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The Role of China in International Fragmentation and Production Network: An Empirical Investigation*

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Many studies have found that China's increasing integration into the world economy has facilitated greater fragmentation of production among Asian countries. Despite the central role of China in parts and components trade, most previous studies on China's components trade have been limited to a particular country or some specific industries. The central objective of this paper is to provide a complete description of China's parts and components trade. In order to achieve this goal, we systematically separate intermediate goods (parts and components) and final goods from manufactured trade flows, and give a description of the pattern and trends of parts and components trade of China for the period 1992-2009. We then estimate the gravity model augmented with regional dummy variables to examine the determinants of China's trade in parts and components and to assess whether China enjoys intense linkages in trade in parts and components with other East Asian countries. We find that China's parts and components trade has increased steadily, in parallel with the growing volume of China's world trade. Second, the share of parts and components in China's imports is much greater than the world average level. In combination with China's role as a globally significant exporter of final goods, this suggests that China is a major a world production center. Finally, China's parts and components trade has a relatively high degree of regional concentration. ASEAN, Japan, Korea, EU, and NAFTA are China's major trading partners.

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Another finding is that China's trade linkages with these countries, in terms of imports, are stronger for parts and components than for final goods, suggesting that China is closely linked with these country groups in the international production network.

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1. INTRODUCTION

The stunning rise of China as a globally influential economic power since its opening up in 1978 closely parallels its equally stunning rise as a globally significant trading power. Trade has been the primary channel through which China has been transformed from a closed autarkic economy to an open globalized economy. Much of China's trade, in turn, is driven by its central role — i.e. its role as the Factory of the World — in international production networks which is based on cross-border flows of parts and components culminating in their assembly into final products. Such flows have been particularly prominent in China's trade with its neighbors, and the resulting regional production network has consolidated East Asia's status as the world's manufacturing hub.

International production fragmentation refers to cross-border dispersion of components production/assembly within vertically integrated production processes, with each country specializing in a particular stage of the production sequence.[1] It has been an important feature of the East Asian

[1] Scholars from different disciplines — economics, management, social economics, economic geography, and other fields — have created different concepts to describe such an economic phenomenon: Jones and Kierzkowski (1990 and 2000) proposed the concept of **production fragmentation**, defined as spatial dispersion of production blocks, which may occur domestically but can also occur across national boundaries. Production fragmentation can take place in vertically integrated companies as well as through outsourcing or market means beyond corporate boundaries; Yi (2003) and Hummels, Ishii, and Yi (2001) put forward the concept of **vertical specialization**, defined as international vertical division of the production process, representing 'the imported input content of exports, or equivalently,

economy and there have been many studies confirming the existence of a well-established East Asia's intra-industry production network.[2)]

In particular, China's rapid growth and development is related to its growing participation in international production networks. Nowadays, the role of China as a globally significant assembly and production center is deepening its integration into the world economy and facilitating greater fragmentation of production across countries in East Asia. As is also shown by Lee *et al*. (2013), due to its sheer size and explosive growth, China has emerged also as a globally influential importer in its own right. In fact, China's export success is to some extent based on importing parts and components and assembling them for export. Therefore, a complete understanding of China's trade requires an understanding of its imports as well as its exports of not only final products but also of parts and components.

Amighini (2005) found empirical evidence that during the 1990s China increased its market share in components trade of ICT products and ranked among the top three world exporters. Athukorala and Yamashita (2008) paid attention to global production sharing in their analysis of the U.S.-China trade deficit. They highlighted the two countries' evolving roles in global production networks, and found that the U.S.-China trade imbalance is basically a structural phenomenon resulting from the pivotal role played by China as the final assembly center in East-Asia centered global production networks.

Dean, Lovely, and Mora (2009) examined the pattern of trade between

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foreign value added embodied in exports', and provided a calculation method to compute vertical specialization share based exclusively on a country's input-output table. **Intra-product specialization** and **offshore sourcing** were proposed by Arndt (2000); offshore sourcing arises when a company utilizes the services of another company in a different country to contribute to some portion of their business process in order to reduce costs. **Global production sharing** was suggested by Yeats (1998) to describe production across national and enterprise borders. We will use the above-mentioned terms interchangeably to describe the phenomenon of trade in parts and components.

2) See among others, Arndt (2000), Athukorala (2005, 2009b, 2010), Athukorala and Yamashita (2006), Ando and Kimura (2003, 2009), and Kimura (2009), among others. Pomfret (2009) argues that the proliferation of regional and bilateral agreements in the Asia-Pacific region has been driven by the rapid emergence of regional production fragmentation.

China and its two largest trading partners, Japan and the United States, and found that only a small share of these flows could be characterized as arm's length, one-way trade in final goods. Instead, they found extensive two-way trade, deep vertical specialization, concentration of trade in computers and communication devices, and a prominent role of foreign-invested enterprises. Nicolas (2009) finds that China and Korea share extensive production networks and are integrated in a triangular trade pattern with the Western markets.

Athukorala (2005, 2009a, 2009b, 2010) analyzed East Asian export performance and found evidence of China's rise as a major player in world machinery parts/components trade. Kim, Lee, and Park (2010) investigated changes in Asia's regional and global trade linkages and their influence on relationships among Asia, EU, and U.S. They found that China played a critical role as an assembly and production center in rapidly expanding intra-Asian trade. However, China's share in the parts and components with Europe and U.S. is rising, suggesting that East Asia's production chains are becoming increasingly integrated into the global business network.

Despite the central role of China in parts and components trade, however, there has been no comprehensive study on the topic and most previous studies of China's parts and components trade have been limited to some particular trading partners or specific industries, as summarized above.

At a broader level, the central objective of our paper is to provide a comprehensive analysis of China's trade in parts and components. Such an analysis would significantly enhance our understanding of China's foreign trade and, by extension, its rapid growth and development. More specifically, we aim to:

(1) Comprehensively document the magnitude of China's participation in international production networks and its changing nature over time;
(2) Examine the various factors that affect China's imports and exports of parts and components.

In order to accomplish the above goals, we systematically separate out intermediate goods (parts and components) and final goods from total trade flows, and give a description of the pattern and trends of parts and components trade of China for the period 1992-2009. We then estimate a gravity model augmented with regional dummy variables to examine the determinants of China's trade in parts and components, and to assess the extent of China's trade in parts and components with other East Asian countries.

The paper is organized as follows. After presenting the scope and sources of the data that we use, section 2 analyzes the structure of China's parts and components trade. Using the gravity equations, section 3 presents the determinants of China's trade in parts and components, as compared with China's total trade, manufactured goods trade and non-manufactured goods trade. Finally, section 4 summarizes the main findings and concludes the paper.

2. STRUCTURE OF CHINA′S PARTS AND COMPONENTS TRADE

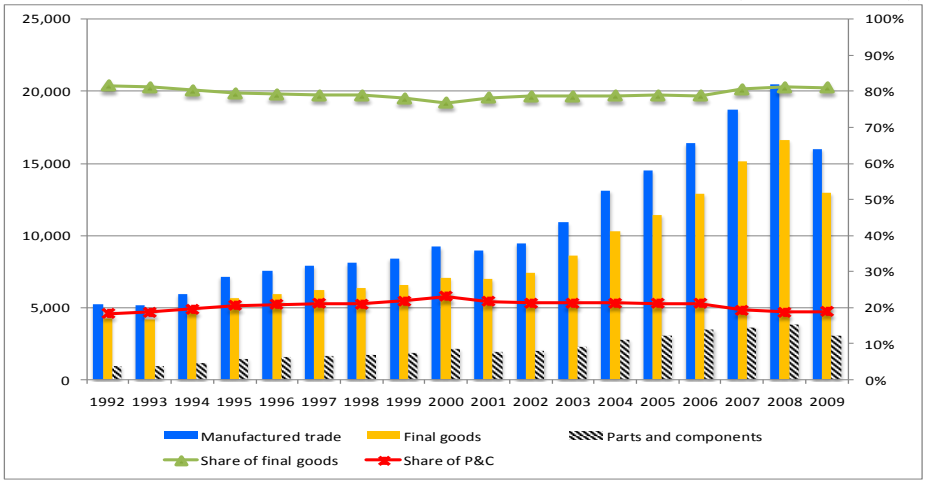
In this section, we examine the structure of China's parts and components trade. We first look at the overall structure — e.g. total parts and components exports and their share in China's total exports — and then the specific structure — e.g. parts and components exports and imports in different product groups. In addition, we assess the relative significance of different countries and regions as export destinations and import sources.

