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Working Paper

The Role of the People's Republic of China in International Fragmentation and Production Networks: An Empirical Investigation

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ADB Working Paper Series on Regional Economic Integration



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No. 87 | September 2011



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Hyun-Hoon Lee⁺, Donghyun Park⁺⁺,
and Jing Wang⁺⁺⁺

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Abstract

Despite the central role of the People's Republic of China (PRC) in global parts and components trade, most previous studies on the PRC's parts and components trade have been limited to a particular trade partner or some specific industries. The central objective of this paper is to provide a more complete description of the PRC's parts and components trade. To do so, we systematically separate total trade flows into parts and components and final goods, and give a description of the pattern of parts and components trade for the period 1992–2009. We then estimate a gravity model to examine the determinants of the PRC's trade in parts and components. We find that the share of parts and components trade in the PRC's total trade has grown rapidly.

Keywords: People's Republic of China, PRC, parts and components trade, fragmentation, production network

JEL Classification: F14, F21, F23

1. Introduction

The stunning rise of the PRC as a globally influential economic power since its opening in 1978 closely parallels its equally impressive rise as a globally significant trading power. Trade has been the primary channel through which the PRC has been transformed from a closed autarkic economy to an open globalized one. Much of the PRC's trade, in turn, is driven by its central role—as the “Factory of the World”—in international production networks that are based on cross-border flows of parts and components culminating in their assembly into final products. Such flows have been particularly prominent in the PRC's trade with its neighbors, and the resulting regional production network has consolidated East Asia's status as the world's manufacturing hub. At a broader level, the central objective of this paper is to provide a comprehensive analysis of the PRC's trade in parts and components. Such an analysis would significantly increase understanding of the PRC's foreign trade and—by extension—its rapid growth and development.

International production fragmentation refers to the cross-border dispersion of components' production and assembly within vertically integrated production processes, with each country specializing in a particular stage of the production sequence. This process has become an important feature of the world economy (Athukorala and Yamashita 2006). In particular, the PRC's rapid growth and development is related to its growing participation in international production networks. The role of the PRC as a globally significant assembly and production center is deepening its integration into the world economy and facilitating the greater fragmentation of production across countries in East Asia.

There have been many studies confirming the existence of well-established East Asian intra-industry production networks. Such studies have also found that the PRC's increasing integration into the world economy has facilitated the greater fragmentation of production across Asian countries. Despite the central role of the PRC in the regional parts and components trade, there has been no comprehensive study on the topic and most previous studies of the PRC's parts and components trade have been limited to a particular trading partner or specific industries. To address this shortcoming, we seek to give a more complete description of the PRC's parts and components trade. More specifically, we aim to

- i. comprehensively document the magnitude of the PRC's participation in international production networks and its changing over time,
- ii. identify the position of the PRC in international production networks and the PRC's major trading partners in the parts and components trade, and
- iii. examine the various factors that affect the PRC'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 the parts and components trade of the PRC during 1992–2009. We then estimate the gravity model augmented with regional dummy

variables to examine the determinants of the PRC's trade in parts and components, and to assess the extent of the PRC's trade in parts and components with other East Asian countries.

The paper is organized as follows. Section 2 provides an overview of recent literature to explain the concepts of international production fragmentation. This section also reviews the literature relating to the PRC in the international fragmentation of production. After presenting the scope and sources of the data that we use, Section 3 analyzes the structure of the PRC's parts and components trade. Using the gravity equations, Section 4 presents the determinants of the PRC's trade in parts and components, as compared with the PRC's total trade, manufactured goods trade, and non-manufactured goods trade. Finally, Section 5 summarizes the main findings and concludes the paper.

2. Literature Review

In this section, we review the literature on the concept of international production fragmentation, including literature that looks specifically at the PRC.

2.1. Production Sharing in the World

A lot of research has been conducted on international production sharing since the 1980s. This phenomenon can be described at both the macro and micro levels. From the microeconomic point of view, most intra-industry trade is based on global production sharing on the part of multinational enterprises (MNEs). These firms' production processes have become internationally fragmented as the assembly line has been replaced by different forms of flexible production located in different countries. The various stages of production correspond to different functions and break up the production process into standardized units. This vertical division of production is driven by gains from specialization. From a macro point of view, a country tends to specialize in the individual segments of production in which it has a comparative advantage.

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, 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.²

The above-mentioned studies have focused on four major aspects. The first aspect concerns the extent of international fragmentation of production: which countries are trading in parts and components (and how much) with which other countries? The second concerns the causes of international fragmentation of production: what drives the parts and components trade? The third concerns the economic effects of international fragmentation: specifically, the impact on (i) the overall welfare of trading partners, (ii) factor prices, (iii) the technological level of participating countries, and (iv) income inequality in developed countries. The fourth aspect of the literature is concerned with the role of each country in international production networks and the parts and components trade, and their implications for regional economic integration and cooperation.

The present study is concerned with the first, second, and fourth aspects.

2.2. The People's Republic of China's Role in Production Sharing

As mentioned earlier, there has been no comprehensive study of the PRC's parts and components trade, and most existing studies only focus on a particular trading partner or specific industries.

Amighini (2005) found empirical evidence that during the 1990s the PRC increased its market share in the parts and components trade of information communications technology (ICT) products to rank among the top three ICT exporters in the world. Athukorala and Yamashita (2008) paid attention to global production sharing in their analysis of the United States (US)–PRC trade deficit. They highlighted the two countries' evolving roles in global production networks and separated trade in parts and components, and trade in final goods for the machinery industry. Salleh and Rene (2009) assessed the impact of the PRC's rapid economic growth on machines and telecommunications equipment. Analysis of import trends into the US established that the PRC had affected the export performance of ASEAN5 countries.³ Dean, Loverly, and Mora (2009) examined the pattern of trade between the PRC and its two largest trading partners, Japan and the US, 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 for foreign-invested enterprises.

Athukorala (2005, 2009a, 2009b, and 2010) analyzed East Asian export performance and found evidence of the PRC's rise as a global player in the machinery parts and components trade. Kim, Lee, and Park (2010) investigated changes in Asia's regional and global trade linkages, and their influence on relationships among Asia, the EU, and

¹ We will use the above-mentioned terms interchangeably to describe the phenomenon of trade in parts and components.

