And the degree of free trade of product is higher than that of services. Therefore, it is necessary result that developed countries' IIT focuses on manufactured industry since international multi-trade system.

International Trade is not just on economy that free trade can help to come true for economic benefit as well as other benefits, such as development of wide and deep for division of intra-industry and trade. Meanwhile, China can learn a series of high technology industry to improve the economic power.

For the protection of free trade policy, there are two directions that one is passive protection trade policy; another one is active protection trade policy. The former one represents at the unbalanced intra-industry trade; the later one reflects extra benefit of intra-industry trade. And the market structure of IIT is imperfect competition that exists some extra benefits. Therefore, China can get the extra benefit through export tariff, subsidize and a serious of protection for infant industry. And it is also necessary to

upgrade the structure of industry of China that can promote horizontal and vertical IIT by a series of protection trade policy.

7.2 Intra-Industry Trade Policy Implication of China

In this section, we talk about what the IIT policy of China should be implemented. In monopoly market competition, differentiated product promotes the competition of international trade of developing countries. That is, diversification of varieties of product makes any country take advantage of their enough resources and they can export and import within one industry. Hence, these firms would like to produce more varieties of product by economic scale effect or low cost. In details, there are some suggest as following:

First, it needs to improve high-quality products that can promote development of horizontal IIT between China and developed countries or regions. For the major trading partners of China, most of them are western countries whose trade pattern focuses on IIT but its amount not huge. Because there is an obvious difference between China and developed countries, especially the division of intra-industry of China is at a low level. Therefore, developing R&D of product promote IIT with developed countries or regions, which plays a significant role at changing trade pattern of IIT between China and these developed countries.

Second, it need carry out brand strategy to improve differentiated product development. The brand strategy plays a important role in IIT by quality, characteristics, function and market positioning of product. More and more firms start to use their brand to show difference of product with that of other firms. Different brand reflects their difference at prices, marketing, technology as well as management. Therefore, brand

strategy can improve the level of IIT of China and implement the change from extensive export to intensive export, which is most important way to trade competition.

Third, it needs to accelerate technology in order to move away from the traditional labor-intensive that promotes development of IIT. China's relative advantage is labor-intensive. So we can upgrade the labor-intensive industry through high and new technology, which can reduce cost and improve difference of products to demand more individual consumption. Meanwhile, it can develop production technology and quality to produce diversified differentiated products by taking full use of high and new technology, in order to promote intra-industry trade.

Fourth, in marketing area, product should get the differentiated advantage at level, quality, style and color and so on. Meanwhile, advertisement, package as well as after-sale service can increase additional value of product. Each firm implements differentiation competition strategy in process of production and transportation activities, into marketing area, which is most important method to improve international competition capacity of multi-national enterprises.

Finally, upgrading structure of industry and developing economic scale of China. Pay attention to leading industry that creates competitive advantage of industry.

By the theories of IIT, we know that now matter what horizontal and vertical IIT investment in foreign countries, also are important source of IIT. And IIT is a trend for international trade that is necessary substitution for traditional inter-industry trade. For economic strength and comprehensive national power, China should accelerate IIT. IIT is beginning compared with traditional inter-industry trade but existence of IIT is a result of global economic integration that has great future.

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APPENDIX

Table 22: Trade Types by Stages of Production: World, 1995 and 2002

	1995				2002			
	OWT	TWTH	TWTV	TWT na	OWT	TWTH	TWTV	TWT na
Primary goods	87.1	5.7	6.8	0.4	86.5	6.2	6.4	0.9
Processed goods	64.7	15.3	18.9	1.1	64.1	13.7	20.7	1.5
Parts and components	43.1	14.9	33.7	8.2	40.1	14.5	36.7	8.7
Capital good	60.4	11.4	25.1	3.1	57.5	10.1	27.2	5.2
Consumption goods	68.8	12.0	17.7	1.4	67.1	12.5	18.5	2.0
Total	64.5	13.4	20.1	2.0	62.9	12.6	21.7	2.8

Table 22 explores the consequences of such distinction by relying on the all products. It shows the importance of trade types in world trade in 1995 and 2002. As can be expected, primary goods are mainly traded in a one-way manner: they are either exported or imported for about 65% of their world trade in value. In contrast, roughly one-third of world trade in consumption goods in two-way trade. The share of two-way trade is even higher for processed goods, capital goods and parts and components. In all stages of production, measured two-way trade is higher in vertically than in horizontally differentiated products. Two-way trade increased in all stages between 1995 and 2002.