2.1. Trends and Patterns of World Trade in Parts and Components

Data from the UN Comtrade database were utilized, based on Revision 3 of the SITC (Standard International Trade Classification System). SITC Revision 3 marks a significant improvement over SITC Revisions 2 and 1.

Figure 1 World Trade in Parts and Components

(unit: Billion US$)



Source: Data calculated from UN Comtrade database.

Apart from providing comprehensive coverage of parts and components in SITC 5 (Chemicals and related products), SITC 6 (Manufactured goods classified chiefly by material), and SITC 7 (Machinery and transport equipment), Revision 3 also separately reports parts and components of some products belonging to SITC 8 (Miscellaneous manufactured articles). The classification of products as parts and components of SITC 5, SITC 6, SITC 7, and SITC 8 follows Athukorala (2010).

The earliest year for which trade data are available for all reporting countries is 1992; therefore, we make use of data from the UN Comtrade database for the period 1992 to 2009. In order to give a complete and comprehensive description of China's international production fragmentation and production network, we selected 141 trade partners of China as a cross-section sample. Following Athukorala (2010), China's parts and components exports and imports are calculated at the 5 digit level of the SITC.

In terms of overall comparison, world trade in parts and components and in final goods show simultaneous growth with total world trade (figure 1).

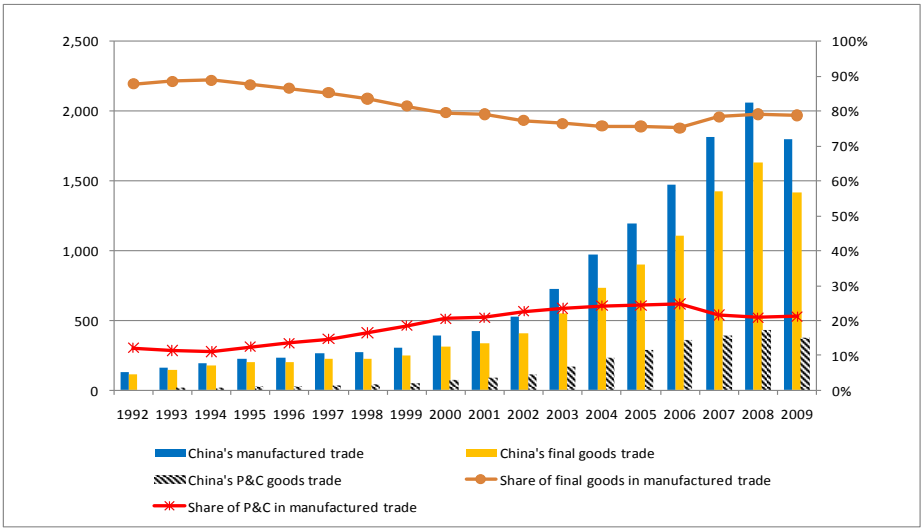
World trade in parts and components increased more than 4 times from about US$961 billion in 1992 to nearly US$3,845 billion in 2008. After the world economic crisis in 2008, it then decreased to US$3,036 billion in 2009. Parts and components accounted for around 20% of total manufacturing trade in the world, and did not fluctuate much during the sample period. Final goods trade increased 3.9 times from about US$4,258 billion in 1992 to US$16,655 billion in 2008. The share of final goods in world's total manufacturing trade was stable at around 80% throughout the sample period.

2.2. Overall Structure of China's Trade in Parts and Components

Turning to China, until the global economic crisis of 2008, China's parts and components trade increased steadily, in parallel with its total trade. China's trade of parts and components increased nearly 27 times from about $16 billion in 1992 to nearly $430 billion in 2008. In 1992 parts and components accounted for about 12% of China's total trade in manufactured

Figure 2 Trade in Parts and Components of China

(unit: Billion US$)



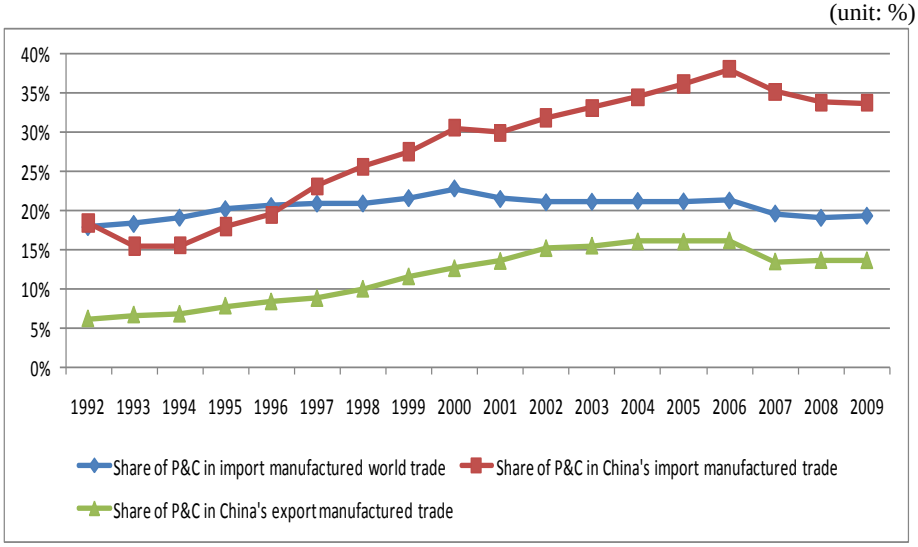
Source: Data calculated from UN Comtrade database.

products, but it experienced a secular rise until 2006, when it peaked at 25%. However, there was a sharp fall in 2007 and no significant recovery in the next two years. China's trade in final goods increased about 14 times from about $115 billion in 1992 to nearly $1,634 billion in 2008. In contrast to parts and components, the share of final goods slightly declined, from 88% in 1992 to 75% in 2006. The share recovered slightly in 2007 but remained lower than in 1990s (figure 2).

Comparing the share of parts and components trade for China and the world average level, the share of parts and components grew very rapidly for both exports and imports. The share of parts and components in China's imports, which was lower than the world average level in the early 1990s, is much higher than the world average level in the 2000s. For China's exports, the share of parts and components also grew rapidly but still remain lower than the world level in the 2000s (figure 3).