² ASEAN5 comprises Indonesia, Malaysia, Philippines, Singapore, and Thailand.

the US. They found that the PRC plays a critical role as an assembly and production center in rapidly expanding intra-Asian trade. However, the PRC's share in the parts and components trade involving Europe and the US is also rising, suggesting that East Asia's production chains are becoming increasingly integrated into the global business network.

In summary, the literature finds that the PRC plays an important role in the world's parts and components trade. However, most previous studies are limited to specific industries and the PRC's relationships with specific countries and regions.

In this paper, we look at the role of international processing activities in the PRC's trade—or equivalently, the PRC's role as an assembly and production center—from a macro viewpoint. The PRC's integration into the world economy is one of the most important developments of the global trading system. Specifically, the rapid growth of trade in parts and components is the direct result of the expansion of global production networks. It is thus necessary to give a comprehensive description of the rapid growth of the PRC's trade in parts and components.

3. Structure of the Parts and Components Trade

In this section, we examine the structure of the PRC's parts and components trade. We first look at the overall structure—total parts and components exports, and their share in the PRC's total exports—and then the specific structure—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.

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

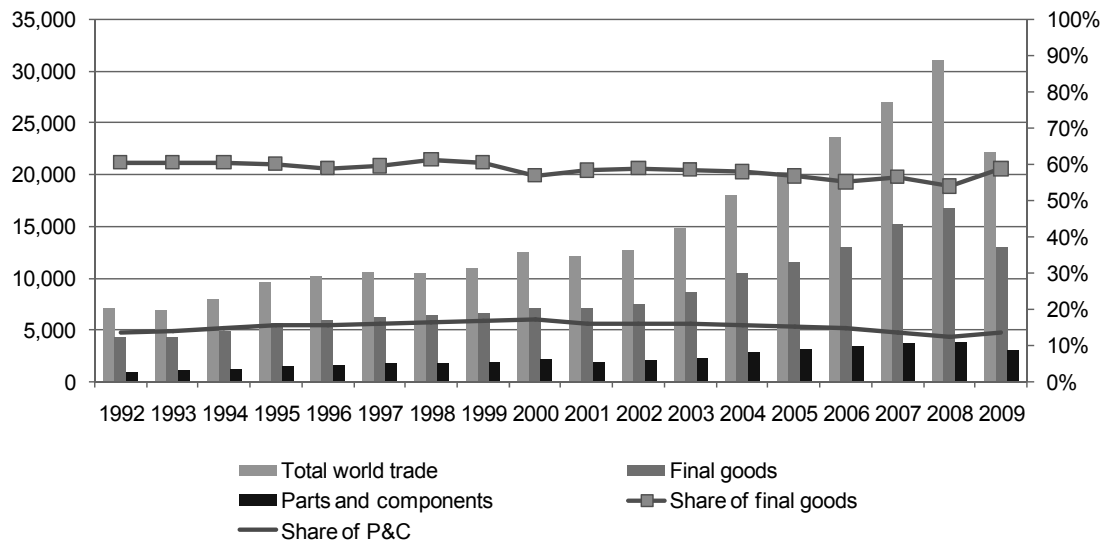
Data from the UN Comtrade database were utilized, based on Revision 3 of the SITC. SITC Revision 3 marks a significant improvement over SITC Revisions 2 and 1. Apart from providing comprehensive coverage of parts and components in SITC 5 (chemicals and related products), SITC 6 (manufactured goods classified 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, or 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 United Nations (UN) Comtrade database for 1992–2009.

In order to give a complete and comprehensive description of the PRC's international production fragmentation and networks, we selected 144 trade partners of the PRC as a cross-section sample. We also look at a few main regions as regional cross-sections: East Asia, which includes Japan; the Republic of Korea; and Hong Kong, China; and the ASEAN6,⁴ NAFTA, and the EU15.⁵

³ Indonesia, Malaysia, Philippines, Thailand, Singapore, and Viet Nam.

Figure 1: World Trade in Parts and Components
(\$ billion)



P&C = parts and components.

Source: Data calculated from UN Comtrade database.

World trade in parts and components and in final goods both show simultaneous growth with total world trade (Figure 1). World trade in parts and components increased more than 3.2 times from about \$961 billion in 1992 to nearly \$3,845 billion in 2008. After the onset of the global economic crisis in 2008, it then decreased to \$3,036 billion in 2009. Parts and components accounted for around 15% of total world trade and did not fluctuate much during 1992–2009. Final goods trade increased 3.1 times from about \$4,258 billion in 1992 to \$16,655 billion in 2008. The share of final goods in total world trade was stable at around 55% throughout the sample period.

3.2. Overall Structure of the People's Republic of China's Trade in Parts and Components

Until the global economic crisis of 2008/09, the PRC's parts and components trade had been increasing steadily in parallel with its total trade since the early 1990s; the PRC's trade of parts and components increased nearly 24 times from about \$16 billion in 1992 to nearly \$430 billion in 2008. In 1992 parts and components accounted for less than 10% of the PRC's total trade, but its share experienced a secular rise until 2006, when it peaked at 21%. However, there was a sharp fall in 2007 and no significant recovery in the next 2 years. The PRC's trade in final goods increased nearly 12 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 74% in 1994 to 63% in 2006. The share