We must finally address the sensitivity of the results to the degree of overlap in trade and on differences in unit

values chosen. One of the possibilities would have been to apply, for example, different similarity criteria for different product groups, but applying one and the same criteria to all products leads to more understandable results.

Table 23 shows the share of two-way trade flows according to the degree of overlap in trade, again calculated at most detailed level. It shows that the case of 64.5% or 62.9% in one-way trade has 15% or 10% overlap. And from Frontagne research, only 4% of all bilateral trade has an overlap of more than 90%, and about 17% have an overlap of 50% or more. About 60% of world trade has an overlap of less than 10%. So we have chosen 10% as the degree of overlap in our thesis.

Table 24 shows the sensitivity of the relative importance of horizontal two-way trade in total two-way trade to unit value differences. As expected, the share of horizontal two-way trade increases with the unit value ratios of bilateral trade flows to be considered horizontal. Such as less than 10% of two-way trade would be considered two-way in horizontal differentiation for unit value differences 5%, and more than 60% for unit value differences of more 85%. In our thesis, we have chosen 25% as the unit value threshold for 30% horizontal

Table 23: Sensitivity of trade types depending on the degree of overlap between exports and imports

Degree of overlap (%)	OWT (%)	TWT (%)	TWTH	TWTV	TWT na
5	50.6	49.4	19.2	26.3	3.9
10	57.8	42.2	16.7	22.2	3.3
15	62.7	37.3	15.0	19.5	2.8
20	67.1	32.9	13.0	17.2	2.6
25	70.8	29.2	11.6	15.3	2.4
30	73.9	26.1	10.5	13.4	2.1
35	76.9	23.1	9.3	12.1	1.7
40	79.5	20.5	8.2	10.8	1.5
45	81.5	18.5	7.5	9.6	1.4
50	83.5	16.5	6.7	8.5	1.3
55	85.5	14.5	5.9	7.6	1.0
60	87.6	12.4	5.1	6.4	0.9
65	89.6	10.4	4.3	5.3	0.8
70	91.5	8.5	3.4	4.4	0.6
75	93.0	7.0	2.8	3.6	0.5
80	94.5	5.5	2.2	2.9	0.4
85	96.0	4.0	1.5	2.2	0.3
90	97.4	2.6	1.0	1.5	0.2
95	98.6	1.4	0.5	0.8	0.1

Note: OWT is one-way trade; TWT is two-way trade; TWTH is two-way trade horizontally; TWTV is two-way trade vertically and TWT is two-way trade. TWT=TWTH+TWTV+TWT. All flows, unrestricted sample, year 2000.

Source: Lionel Fontagne, Michael Freudenberg and Guillaume Gaulier (10th Jul. 2005)'s Disentangling Horizontal and Vertical Intra-Industry Trade.

And 70% vertical two-way trade in total two-way trade.

Table 24: Sensitivity of the Relative Importance of Horizontal and Vertical Two-Way Trade in Total Two-Way Trade

Univ value threshold (%)	TWTH%	TWTV%
5	8.8	91.2
10	14.9	85.1
15	21.1	78.9
20	26.7	73.3
25	30.7	69.3
30	34.1	65.9
35	38.0	62.0
40	41.7	58.3
45	45.0	55.0
50	47.4	52.6
55	49.8	50.2
60	51.6	48.4
65	53.8	46.2
70	55.3	44.7
75	57.7	42.3
80	59.0	41.0
85	60.9	39.1
90	62.1	37.9
95	63.4	36.6

Note: Share of type in TWT excluding NA, All flows, unrestricted sample, year 2000.

Source: Lionel Fontagne, Michael Freudenberg and Guillaume Gaulier (10th Jul. 2005)'s Disentangling Horizontal and Vertical Intra-Industry Trade.

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