Figure 3 Share of Parts and Components Trade of China Compared with the World Average

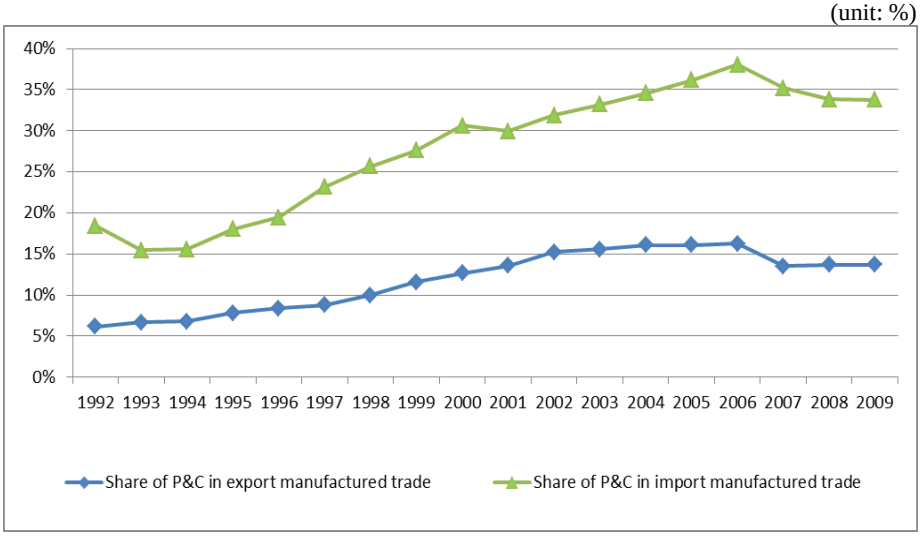
(unit: %)



Source: Data calculated from UN Comtrade database.

Figure 4 Share of Parts and Components in China's Exports and Imports of Manufactured Goods

(unit: %)



Source: Data calculated from UN Comtrade database.

We now look at the share of parts and components versus final goods in China's manufactured exports and imports. Final goods dominated China's manufactured exports throughout the sample period: final goods accounted for around 90% of China's manufactured exports throughout the period, but its share appears to have declined in the early 2000s; the share of parts and components in China's manufactured exports remained small, but it appears to have increased in the early 2000s. The pattern for imports was somewhat different from the pattern for exports. The gap between the share of final goods and that of parts and components narrowed. The share of China's final goods imports decreased from 82% in 1992 to 62% in 2006, and then increased again to 66% in 2009; the share of parts and components steadily increased from 18% in 1992 to 38% in 2006 and decreased again to 34% in 2009 (figure 4).

Furthermore, we found that the share of final goods in manufactured exports (averaging 90%) was consistently higher than its share in imports (averaging 70%). In contrast, the share of parts and components in China's

imports (averaging 30%) was larger than its share in its exports (averaging 10%).

The overall trends suggest that China has become a global production center, importing components and exporting finished products. The gradual growth of China's parts and components exports indicate that the country has also become gradually an important global supply base for parts and components. One puzzle is the downward trend of the share of parts and components trade (both exports and imports) in recent years. This might have something to do with the global financial crisis, but requires a further investigation.

2.3. Specific Structure of China's Parts and Components Trade

The definition of 'parts and components' includes four main SITCs, namely SITC 5 (Chemicals and related products), SITC 6 (Manufactured goods classified chiefly by material), SITC 7 (Machinery and transport equipment), and SITC 8 (Miscellaneous manufactured articles). The four SITCs show differences in their characteristics.

As table 1a shows, the parts and components that China exports are primarily in the machinery and transport equipment sector (SITC 7). The share of SITC 7 parts and components exports in China's manufactured exports increased from 4.8% to 15.1% between 1992 and 2006 but then fell in 2007. Similarly, the share of parts and components in China's SITC 7 exports rose from 24.3 % to 32.6% between 1992 and 2002 but then fell in 2003. The share of parts and components in China's exports in the three other SITCs is much smaller. The share of parts and components exports in China's SITC 8 exports increased from 1.7% to 2.7% between 1992 and 2009. For SITC 6 exports, the share of parts and components rose from 1.9% to 3.3% during the same period. For SITC 5 exports, the share of parts and components dropped from 0.9% to 0.5% during the period.

In the context of imports (table 1b), parts and components hold a dominant position also for SITC 7. The share of SITC 7 parts and components in

Table 1a China's Exports of Parts and Components

(unit: US$ billion)

Year	Manu-factured Exports	Export of P&C		Export of P&C in SITC 5			Export of P&C in SITC 6			Export of P&C in SITC 7			Export of P&C in SITC 8		
		Export Value of P&C	Share of P&C in Manu-factured Exports (%)	Export Value P&C SITC 5	Share in SITC 5 (%)	Share in Manu-factured Exports (%)	Export Value P&C SITC 6	Share in SITC 6 (%)	Share in Manu-factured Exports (%)	Export Value P&C SITC 7	Share in SITC 7 (%)	Share in Manu-factured Exports (%)	Export Value P&C SITC 8	Share in SITC 8 (%)	Share in Manu-factured Exports (%)
1992	66.8	4.1	6.2	0.0	0.9	0.06	0.3	1.9	0.4	3.2	24.3	4.8	0.6	1.7	0.9
1993	73.9	4.9	6.7	0.0	0.6	0.04	0.3	2.0	0.4	4.0	26.1	5.4	0.6	1.6	0.8
1994	99.6	6.8	6.8	0.1	0.9	0.05	0.5	2.1	0.4	5.4	24.5	5.4	0.9	1.7	0.9
1995	125.0	9.8	7.8	0.1	1.4	0.10	0.6	1.8	0.4	8.2	26.0	55	0.9	1.7	0.7
1996	127.3	10.7	8.4	0.1	0.6	0.04	0.6	2.2	0.4	9.1	25.8	7.2	0.8	1.5	0.7
1997	155.9	13.7	8.8	0.1	0.7	0.05	0.8	2.2	0.4	11.8	27.0	7.6	1.1	1.6	0.8
1998	160.6	16.1	10.0	0.1	0.7	0.04	0.8	2.6	0.5	13.8	27.5	8.6	1.4	1.9	0.7
1999	172.1	20.0	11.6	0.1	0.7	0.04	0.9	2.7	0.5	17.8	30.2	10.3	1.2	1.7	0.6
2000	219.9	27.8	12.6	0.1	0.6	0.04	1.1	2.6	0.4	25.2	30.5	11.5	1.4	1.7	0.6
2001	235.8	32.0	13.6	0.1	0.6	0.03	1.2	2.7	0.4	29.3	30.9	12.4	1.5	1.7	0.6
2002	292.6	44.6	15.2	0.1	0.6	0.03	1.4	2.6	0.4	41.4	32.6	14.1	1.7	1.7	0.6
2003	397.0	61.7	15.6	0.2	0.6	0.03	1.7	2.5	0.4	57.5	30.6	14.5	2.4	1.9	0.7
2004	542.4	87.4	16.1	0.2	0.7	0.03	2.5	2.5	0.4	81.2	30.3	15.0	3.6	2.3	0.6
2005	700.4	112.6	16.1	0.3	0.7	0.03	3.4	2.6	0.4	105.0	29.8	15.0	4.5	2.3	0.6
2006	895.5	145.3	16.2	0.3	0.8	0.04	4.5	2.5	0.5	135.0	29.6	15.1	5.3	2.2	0.6
2007	1,136.2	153.6	13.5	0.4	0.7	0.03	5.8	2.6	0.5	140.2	24.3	12.3	7.0	2.4	0.6
2008	1,331.5	182.3	13.7	0.3	0.4	0.03	6.8	2.6	0.5	166.1	24.6	12.5	9.4	2.8	0.7
2009	1,124.8	153.9	13.7	0.3	0.5	0.02	6.0	3.3	0.5	139.0	23.5	12.4	8.0	2.7	0.7

Source: Data calculated from UN Comtrade database.