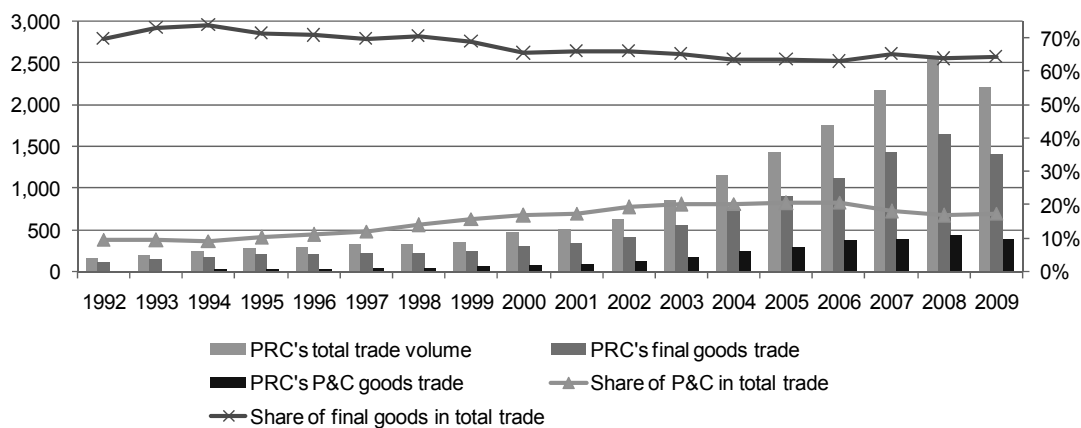
⁴ Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden, and the United Kingdom.

recovered modestly in 2007, but fell again after the 2008/09 global economic crisis (Figure 2). The overall trend of convergence between the share of parts and components and the share of final goods supports the notion of the PRC as an assembly and production center.

Comparing the PRC's parts and components trade with the world average, the share of parts and components as a portion of PRC trade flows grew very rapidly for both exports and imports between 1992 and 2009. As a result, the share of parts and components in the PRC's imports was much higher than the world average in 2009. For the PRC's exports, the share of parts and components was far lower than the world average in the early 1990s but it subsequently rose to reach the world average in 2004 (Figure 3).

We now look at the share of parts and components versus final goods in the PRC's exports and imports. Final goods dominated the PRC's exports throughout the sample period. In 1992 final goods accounted for 73.8% of the PRC's exports, rising to reach 80.8% by 2009. The share of parts and components in the PRC's exports also increased, from 4.9% in 1992 to 12.8% in 2009. The pattern for imports was somewhat different from that of exports. The gap between the share of final goods imports and the share of parts and components imports narrowed during 1992–2009. The share of final goods as a portion of total PRC imports increased to 70.9% in 1994, but had fallen to 44.5% by 2009. The share of parts and components steadily increased to 27.9% by 2006, but decreased somewhat in subsequent years (Figure 4).

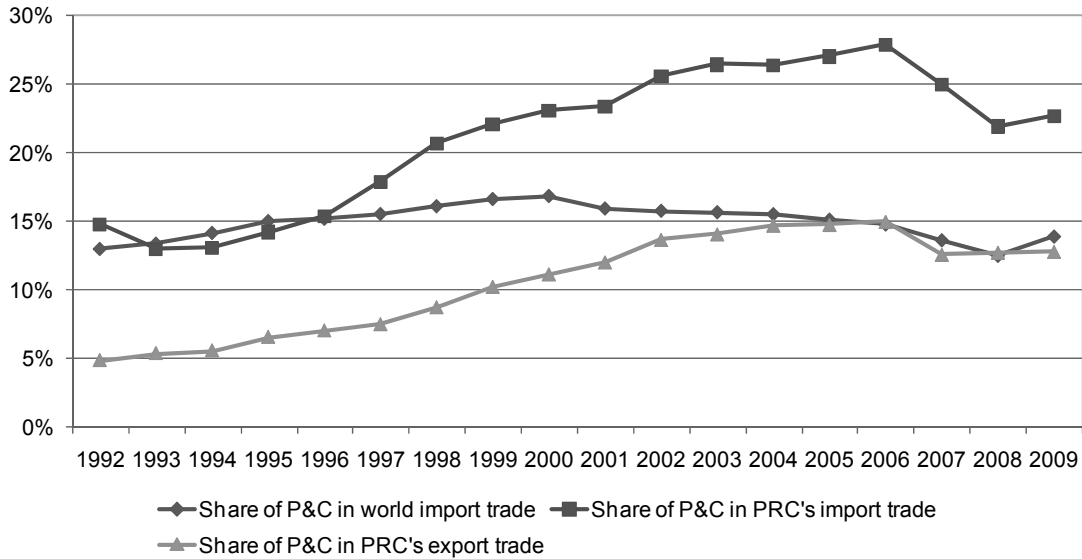
Figure 2: The People's Republic of China's Trade in Parts and Components
(\$ billion)



PRC = People's Republic of China, P&C = parts and components.

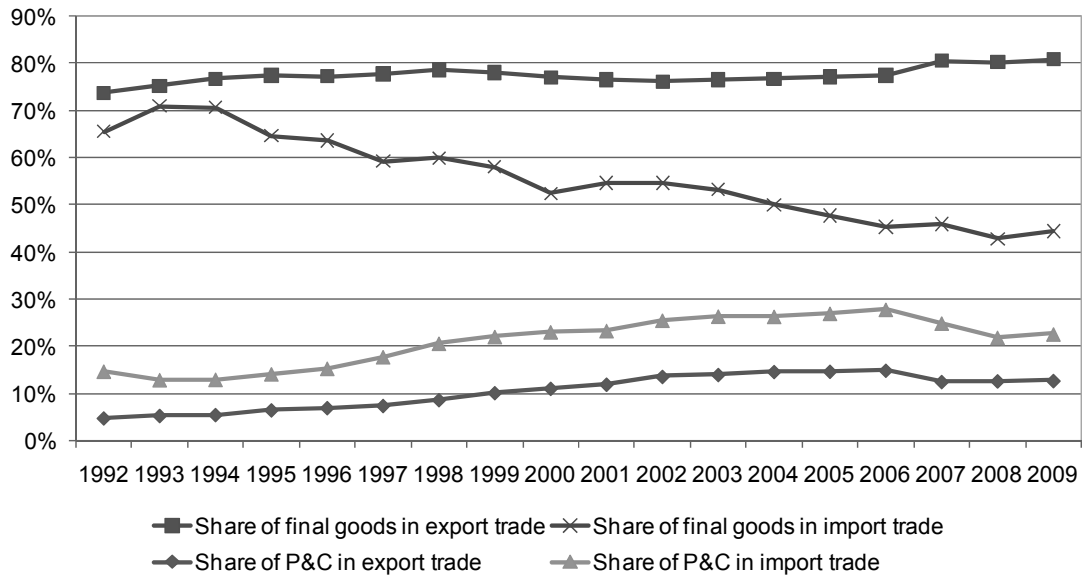
Source: Data calculated from UN Comtrade database

Figure 3: Parts and Components Trade as a Share of Total Trade—The People’s Republic of China and the World Average



PRC = People’s Republic of China, P&C = parts and components.
 Source: Data calculated from UN Comtrade database.

Figure 4: The People’s Republic of China’s Exports and Imports—Parts and Components vs. Final Goods



PRC = People’s Republic of China, P&C = parts and components.
 Source: Data calculated from UN Comtrade database.

Furthermore, we found that the share of final goods in exports (averaging 77.4%) was consistently larger than its share in imports (averaging 55.7%). In contrast, the share of parts and components in the PRC's imports (averaging 21.1%) was larger than its share in exports (averaging 10.5%).

The overall trends suggest that the PRC has become a global production center, importing components and exporting finished products. The rapid growth of the PRC's parts and components exports indicates that the country has also become an increasingly important global supply base for parts and components.

3.3. Structure of the People's Republic of China's Parts and Components Trade

The definition of parts and components includes four main SITCs: 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 each display different characteristics.

As Tables 1a and 1b show, the parts and components that the PRC exports and imports are primarily machinery and transport equipment (SITC 7), chemicals and related products (SITC 5), manufactured goods classified chiefly by material (SITC 6), and miscellaneous manufactures articles (SITC 8).

The share of SITC 7 parts and components in the PRC's total exports increased from 3.8% to 13.9% between 1992 and 2006, but then fell in 2007. Similarly, the share of parts and components in the PRC'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 the PRC's trade in the three other aforementioned SITCs is much smaller. The share of parts and components in the PRC'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%. For SITC 5 exports, the share of parts and components dropped from 0.9% to 0.4%.

In the context of imports, parts and components hold a dominant position for SITC 7. The share of parts and components in the PRC's SITC 8 imports fell sharply from 20.2% to 6.8% between 1992 and 2009. However, the export value of SITC 8 parts and components exceeded the import value, although the export share of parts and components trade was lower than the import share. This reflects the fact that the PRC is a major exporter of SITC 8 finished products. For SITC 5 and SITC 6, the export and import shares of parts and components show similar trends, with both SITCs accounting for relatively small shares of the PRC's parts and components imports.

Table 1a: The People's Republic of China's Export Trade in Parts and Components
(\$ billion)

Year	Total Export Volume of the PRC	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 Total Exports (%)	Export Value P&C SITC 5	Share in Total Exports (%)	Share in SITC 5 (%)	Export Value P&C SITC 6	Share in Total Exports (%)	Share in SITC 6 (%)	Export Value P&C SITC 7	Share in Total Exports (%)	Share in SITC 7 (%)	Export Value P&C SITC8	Share in Total Exports (%)	Share in SITC 8 (%)
1992	84.94	4.13	4.9	0.04	0.0	0.9	0.31	0.4	1.9	3.21	3.8	24.3	0.58	0.7	1.7
1993	91.74	4.94	5.4	0.03	0.0	0.6	0.32	0.4	2.0	3.99	4.4	26.1	0.60	0.7	1.6
1994	121.01	6.76	5.6	0.05	0.0	0.9	0.48	0.4	2.1	5.37	4.4	24.5	0.85	0.7	1.7
1995	148.78	9.79	6.6	0.13	0.1	1.4	0.59	0.4	1.8	8.16	5.5	26.0	0.91	0.6	1.7
1996	151.05	10.65	7.1	0.06	0.0	0.6	0.63	0.4	2.2	9.11	6.0	25.8	0.85	0.6	1.5
1997	182.79	13.73	7.5	0.07	0.0	0.7	0.77	0.4	2.2	11.79	6.5	27.0	1.08	0.6	1.6
1998	183.81	16.07	8.7	0.07	0.0	0.7	0.83	0.5	2.6	13.81	7.5	27.5	1.35	0.7	1.9
1999	194.93	19.96	10.2	0.78	0.0	0.7	0.89	0.5	2.7	17.76	9.1	30.2	1.24	0.6	1.7
2000	249.20	27.80	11.2	0.78	0.0	0.6	1.09	0.4	2.6	25.22	10.1	30.5	1.42	0.6	1.7
2001	266.10	32.02	12.0	0.94	0.0	0.6	1.18	0.4	2.7	29.29	11.0	30.9	1.47	0.5	1.7
2002	325.60	44.59	13.7	0.12	0.0	0.6	1.40	0.4	2.6	41.36	12.7	32.6	1.71	0.5	1.7
2003	438.23	61.75	14.1	0.18	0.0	0.6	1.73	0.4	2.5	57.50	13.1	30.6	2.40	0.6	1.9
2004	593.33	87.36	14.7	0.24	0.0	0.7	2.47	0.4	2.5	81.15	13.7	30.3	3.57	0.6	2.3
2005	761.95	112.63	14.8	0.23	0.0	0.7	3.35	0.4	2.6	105.00	13.8	29.8	4.47	0.6	2.3
2006	968.94	145.35	15.0	0.34	0.0	0.8	4.45	0.5	2.5	135.00	13.9	29.6	5.29	0.5	2.2
2007	1220.06	153.59	12.6	0.40	0.0	0.7	5.82	0.5	2.6	140.24	11.5	24.3	7.01	0.6	2.4
2008	1430.69	182.27	12.7	0.34	0.0	0.4	6.75	0.5	2.6	166.05	11.6	24.6	9.37	0.7	2.8
2009	1201.65	153.38	12.8	0.28	0.0	0.5	6.05	0.5	3.3	139.00	11.6	23.5	8.05	0.7	2.7

PRC = People's Republic of China, P&C = parts and components, SITC = Standard International Trade Classification.

Source: Data calculated from UN Comtrade database.