Table 1b China's Imports of Parts and Components

(unit: US$ billion)

Year	Manu-factured Imports	Import of P&C		Import of P&C in SITC 5			Import of P&C in SITC 6			Import of P&C in SITC 7			Import of P&C in SITC 8		
		Import Value of P&C	Share of P&C in Manu-factured Imports (%)	Import Value P&C SITC 5	Share In SITC 5 (%)	Share in Manu-factured Imports (%)	Import Value P&C SITC 6	Share in SITC 6 (%)	Share in Manu-factured Imports (%)	Import Value P&C SITC 7	Share in SITC 7 (%)	Share in Manu-factured Imports (%)	Import Value P&C SITC 8	Share in SITC 8 (%)	Share of in Manu-factured Imports (%)
1992	64.7	11.9	18.4	0.2	2.0	0.3	0.5	2.4	0.6	10.1	32.8	15.6	1.1	20.2	1. 7
1993	87.2	13.5	15.5	0.3	3.5	0.4	0.5	1.8	0.5	11.5	25.8	13.2	1.1	18.3	1.3
1994	96.7	15.1	15.6	0.4	3.3	0.4	0.6	2.1	0.5	12.9	25.1	13.4	1.1	17.0	1.2
1995	104.1	18.8	18.0	0.4	2.5	0.4	0.7	2.4	0.5	16.4	31.1	15.7	1.3	15.5	1.2
1996	109.6	21.3	19.5	0.4	2.5	0.4	0.7	2.3	0.5	18.9	34.5	17.2	1.3	15.5	1.2
1997	109.6	25.4	23.2	0.4	2.2	0.4	0.8	2.4	0.5	22.8	43.2	20.8	1.4	16.3	1.3
1998	113.1	29.0	25.6	0.4	2.0	0.4	0.8	2.6	0.6	26.3	46.3	23.3	1.5	17.2	1.1
1999	132.8	36.6	27.6	0.4	1.7	0.3	0.9	2.7	0.6	33.8	48.7	25.5	1.4	14.9	1.0
2000	169.9	52.0	30.6	0.4	1.4	0.2	1.2	2.8	0.5	48.7	53.0	28.7	1.7	13.2	0.9
2001	189.9	56.9	30.0	0.4	1.3	0.2	1.3	3.1	0.5	53.6	50.0	28.2	1.6	10.9	0.8
2002	236.8	75.4	31.9	0.5	1.2	0.2	1.8	3.7	0.6	71.3	52.0	30.1	1.9	9.7	0.8
2003	328.6	109.1	33.2	0.5	1.0	0.2	2.6	4.0	0.6	103.0	53.4	31.3	2.6	8.0	0.8
2004	428.3	148.0	34.6	0.5	0.8	0.1	3.4	4.6	0.6	141.0	55.8	32.9	3.4	6.7	0.7
2005	493.1	178.4	36.2	0.6	0.8	0.1	3.9	4.8	0.6	170.0	58.5	34.5	3.6	5.9	0.7
2006	579.5	220.6	38.1	0.6	0.7	0.1	4.8	5.5	0.6	211.0	59.1	36.4	4.1	5.8	0.7
2007	677.5	238.5	35.2	0.7	0.6	0.1	5.7	5.5	0.6	227.3	55.1	33.6	4.9	5.6	0.8
2008	733.5	248.2	33.8	0.7	0.6	0.1	6.1	5.7	0.5	235.5	53.3	32.1	6.0	6.2	0.9
2009	675.2	227.8	33.7	0.6	0.5	0.1	5.5	5.1	5.1	216.0	52.9	32.0	5.8	6.8	6.8

Source: Data calculated from UN Comtrade database.

China's manufactured imports rose from 15.6% in 1992 to 36.4% in 2007 but then fell in 2007. The share of parts and components in China's SITC 7 imports also increased sharply from 32.8% to 59.1% between 1992 and 2007 but then fell in 2007. On the other hand, the share of parts and components in China's SITC 8 imports fell sharply from 20.2% to 6.8% between 1992 and 2009. For SITC 5 and SITC 6, the import share of parts and components is relatively small, similarly to the corresponding export share of parts and components.

Tables 2a and 2b makes use of the UN 2-digit product codes within SITC 5, SITC 6, SITC 7, and SITC 8 in order to assess the relative importance of individual product groups in China's trade. The table describes each item, and provides the value and share of each item in a particular year. This allows us to see the trends and patterns at a deeper level of fragmentation. We chose four observation years — 1992, 1999, 2006, and 2009.

Machinery and transport equipment (SITC 7) accounted for 77.6% of China's parts and components exports in 1992 and 93.0% in 2006, although the share fell modestly to 90.6% in 2009. For imports, the share increased from 84.8% in 1992 to 95.7% in 2006 and then decreased to 94.8% in 2009. Thus, SITC 7 accounts for a high proportion of both exports and imports throughout the sample period. In other words, trade in SITC 7 parts and components plays a big role in China's participation in the international production network.

Within SITC 7, electrical machinery and apparatus (SITC 77) accounted for the largest share of parts and components trade. It accounted for 40.8% of parts and components exports and 71.5% of parts and components imports in 2009. The following most important 2-digit product codes are office machinery (SITC 75) and telecommunication and sound equipment (SITC 76): they accounted for 17.0% and 8.7% of parts and components exports, respectively, and 6.0% and 3.8% of parts and components imports, respectively, in 2009.

Table 2a Percentage Composition of Parts and Components in China's Exports by 2-digit Categories*

(unit: US$ million)

SITC Code	Product	1992		1999		2006		2009	
Exports		Value	%	Value	%	Value	%	Value	%
5	Chemicals and related products	37.1	0.9	68.2	0.3	227.0	0.2	279.9	0.2
6	Manufactured goods classified chiefly by material	307.4	7.4	892.3	4.5	4,452.2	3.1	6,047.7	3.9
62	Rubber manufactures	76.4	1.8	236.8	1.2	1,167.4	0.8	1,517.2	1.0
65	Textile yarn, fabric	65.6	1.6	122.6	0.6	492	0.3	1,017.6	0.7
66	Non- metal, mineral manfct	28.1	0.7	168.8	0.8	975.7	0.7	1,357.0	0.9
69	Metals manufactures nets	137.3	3.3	364.2	1.8	1,817.1	1.3	2,155.9	1.4
7	Machinery and transport equipment	3,208	77.6	17,756.1	89.0	135,400.2	93.0	139,003.5	90.6
71	Power generating-machines	213.1	5.2	473.2	2.4	2,984.1	2.1	8,395.0	5.5
72	Special industrial machinery	143.7	3.5	419.5	2.1	3,341.5	2.3	5,022.8	3.3
73	Metalworking machinery	30.6	0.7	124.2	0.6	934.0	0.6	1,679.3	1.1
74	General industrial machinery nets	153.5	3.7	813.9	4.1	7,370.5	5.1	11,732.7	7.6
75	Office machines	565.7	13.7	4,126.2	20.7	34,611.2	23.9	26,122.3	17.0
76	Telecommunication and sound equipment	706.8	17.1	3,735.0	18.7	31,473.9	21.7	13,371.8	8.7
77	Electrical machinery and apparatus	1,132.7	27.4	7,029.2	35.2	46,236.1	31.9	56,664.7	40.8
78	Road vehicles	231	5.6	1,327.1	6.7	11,507.6	7.9	14,771.7	9.6
79	Other transport equipment	99.6	2.4	351	1.8	1291	0.9	1,243.2	0.8
8	Miscellaneous manufactured articles	581.7	14.1	1,238.5	6.2	5,294.6	3.6	8,049.5	5.2
81	Prefabricated buildings fixtures and fittings	59.9	1.4	133.1	0.7	647.8	0.4	1,342.5	0.9
82	Furniture, and parts thereof	7.2	0.2	39.8	0.2	860.9	0.6	1,600.9	1.0
84	Apparel and clothing accessories	42.7	1.0	129.3	0.6	229.4	0.2	280.6	0.2
87	Professional, scientific instruments	25.4	0.6	193	1.0	1,038.9	0.7	1,600.1	1.0
88	Photographic apparatus, optical goods and watches/clocks	333.3	8.1	511.9	2.6	1,868.9	1.3	1,997.5	1.3
89	Miscellaneous manufactured articles, n.e.s.	113.1	2.7	231.4	1.2	648.7	0.4	1,228.0	0.8
P&C	Total (US$ million)	4,134.2	100	19,955.1	100	145,347.0	100	153,861.0	100

Note: * Calculated utilizing 5-digit SITC parts and components items aggregated at the 2-digit level.
Source: Data calculated from UN Comtrade database.