Table 1b: The People's Republic of China's Import Trade in Parts and Components
(\$ billion)

Year	Total Import volume of the PRC	Import of P&C		Import of P&C in SITC5			Import of P&C in SITC6			Import of P&C in SITC 7			Import of P&C in SITC8		
		Import value of P&C	Share of P&C in total import (%)	Import value P&C SITC5	Share in total Imports (%)	Share in SITC5 (%)	Import value P&C SITC6	Share in total Imports (%)	Share in SITC6 (%)	Import value P&C SITC7	Share in total Imports (%)	Share in SITC7 (%)	Import value P&C SITC8	Share in total Imports (%)	Share in SITC8 (%)
1992	84.94	11.90	14.8	0.22	0.3	2.0	0.47	0.6	2.4	10.10	12.5	32.8	1.12	1.4	20.2
1993	91.74	13.49	13.0	0.34	0.3	3.5	0.50	0.5	1.8	11.51	11.8	25.8	1.14	1.1	18.3
1994	121.01	15.06	13.0	0.39	0.3	3.3	0.59	0.5	2.1	12.93	11.2	25.1	1.14	1.0	17.0
1995	148.78	18.76	14.2	0.43	0.3	2.5	0.70	0.5	2.4	16.36	12.4	31.1	1.26	0.9	15.5
1996	151.05	21.34	15.4	0.45	0.3	2.5	0.72	0.5	2.3	18.88	13.6	34.5	1.30	0.9	15.5
1997	182.79	25.39	17.8	0.43	0.3	2.2	0.77	0.5	2.4	22.79	16.0	43.2	1.39	1.0	16.3
1998	183.81	29.00	20.7	0.40	0.3	2.0	0.81	0.6	2.6	26.33	18.8	46.3	1.45	1.0	17.2
1999	194.93	36.62	22.1	0.42	0.3	1.7	0.93	0.6	2.7	33.82	20.4	48.7	1.44	0.9	14.9
2000	249.20	52.00	23.1	0.41	0.2	1.4	1.16	0.5	2.8	48.75	21.7	53.0	1.68	0.8	13.2
2001	266.10	56.92	23.4	0.42	0.2	1.3	1.30	0.5	3.1	53.56	22.0	50.0	1.64	0.7	10.9
2002	325.60	75.43	25.6	0.45	0.2	1.2	1.77	0.6	3.7	71.30	24.2	52.0	1.91	0.7	9.7
2003	438.23	109.06	26.4	0.48	0.1	1.0	2.56	0.6	4.0	103.00	24.9	53.4	2.65	0.6	8.0
2004	593.33	148.02	26.4	0.54	0.1	0.8	3.40	0.6	4.6	141.00	25.1	55.8	3.36	0.6	6.7
2005	761.95	178.38	27.0	0.59	0.1	0.8	3.87	0.6	4.8	170.00	25.8	58.5	3.60	0.5	5.9
2006	968.94	220.56	27.9	0.64	0.1	0.7	4.77	0.6	5.5	211.00	26.7	59.1	4.12	0.5	5.8
2007	1220.06	238.50	24.9	0.66	0.1	0.6	5.66	0.6	5.5	227.31	23.8	55.1	4.88	0.5	5.6
2008	1430.69	248.23	21.9	0.66	0.1	0.6	6.08	0.5	5.7	235.46	20.8	53.3	6.03	0.5	6.2
2009	1201.65	227.80	22.7	0.57	0.1	0.5	5.46	0.5	5.1	216.02	21.5	52.9	5.75	0.6	6.8

PRC = People's Republic of China, P&C = parts and components, SITC = Standard International Trade Classification.

Source: Data calculated from UN Comtrade database.

Tables 2a and 2b make use of the United Nations (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 the PRC's trade. The tables describe each item and provide their respective value and share 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 the PRC'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. SITC 7 accounts for a high proportion of both exports and imports throughout the sample period. This suggests that trade in SITC 7 parts and components plays a major role in the PRC's participation in international production networks.

Within SITC 7, the most important 2-digit product codes are office machinery (SITC 75), telecommunication and sound equipment (SITC 76), and electrical machinery and apparatus (SITC 77). In 2006, SITC 75, 76, and 77 accounted for 23.9%, 21.7%, and 31.9% of the PRC's parts and components imports, respectively, and 8.9%, 11.4%, and 65.1% of parts and components exports, respectively.

Taking a closer look, electrical machinery and apparatus (SITC 77) accounted for the largest share of the PRC's parts and components trade. SITC 77's share in imports and exports of parts and components reached 85.4% and 40.4%, respectively, in 2009.

The parts and components trade in SITC 6 (62, 65, 66, and 69) and SITC 8 (81, 82, 87, and 88) increased significantly between 1992 and 2009, although their shares of the PRC's total parts and components trade remained relatively small.

Table 2a: Percentage of Parts and Components in the People's Republic of China's Exports by 2-Digit SITC Categories

SITC code	Product	1992		1999		2006		2009	
		\$ million	%	\$ million	%	\$ million	%	\$ million	%
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 manufactures	28.1	0.7	168.8	0.8	975.7	0.7	1,357.0	0.9
69	Metals manufactures	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	139,003.1	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
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	61,899.7	40.4
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 and clocks	333.3	8.1	511.9	2.6	1,868.9	1.3	1,997.5	1.3
89	Miscellaneous manufactured articles	113.1	2.7	231.4	1.2	648.7	0.4	1,228.0	0.8
P&C	Total	4,134.2	100	19,955.1	100	145,374.0	100	153,380.1	100

Note: Tables 2a uses 5-digit Standard International Trade Classification (SITC) parts and components (P&C) items aggregated at the 2-digit level.

Source: Data calculated from UN Comtrade database.

Table 2b: Percentage of Parts and Components in the People's Republic of China's Imports by 2-Digit Categories

SITC code	Product	1992		1999		2006		2009	
		\$ million	%	\$ million	%	\$ million	%	\$ million	%
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 manufactures	22.2	0.2	114.4	0.3	894.1	0.4	917.6	0.4
69	Metals manufactures	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	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 and clocks	662.5	5.6	911.1	2.5	1,663.7	0.8	1,813.3	0.8
89	Miscellaneous manufactured articles,	150.8	1.3	74.8	0.2	170.8	0.1	242.1	0.1
P&C	Total	11,902.5	100	36,616.3	100	220,558.0	100.0	227,798.2	100

Note: Table 2b uses 5-digit Standard International Trade Classification (SITC) parts and components (P&C) items aggregated at the 2-digit level.