Table 2b Percentage Composition of Parts and Components in China's Imports by 2-digit Categories*

(unit: US$ million)

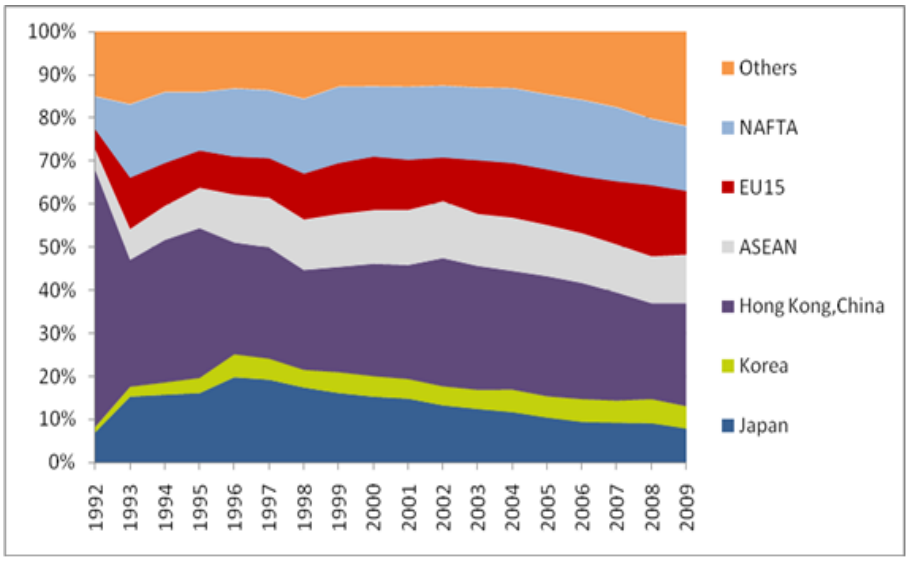
SITC Code	Product	1992		1999		2006		2009	
Imports		Value	%	Value	%	Value	%	Value	%
5	Chemicals and related products	222.0	1.9	419.4	1.1	644.0	0.3	572.3	0.3
6	Manufactured goods classified chiefly by material	465.9	3.9	932.7	2.5	4,774.0	2.2	5,460.1	2.4
62	Rubber manufactures	49.0	0.4	214.7	0.6	1,284.6	0.6	1,649.4	0.7
65	Textile yarn, fabric	199.4	1.7	206.0	0.6	489.3	0.2	530.6	0.2
66	Non- metal, mineral manfct	22.2	0.2	114.4	0.3	894.1	0.4	917.6	0.4
69	Metals manufactures nets	195.3	1.6	397.7	1.1	2,106.0	1.0	2,362.6	1.0
7	Machinery and transport equipment	10,096.9	84.8	33,820.8	92.4	211,016.0	95.7	216,017.3	94.8
71	Power generating-machines	1,107.1	9.9	2,495.2	7.1	5,263.2	2.4	5,869.0	2.6
72	Special industrial machinery	966.1	8.6	1,242.3	3.5	3,204.8	1.5	4,299.7	1.9
73	Metalworking machinery	265.5	2.4	376.7	1.1	1,825.6	0.8	1,830.2	0.8
74	General industrial machinery nets	591.7	5.3	1,179.7	3.3	4,786.0	2.2	6,724.1	3.0
75	Office machines	682.1	5.7	4,196.6	11.5	19,631.5	8.9	13,580.4	6.0
76	Telecommunication and sound equipment	1,843.2	15.5	5,363.7	14.6	25,088.4	11.4	8,769.8	3.8
77	Electrical machinery and apparatus	3,205.8	26.9	17,801.1	48.6	143,476.7	65.1	162,804.7	71.5
78	Road vehicles	1,047.2	8.8	1,470.5	4.0	9362.0	4.2	12,696.8	5.6
79	Other transport equipment	633.9	5.3	871.4	2.4	1,903.6	0.9	2,353.1	1.0
8	Miscellaneous manufactured articles	1,117.7	9.4	1,443.3	3.9	4,124.3	1.9	5,748.5	2.5
81	Prefabricated buildings fixtures and fittings	49.0	0.4	28.7	0.1	53.4	0.0	376.8	0.2
82	Furniture, and parts thereof	4.8	0.0	20.5	0.1	377.6	0.2	609.6	0.3
84	Apparel and clothing accessories	58.3	0.5	115.7	0.3	62.3	0.0	36.6	0.0
87	Professional, scientific instruments	192.3	1.6	292.5	0.8	1,796.6	0.8	2,670.1	1.2
88	Photographic apparatus, optical goods and watches/clocks	662.5	5.6	911.1	2.5	1,663.7	0.8	1,813.3	0.8
89	Miscellaneous manufactured articles, n.e.s.	150.8	1.3	74.8	0.2	170.8	0.1	242.1	0.1
P&C	Total (US$ million)	11,902.5	100	36,616.3	100	220,558.0	100	227,798.2	100

Note: * Calculated utilizing 5-digit SITC parts and components items aggregated at the 2-digit level.
Source: Data calculated from UN Comtrade database.

2.4. Destination and Source Countries of China's Parts and Components Trade

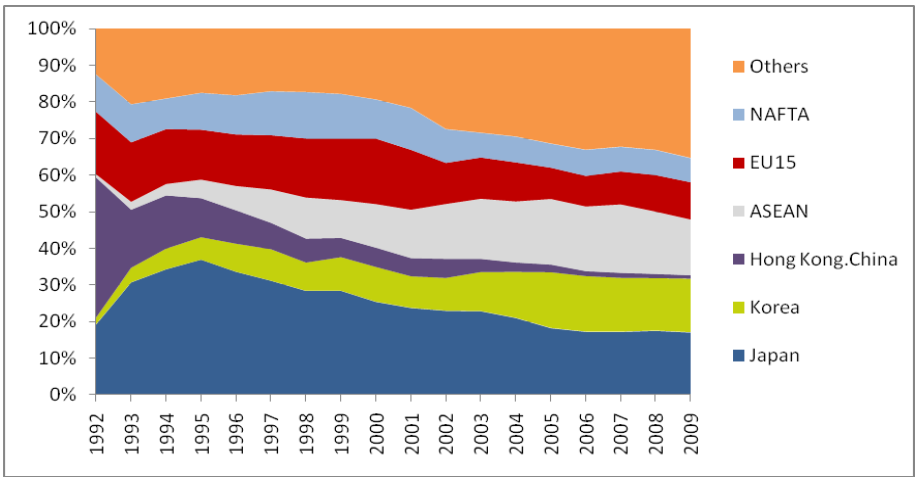
The export destination countries and import source countries of China's parts and components trade are heavily concentrated (figures 5a, 5b and tables 3a, 3b). Japan, Korea, Hong Kong, China, ASEAN, EU15, and NAFTA countries are China's most important trading partners for parts and components. Hong Kong, NAFTA and EU15 are the main destinations for China's exports whereas Japan, ASEAN and Korea are the main sources of imports. The shares of parts and components imports accounted for by Hong Kong and Japan fell sharply between 1992 and 2009. In contrast, the shares of ASEAN countries and Korea rose significantly. Hong Kong, which is the most important destination for China's parts and components exports, is not a significant source of China's imports in recent years.