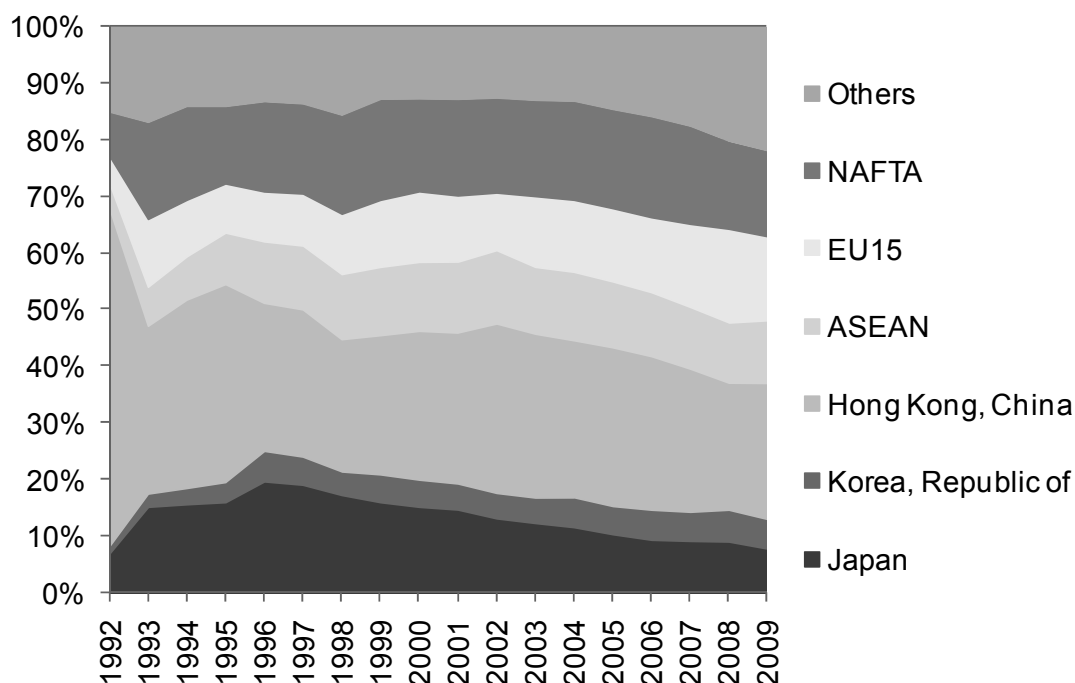
Source: Data calculated from UN Comtrade database.

3.4. The People's Republic of China's Parts and Components Trade—Destination and Source Countries

The export destination countries and import source countries of the PRC's parts and components trade are heavily concentrated (Figures 5 and 6; Tables 3a and 3b). The PRC's most important trading partners for parts and components are Japan; the Republic of Korea; Hong Kong, China; ASEAN; the EU15; and NAFTA. NAFTA and Hong Kong, China are the main destinations for the PRC's exports, while Japan and ASEAN are the main sources of imports. Meanwhile, the shares of imports accounted for by Hong Kong, China and Japan fell sharply between 1992 and 2009. In contrast, the shares of ASEAN countries and the Republic of Korea rose significantly over the same period. Hong Kong, China, which is the most important destination for the PRC's parts and components exports, is not a significant source of the PRC's imports.

The PRC'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 during 1992–2009 for both imports and exports to reach substantial levels. This trend suggests that the PRC's parts and components trade is an integral part of increasingly globalized production networks.

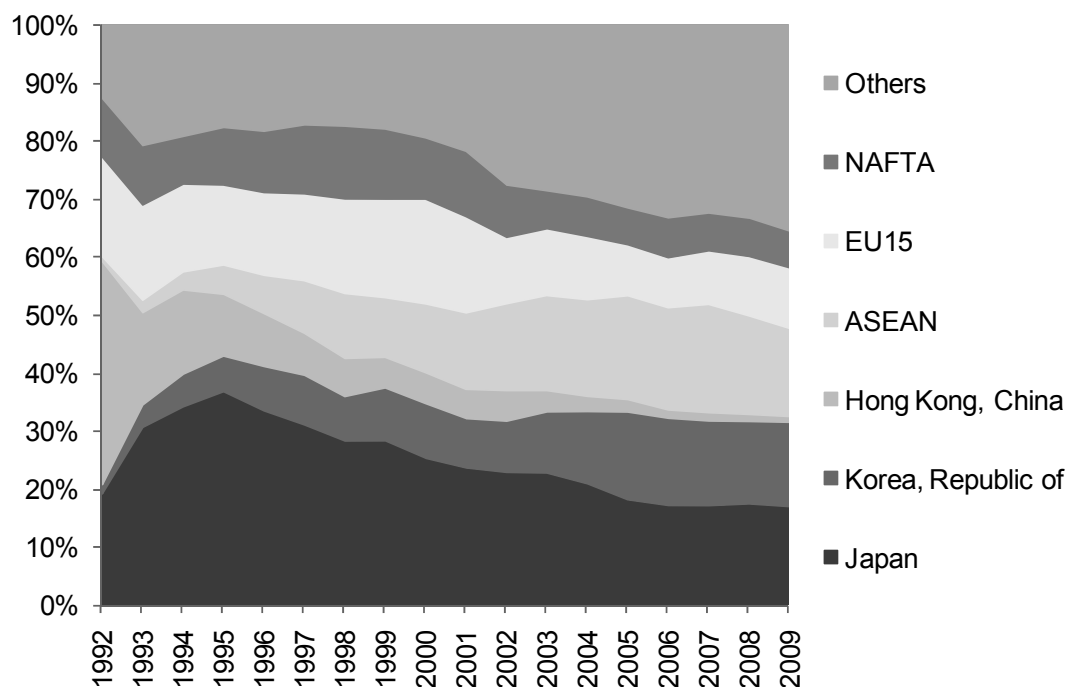
Figure 5: Export Destination Countries for the Parts and Components Trade of the People's Republic of China



ASEAN = Association of Southeast Asian Nations, EU = European Union, NAFTA = North American Free Trade Area, PRC = People's Republic of China.

Source: Data calculated from UN Comtrade database.

Figure 6: Import Source Countries for the Parts and Components Trade of the People's Republic of China



ASEAN = Association of Southeast Asian Nations, EU = European Union, NAFTA = North American Free Trade Area, PRC = People's Republic of China.

Source: Data calculated from UN Comtrade database.

Table 3a: The People's Republic of China's Parts and Components Export Share by Major Trading Partners and Regions

Reporting Country or Region	1992		1999		2006		2009	
	\$ million	%	\$ million	%	\$ million	%	\$ million	%
Japan	292.5	7.1	3221.7	16.1	13,779.8	9.5	12,226.4	7.9
Republic of Korea	53.5	1.3	978.5	4.9	7,730.6	5.3	8,038.1	5.3
Hong Kong, China	2,465.1	59.6	4,887.5	24.5	39,227.0	27.0	36,735.0	24.0
ASEAN6	192.3	5.5	2,428.3	12.2	16,536.2	11.4	17,132.2	11.2
NAFTA	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
Total	3,515.0	85.8	17,427.9	87.3	122,378.7	84.2	120,208.9	78.4
World	4,134.2	100	19,955.1	100	145,374.0	100	153,380.1	100

ASEAN = Association of Southeast Asian Nations, EU = European Union, NAFTA = North American Free Trade Area.
Source: Data calculated from UN Comtrade database.

Table 3b: The People's Republic of China's Parts and Components Import Share by Major Trading Partners and Regions

Reporting Country or Region	1992		1999		2006		2009	
	\$ million	%	\$ million	%	\$ million	%	\$ million	%
Japan	2,284.1	19.2	10,387.0	28.7	37,879.6	17.2	38,688.7	17.0
Republic of 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
NAFTA	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
Total	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

ASEAN = Association of Southeast Asian Nations, EU = European Union, NAFTA = North American Free Trade Area.
Source: Data calculated from UN Comtrade database.

4. The Determinants of the People's Republic 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 the PRC'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—manufactured goods, non-manufactured goods, and final goods—for comparative purposes.

4.1. 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 (i.e., gross domestic product [GDP]) and inversely related to the distance between them. The gravity equation has enjoyed widespread empirical success. 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).⁶ Therefore, it possesses “more theoretical foundation than any other trade model” (Baldwin 2006).

⁵ Harrigan (2001) and Anderson and van Wincoop (2003) provide a comprehensive review of the literature on the theoretical foundations for the gravity model. Baier et al. (2007) address the potential problems in estimating the gravity model to isolate the effects of a free trade agreement on bilateral trade.

The standard gravity equation takes the following form:

$$\text{LnXM}_{ijt} = \alpha + \beta_1 \text{LnGDP}_{it} + \beta_2 \text{LnGDP}_{jt} + \beta_3 \text{LnDIST}_{ij} + \varepsilon_{ijt},$$

where

LnXM_{ijt} = log of export (or import) flows from country i to country j at time t

LnGDP_{it} = log of GDP of country i at time t

LnGDP_{jt} = log of GDP of country j at time t

LnDIST_{ij} = log of geographical distance between country i and country j

ε_{ijt} = random disturbance term

4.2. The Augmented Gravity Equation for the People's Republic of China's Trade in Parts and Components

Based on the equation above, dummy variables are introduced for countries sharing a common border, countries surrounded by land, and language commonality. We also include a dummy variable for World Trade Organization (WTO) member countries and another dummy variable to take into account the PRC's bilateral and sub-regional free trade agreements (FTAs):

$$\text{LnXM}_{ijt} = \alpha + \beta_1 \text{LnGDP}_{it} + \beta_2 \text{LnGDP}_{jt} + \beta_3 \text{LnDIST}_{ij} + \beta_4 \text{CONTIG}_{ij} + \beta_5 \text{LANDLOCKED}_{ij} + \beta_6 \text{COMLANG}_{ij} + \beta_7 \text{WTO}_{jt} + \beta_8 \text{FTA}_{ijt} + u_i + u_t + \varepsilon_{ijt},$$

where

LnXM : bilateral trade (total manufactured goods or parts and components under SITC5, SITC6, SITC 7, and SITC 8)

LnGDP_{it} = log of GDP of country i (PRC) at time t

LnGDP_{jt} = log of GDP of country j at time t

LnDIST_{ij} = log of geographical distance between country i (PRC) and country j

$\text{CONTIG}_{ij} = 1$ if economy i (PRC) and economy j share the same border

$= 0$ otherwise

$\text{LANDLOCKED}_j = 1$ if economy j is a landlocked economy

$= 0$ otherwise

$\text{COMLANG}_{ij} = 1$ if economy i (PRC) and economy j share the same language

$= 0$ otherwise

$\text{WTO}_{jt} = 1$ if economy j is a WTO member at time t

$= 0$ otherwise

$\text{FTA}_{ijt} = 1$ if economy i (PRC) and economy j are members of a bilateral or sub-regional

FTA at time t

$= 0$ otherwise

Various regional dummies may also be included.

We estimate the equation separately for imports and exports. For both imports and exports, we again estimate the equation separately for all goods, manufactured goods, non-manufactured goods, final goods, and parts and components.

Our data cover the PRC's trade with 144 countries during 1992–2007. The augmented gravity model is first estimated using the most common fixed effects procedure to account for time-invariant partner country fixed effects. We also include year dummies to take account of factors such as world business cycles and global financial shocks. In the fixed effects model, we cannot estimate time-invariant variables such as distance and regional dummies. Therefore, as an alternative, we also estimate a random effects model with the assumption of strict exogeneity and orthogonality between explanatory variables and the error term.

4.3 Estimation Results

Tables 4 and 5 report the results obtained from the fixed effects model for the PRC's exports and imports of various types of goods, respectively.