Figure 5a Destination Countries for China's Parts and Components Export



Source: Data calculated from UN Comtrade database.

Figure 5b Source Countries for China's Parts and Components Imports



Source: Data calculated from UN Comtrade database.

Table 3a China's Parts and Components Export Share with Major Trade Partners/Regions

Country/ Region	1992		1999		2006		2009	
	US$ million	%	US$ million	%	US$ million	%	US$ million	%
Japan	292.5	7.1	3221.7	16.1	13,779.8	9.5	12,226.4	7.9
Korea	53.5	1.3	978.5	4.9	7,730.6	5.3	8,038.1	5.2
Hong Kong. China	2,465.1	59.6	4,887.5	24.5	39,227.0	27.0	36,735.0	23.9
ASEAN6	192.3	5.5	2,428.3	12.2	16,536.2	11.4	17,132.2	11.1
NATFA	314.0	7.6	3,527.8	17.7	25,709.9	17.7	23,064.8	15.0
EU15	197.7	4.8	2,384.1	11.9	19,395.3	13.3	23,012.6	15.0
Sum	**3,515.0**	**85.8**	**17,427.9**	**87.3**	**122,378.7**	**84.2**	**120,208.9**	**78.1**
World	**4,134.2**	**100**	**19,955.1**	**100**	**145,347.0**	**100**	**153,861.0**	**100**

Source: Data calculated from UN Comtrade database.

Table 3b China's Parts and Components Import Share with Major Trade Partners/Regions

Country/ Region	1992		1999		2006		2009	
	US$ million	%	US$ million	%	US$ million	%	US$ million	%
Japan	2,284.1	19.2	10,387.0	28.7	37,879.6	17.2	38,688.7	17.0
Korea	216.1	1.8	3,370.4	9.3	33,511.8	15.2	33,472.4	17.0
Hong Kong. China	4,576.8	38.5	1,947.4	5.4	3,155.1	1.4	2,260.8	1.0
ASEAN6	97.6	0.8	3,782.7	10.5	38,993.7	17.7	34,758.5	15.3
NATFA	1,204.6	10.1	4,456.2	12.3	15,656.7	7.1	14,992.9	6.6
EU15	2,031.3	17.1	6,150.5	17.0	18,483.1	8.4	23,206.4	10.2
Sum	**10,410.5**	**87.5**	**30,094.2**	**83.2**	**147,680.0**	**67.0**	**147,379.6**	**64.7**
World	**11,902.6**	**100**	**36,161.3**	**100**	**220,558.0**	**100**	**227,798.0**	**100**

Source: Data calculated from UN Comtrade database.

China's parts and components trade is by no means limited to its major trading partners. The market share of the rest of the world increased for both exports and imports to reach substantial levels. This trend suggests that China's parts and components is an integral part of an increasingly globalized production network.

3. THE DETERMINANTS OF CHINA'S TRADE IN PARTS AND COMPONENTS

In this section, we estimate the gravity equation — a widely used empirical tool for analyzing international trade flows — to identify the main determinants of China's parts and components exports and imports. In addition to parts and components, we also estimate the gravity equation for the other major groups of traded goods — non-manufactured goods, manufactured goods and final goods — for comparative purposes.

3.1. The Gravity Equation

Tinbergen (1962) and Pöyhönen (1963) pioneered the simple gravity equation, in which the volume of trade between two countries is proportional to the product of their masses (GDPs) and inversely related to the distance between them. The gravity equation has been empirically highly successful. Recently, renewed interest in geography among economists has rekindled its popularity as a tool for empirical analysis. Furthermore, a number of studies have shown that the gravity equation can be derived from many different models of international trade (Helpman and Krugman, 1985; Bergstrand, 1989; Deardorff, 1998; Eaton and Kortum, 2002; and Evenett and Keller, 2002).[3] Therefore, it possesses 'more theoretical foundation than any other trade model' (Baldwin, 2006b).

The standard gravity equation takes the following form:

$$\ln XM_{ijt} = \alpha + \beta_1 \ln GDP_{it} + \beta_2 \ln GDP_{jt} + \beta_3 \ln DIST_{ij} + \varepsilon_{ijt},$$

where,

$\ln XM_{ijt}$ = log of export (or import) flows from country *i* to country *j* at time *t*
$\ln GDP_{it}$ = log of GDP of country *i* at time *t*
$\ln GDP_{jt}$ = log of GDP of country *j* at time *t*
$\ln DIST_{ij}$ = log of geographical distance between country *i* and country *j*
ε_{ijt} = random disturbance term.

3.2. The Augmented Gravity Equation for China's Trade in Parts and Components

Based on the equation above, dummy variables are introduced for countries sharing a common border and countries surrounded by land. We also include year dummies to take account of factors such as world business cycle, global financial shocks, and so forth.

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[3] Harrigan (2001) and Anderson and van Wincoop (2003) provide a comprehensive review of the literature on the theoretical foundations for the gravity model.

$$\ln XM_{ijt} = \alpha + \beta_1 \ln GDP_{it} + \beta_2 \ln GDP_{jt} + \beta_3 \ln DIST_{ij} + \beta_4 CONTIG_{ij} + \beta_5 LANDLOCKED_{ij} + \beta_6 COMLANG_{ij} + u_i + u_t + \varepsilon_{ijt},$$

where

$\ln XM$ = bilateral trade (total, manufactured goods or parts and components under SITC5, SITC6, SITC 7 and SITC 8)

$\ln GDP_{it}$ = log of GDP of country *i* (China) at time *t*

$\ln GDP_{jt}$ = log of GDP of country *j* at time *t*

$\ln DIST_{ij}$ = log of geographical distance between country *i* (China) and country *j*

$CONTIG_{ij}$ = 1 if economy *i* (China) and economy *j* share the same border
= 0 otherwise

$LANDLOCKED_j$ = 1 if economy *j* is a landlocked economy
= 0 otherwise

$COMLANG_{ij}$ = 1 if economy *i* (China) and economy *j* share the same language
= 0 otherwise

u_i = partner country-specific effects

u_t = year-specific effects

ε_{ijt} = error term.

In addition to the above-mentioned explanatory variables, various regional dummies are also included. Specifically, we aim to assess whether China's trade in parts and components is greater in East Asia. In order to do this, we include four different Asia dummies: ASEAN6 (for ASEAN six member countries excluding CLMV countries), Hong Kong, Japan, and Korea. We also include two extra-regional dummies: EU15 (for EU 15 original member countries) and NAFTA (for U.S., Canada, and Mexico).

We estimate the equation separately for exports and imports. For both exports and imports, we estimate the equation separately for all goods, non-manufactured goods, manufactured goods, final goods, and parts and components. Our data cover China's trade with 141 countries for the period

1992-2009. Except for GDPs, all explanatory variables are time invariant. In the fixed effects model, we cannot estimate time-invariant variables. Therefore, we estimate a random-effects model with the assumption of strict exogeneity and orthogonality between explanatory variables and the error term.

As has been argued in Santos Silva and Tenreyro (2006), estimating the log-linearized equation by least squares (OLS) might lead to biases when the presence of heteroskedacity is severe, though the gravity model is commonly used in estimating the pattern of international trade. Therefore, as an alternative, following Santos Silva and Tenreyro (2006)'s suggestion, we also estimate the gravity model in its multiplicative form, using a Poisson pseudo- maximum likelihood (PPML) estimator.

3.3. Estimation Results

Tables 4 and 5 report the results obtained by the random effects model and PPML model, respectively, for Chinese exports of various types of goods. The two model yield somewhat similar results in terms of signs and significance of estimates. As the PPML model is more consistent in the presence of heteroskedacity which is common in the gravity equation, we summary the results based on the PPML model.

There are four significant points to note about the results for Chinese exports. First, the estimated coefficients for China's GDP are positive and significant; a 10 percent increase in Chinese GDP is associated with a 7.3 percent increase in total Chinese exports (Column I of table 5). When total exports are divided into non-manufactured products and manufactured products, manufactured exports are more closely associated with China's GDP. Specifically, a 10 percent increase in Chinese GDP is associated with a 10.3 percent increase in Chinese exports of manufactured products (Column III), and a 2.9 percent increase in exports of non-manufactured products (Column II). This is in line with the widespread expectation that China will increasingly export more manufactured products as it grows.

Table 4 Determinants of Chinese Exports (Random Effects Model)

	I	II	III	IV	V
	Total	Non-manufacturing	Manufacturing	Final	Parts/ Components
lgdp_h	0.570***	0.559***	1.467***	1.463***	1.638***
	(0.091)	(0.072)	(0.038)	(0.039)	(0.059)
lgdp_p	0.323***	0.352***	0.244***	0.247***	0.354***
	(0.061)	(0.053)	(0.041)	(0.041)	(0.048)
ldistw	–0.390	–1.082***	–0.411	–0.372	–0.480*
	(0.249)	(0.244)	(0.259)	(0.260)	(0.273)
contig	1.468***	1.906***	1.443***	1.514***	1.066**
	(0.342)	(0.323)	(0.469)	(0.466)	(0.489)
landlocked	–0.955***	–1.789***	–1.091***	–1.096***	–0.979***
	(0.226)	(0.296)	(0.267)	(0.267)	(0.309)
EU_15	2.019***	1.644***	2.213***	2.198***	2.081***
	(0.327)	(0.278)	(0.257)	(0.250)	(0.325)
NAFTA	1.384***	1.360***	0.691**	0.654**	1.537***
	(0.403)	(0.369)	(0.318)	(0.318)	(0.382)
ASEAN_6	2.435***	2.510***	2.257***	2.159***	3.074***
	(0.350)	(0.320)	(0.331)	(0.333)	(0.374)
Japan	3.949***	3.695***	3.998***	4.003***	3.974***
	(0.705)	(0.693)	(0.951)	(0.977)	(0.730)
HK	3.689***	2.268**	3.958***	3.858***	5.003***
	(0.562)	(0.888)	(0.937)	(1.002)	(0.780)
Korea	3.273***	2.876***	3.067***	3.083***	3.338***
	(0.855)	(0.589)	(0.701)	(0.708)	(0.748)
Constant	–16.266***	–12.465***	–38.571***	–25.164***	–34.412***
	(3.652)	(3.095)	(2.840)	(2.846)	(3.293)
Number of Observations	2,506	2,435	2,508	2,508	2,483
R^2	0.664	0.643	0.677	0.674	0.690

Notes: Estimates are made with random effects model. Robust standard errors are in parentheses. ***, **, and * show 1%, 5%, and 10% significance, respectively. Year dummies are included but not shown for brevity.

Table 5 Determinants of Chinese Exports (PPML Model)

	I	II	III	IV	V
	Total	Non-manufacturing	Manufacturing	Final	Parts/ Components
lgdp_h	0.731***	0.286**	1.034***	0.980***	1.465***
	(0.126)	(0.140)	(0.139)	(0.140)	(0.133)
lgdp_p	0.667***	0.414***	0.410***	0.431***	0.291***
	(0.061)	(0.125)	(0.097)	(0.094)	(0.082)
ldistw	–0.380***	0.012	–0.409***	–0.402***	–0.409**
	(0.139)	(0.139)	(0.106)	(0.103)	(0.166)
contig	0.248*	1.075***	0.638***	0.688***	0.150
	(0.133)	(0.105)	(0.137)	(0.137)	(0.226)
landlocked	–0.492***	–1.353***	–0.674***	–0.687***	–0.455**
	(0.133)	(0.207)	(0.177)	(0.176)	(0.214)
EU_15	0.245	0.770**	1.020***	0.963***	1.424***
	(0.215)	(0.303)	(0.265)	(0.259)	(0.259)
NAFTA	1.047***	1.568***	2.323***	2.244***	2.805***
	(0.269)	(0.508)	(0.414)	(0.403)	(0.381)
ASEAN_6	1.081***	2.137***	0.976***	0.813***	1.979***
	(0.162)	(0.126)	(0.133)	(0.123)	(0.230)
Japan	0.894***	3.353***	1.636***	1.515***	2.521***
	(0.325)	(0.487)	(0.425)	(0.418)	(0.442)
HK	3.052***	3.165***	3.161***	2.978***	4.499***
	(0.171)	(0.253)	(0.215)	(0.209)	(0.380)
Korea	1.168***	3.297***	1.283***	1.180***	2.087***
	(0.348)	(0.307)	(0.296)	(0.291)	(0.396)
Constant	–27.211***	–14.553***	–28.949***	–14.270***	–27.015***
	(3.772)	(3.204)	(3.481)	(3.583)	(3.640)
Number of observations	2,529	2,529	2,529	2,529	2,529
Psuedo R^2	0.902	0.892	0.891	0.889	0.891

Notes: Estimates are made with Poisson Pseudo Maximum Likelihood (PPML) model. Robust standard errors are in parentheses. ***, **, and * show 1%, 5%, and 10% significance, respectively. Year dummies are included but not shown for brevity.

When exports of manufactured products are divided into final products and parts and components, we observe that their response to China's GDP is greater for parts and components (Columns IV and V).

Second, the estimated coefficient for partner countries' GDP is also positive, significant, and similar in size to that for China's GDP in the equation for total exports. A difference is that the size of coefficient for partner countries' GDP is similar irrespective of the types of exporting products.

Third, except for non-manufactured products, geographic distance appears to hamper Chinese exports, according to the estimates made by the PPML model. This is in contrast with the estimated results by the random effects model in which geographic distance yields statistically significant negative coefficient in the equation for non-manufactures. This may be the evidence that there is strong heteroskedacity in our gravity equation and the use of the PPML is preferred for the consistent inference.

Forth, China appears to export more to those countries which share the border, except for parts and components, whereas it exports less to the landlocked countries.

We now assess whether China's exports of parts and components is greater in East Asia, even after all possible natural and institutional causes of trade are controlled for. As shown in table 5, China exports more to ASEAN 6 countries, Japan, Hong Kong and Korea. It also exports more to EU 15 and NAFTA member countries. This finding remains stable for all different types of products in terms of the size of elasticity. Among the different groups of countries, Hong Kong appears the strongest partner for China's exports, especially for exports of parts and components. Specifically, China exports of total products (Column I) to Hong Kong are 2016% larger than what is expected for a similar economy.[4] This extremely large elasticity suggests that Hong Kong is China's 'special' trading partner being used as a transit port for China's exports. It is also noted that such a special partnership with East Asian countries and EU and NAFT member countries

[4] 2016% = (exp(3.052)–1) ·100.

is stronger for China's exports of parts and components than that of final products, suggesting that China is closely linked with these country groups in the international production network.

The results for Chinese imports are presented in tables 6 (random effects) and 7 (PPML). Based on the PPML results, we can summarize the following four major findings: First, the estimated coefficients for China's GDP are again positive and significant; a 10 percent increase in Chinese GDP is associated with a 7.4 percent increase in Chinese total imports (Column I of table 7), which is very similar to that for China's total exports (Column I of table 5). When total imports are divided into manufactured products and non-manufactured products, non-manufactured imports are more closely associated with China's GDP. Specifically, a 10 percent increase in China's GDP is associated with a 9.7 percent increase in Chinese imports of non-manufactured products (Column III), and a 6.8 percent increase in imports of manufactured products (Column II). When imports of final products and parts/components are estimated separately for manufactured products, we observe that part and components imports are more closely associated with China's GDP (Columns IV and V).

Second, the estimated coefficients for partner countries' GDP are also positive and significant, but the size of the coefficient is slightly smaller than that for China's GDP. When manufactured imports are divided into final products vs. parts and components, foreign income elasticity is smaller for parts and components.

Third, geographic distance has a statistically significant negative association with manufactured imports (both final and parts and components) but does not appear to be associated with non-manufactured imports of China. This finding is similar to that for China's exports. Thus, we have evidence that China's exports and imports of non-manufactured products are not significantly bounded by the geographic distance. This finding is also consistent with the finding that the contingency dummy variable does not yield any positive and significant coefficients irrespective of types of products in all import equations.

Table 6 Determinants of Chinese Imports (Random Effects Model)

	I	II	III	IV	V
	Total	Non-manufacturing	Manufacturing	Final	Parts/ Components
lgdp_h	1.113***	1.326***	0.779***	0.768***	1.060***
	(0.083)	(0.088)	(0.098)	(0.097)	(0.129)
lgdp_p	0.573***	0.377***	0.660***	0.658***	0.515***
	(0.061)	(0.054)	(0.074)	(0.077)	(0.079)
ldistw	–1.343***	–0.270	–2.276***	–2.479***	–1.885**
	(0.458)	(0.466)	(0.433)	(0.437)	(0.743)
contig	1.540***	2.709***	1.645***	1.595***	0.080
	(0.489)	(0.580)	(0.529)	(0.545)	(1.022)
landlocked	–0.656	–0.907*	–1.074**	–1.205***	–1.105*
	(0.440)	(0.540)	(0.444)	(0.462)	(0.651)
EU_15	2.509***	1.547***	4.169***	4.156***	6.259***
	(0.357)	(0.373)	(0.413)	(0.413)	(0.542)
NAFTA	1.126**	0.435	2.410***	2.323***	3.452***
	(0.489)	(0.503)	(0.582)	(0.590)	(0.860)
ASEAN_6	2.829***	3.773***	3.134***	2.683***	5.890***
	(0.507)	(0.591)	(0.576)	(0.558)	(1.062)
Japan	2.937***	3.275***	3.143***	2.725***	6.737***
	(0.887)	(0.948)	(0.827)	(0.826)	(1.282)
HK	1.787	0.850	1.997*	1.568	6.705***
	(1.249)	(1.432)	(1.191)	(1.165)	(1.470)
Korea	2.732***	4.042***	2.575**	2.108**	5.808***
	(1.058)	(1.189)	(1.051)	(1.044)	(1.829)
Constant	–29.681***	–41.677***	–15.928***	–0.133	–13.711*
	(4.796)	(4.832)	(4.981)	(4.901)	(7.997)
Number of Observations	2,384	2,223	2,259	2,192	1,750
R^2	0.603	0.455	0.624	0.623	0.568

Notes: Estimates are made with random effects model. Robust standard errors are in parentheses. ***, **, and * show 1%, 5%, and 10% significance, respectively. Year dummies are included but not shown for brevity.

Table 7 Determinants of Chinese Imports (PPML Model)

	I	II	III	IV	V
	Total	Non-manufacturing	Manufacturing	Final	Parts/ Components
lgdp_h	0.736***	0.970***	0.680***	0.620***	0.948***
	(0.122)	(0.105)	(0.155)	(0.150)	(0.193)
lgdp_p	0.671***	0.721***	0.604***	0.643***	0.415***
	(0.076)	(0.061)	(0.120)	(0.130)	(0.105)
ldistw	–0.347**	–0.053	–0.855***	–0.911***	–1.035***
	(0.155)	(0.216)	(0.171)	(0.160)	(0.323)
contig	0.163	0.344	–0.145	0.133	–2.091***
	(0.166)	(0.242)	(0.193)	(0.185)	(0.327)
landlocked	–0.535***	–1.150***	–0.083	–0.015	–0.324
	(0.146)	(0.238)	(0.224)	(0.250)	(0.222)
EU_15	–0.041	–2.345***	1.272***	1.272***	2.181***
	(0.267)	(0.226)	(0.342)	(0.354)	(0.373)
NAFTA	0.291	–0.953***	1.666***	1.595***	3.007***
	(0.322)	(0.321)	(0.455)	(0.482)	(0.470)
ASEAN_6	1.320***	0.577**	1.887***	1.452***	3.143***
	(0.185)	(0.251)	(0.192)	(0.170)	(0.342)
Japan	1.058***	–1.292***	1.777***	1.509***	3.039***
	(0.392)	(0.491)	(0.523)	(0.553)	(0.661)
HK	1.479***	–0.348	2.128***	1.724***	4.640***
	(0.272)	(0.368)	(0.312)	(0.273)	(0.617)
Korea	1.694***	0.138	1.990***	1.752***	2.826***
	(0.371)	(0.534)	(0.414)	(0.414)	(0.682)
Constant	–27.695***	–38.752***	–21.066***	–6.303	–10.523*
	(3.822)	(3.871)	(4.457)	(4.120)	(6.241)
Number of Observations	2,529	2,529	2,529	2,528	2,527
Psuedo R^2	0.858	0.712	0.889	0.885	0.894

Notes: Estimates are made with Poisson Pseudo Maximum Likelihood (PPML) model. Robust standard errors are in parentheses. ***, **, and * show 1%, 5%, and 10% significance, respectively. Year dummies are included but not shown for brevity.

Lastly, all the region/country dummy variables yield positive and significant coefficients in the equations for manufactured products, while in the equations for non-manufactured products, only the ASEAN-6 dummy variable yields a statistically significant positive coefficient, which seems consistent with the common wisdom. It is also interesting to note that the size of the coefficient for the regional dummy is greater for parts and components and for final products, which again supports the view that China is closely linked with these country groups in the international production network.

4. CONCLUDING OBSERVATIONS

The rapid integration of China into global production network has become an important feature of global trade, development, and production networks. While the literature contains a large number of studies which look at the issue of China's parts and components trade from the perspective of specific partner countries or industries, what is lacking is a more comprehensive study which gives the overall picture. In order fill this big gap in the literature, this paper has aimed to examine the characteristics of China's trade in terms of production sharing, and to provide a more complete description of China's trade in parts and components. We observed and analyzed China's parts and components trade at great depths, and then we used an augmented gravity model to identify its main determinants.

At a broader level, given the central importance of parts and components trade in China's trade, and given the central importance of trade in China's growth and development, we believe that our study can substantially deepen and broaden our understanding of China's trade, growth and development. More specifically, our study helps us to better understand the primary drivers of China's parts and components trade, and the structure of this trade — e.g., what are the most important product groups and which countries are most important trading partners.

In terms of empirical results, we found that the shares of parts and components in China's exports and imports have grown very rapidly. Their share in China's imports is much higher than the world average level. In contrast, their share in China's exports is far below the world level even though it increased until the mid 2000s. Indeed, China's imports of parts and components far exceed its exports, confirming China's role as a major world production center. The data also indicate that 'electrical machinery and apparatus (SITC 77)' is a pivotal sector in China's parts and components trade, accounting for a large share of both exports and imports.

We also find that China's parts and components trade has a relatively high degree of regional concentration. ASEAN, Japan, Korea, EU and NAFTA are China's major trading partners. Another finding is that China's trade linkages with these countries, in terms of imports, are stronger for parts and components than for final goods, suggesting that the view that China is closely linked with these country groups in the international production network.

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