There are four significant points to note about the results in Table 4. First, the estimated coefficients for the PRC's GDP are positive and significant; a 10% increase in the PRC's GDP is associated with a 15% increase in total exports (Column I). When total exports are divided into manufactured products and non-manufactured products, manufactured exports are more closely associated with the PRC's GDP. Specifically, a 10% increase in the PRC's GDP is associated with a 16% increase in the export of manufactured products (Column II) and an 8% increase in the export of non-manufactured products (Column III). This contradicts the widespread expectation that the PRC will increasingly export more manufactured products as it grows. When exports of manufactured products are divided into final products and parts and components, we observe that their response to the PRC's GDP growth is about the same for both types of manufactured products (Columns IV and V).

Second, the estimated coefficients for partner countries' GDP are also positive and significant, in line with theoretical predictions. More precisely, a 10% increase in partner countries' GDP is associated with a 10% increase in the PRC's total exports. Furthermore, the foreign income elasticity of PRC exports is greater for manufactured products than for non-manufactured products, and greater for parts and components than for final products.

Third, the results indicate that the PRC exports more to WTO members than to non-members. Specifically, the PRC exports 39% more to WTO members than to non-members.⁷ The WTO membership effect is greater for non-manufactured products than for manufactured products, and greater for parts and components than for final products.

Fourth, the estimated coefficients for an FTA are negative and significant, which implies that the PRC does not export more to its FTA partners.

⁶ Calculated as $39\% = (\exp(.329) - 1)100$.

Table 4: Determinants of the People's Republic of China's Exports—Fixed Effects Model

	I	II	III	IV	V
	Total	Manufactured	Non-Manufactured	Final	Parts and Components
Lgdp_h	1.455*** (0.044)	1.628*** (0.046)	0.811*** (0.088)	1.631*** (0.046)	1.823*** (0.078)
Lgdp_p	1.040*** (0.058)	1.045*** (0.060)	0.723*** (0.114)	1.021*** (0.061)	1.287*** (0.102)
WTO	0.329*** (0.060)	0.274*** (0.062)	0.589*** (0.121)	0.263*** (0.063)	0.588*** (0.111)
FTA	-0.252** (0.103)	-0.230** (0.107)	-0.335* (0.201)	-0.294*** (0.108)	-0.094 (0.178)
_cons	-60.305*** (1.329)	-65.388*** (1.381)	-37.842*** (2.632)	-51.180*** (1.398)	-65.860*** (2.334)
Number of observations	2,242	2,242	2,170	2,242	2,185
R ²	0.780	0.787	0.315	0.777	0.669

Notes: Estimates are made with partner country fixed effects and year dummies included. Standard errors are in parentheses. ***, **, and * show 1%, 5%, and 10% significance, respectively

Source: Author's observations.

Table 5: Determinants of the People's Republic of China's Imports—Fixed Effects Model

	I	II	III	IV	V
	Total	Manufactured	Non-Manufactured	Final	Parts and Components
Lgdp_h	1.682*** (0.129)	1.296*** (0.144)	1.949*** (0.131)	1.067*** (0.147)	1.521*** (0.194)
Lgdp_p	0.372** (0.169)	0.297 (0.189)	0.239 (0.171)	0.373* (0.193)	0.502* (0.258)
WTO	-0.704*** (0.177)	-0.251 (0.192)	-0.240 (0.184)	-0.295 (0.199)	-0.603** (0.273)
FTA	0.025 (0.297)	0.147 (0.319)	-1.023*** (0.292)	0.034 (0.318)	0.723** (0.358)
_cons	-51.420*** (3.954)	-40.687*** (4.383)	-56.826*** (4.013)	-22.637*** (4.434)	-40.304*** (5.902)
Number of observations	2,120	1,996	1,965	1,915	1,459
R ²	0.335	0.205	0.379	0.176	0.190

Notes: Estimates are made with partner country fixed effects and year dummies included. Standard errors are in parentheses. ***, **, and * show 1%, 5%, and 10% significance, respectively.

Source: Author's observations.

The results for PRC imports in Table 5 reveal four major highlights. First, the estimated coefficients for the PRC's GDP are again positive and significant; a 10% increase in the PRC's GDP is associated with a 17% increase in total imports (Column I). Thus, the PRC's GDP growth has a disproportionately positive impact on its demand for foreign goods.

When total imports are divided into manufactured products and non-manufactured products, non-manufactured imports are more closely associated with the PRC's GDP. Specifically, a 10% increase in the PRC's GDP is associated with a 19% increase in imports of non-manufactured products (Column III), and a 13% increase in imports of manufactured products (Column II). When imports of final products and parts and components are estimated separately, we observe that both types of imports increase by about the same percentage in response to increases in the PRC's GDP (Columns IV and V).

Second, the estimated coefficient for partner countries' GDP is also positive and significant, but the size of the coefficient is considerably smaller than the coefficient for the PRC's GDP. For example, a 10% increase in partner countries' GDP is associated with only a 4% increase in total imports. This is consistent with economic intuition. Furthermore, when total imports are divided, foreign income elasticity is statistically significant only for parts and components.

Third, in direct contrast to the results for PRC exports, Table 5 reveals that the PRC has been importing less from WTO members than from non-members. This is inconsistent with economic intuition and merits further investigation in the future.

Fourth, the PRC does not seem to import more from its FTA partners. When total imports are divided into manufactured and non-manufactured products, the PRC in fact imports less non-manufactured products from its FTA partners. Yet when imports of final products and parts and components are estimated separately, the estimated coefficients for FTA are positive and significant for both.

We now assess whether the PRC's trade in parts and components is greater with countries in East Asia than in other regions. In order to do this, we have included four different Asia dummies: (i) ASEAN6 (Brunei Darussalam, Indonesia, Malaysia, Philippines, Singapore, and Thailand); (ii) Hong Kong, China; (iii) Japan; and (iv) the Republic of Korea. We also include two extra-regional dummies: (i) EU15 (the EU's 15 original member countries) and (ii) NAFTA (US, Canada, and Mexico).

In this case, the fixed effects procedure is not appropriate, since these time-invariant regional dummies cannot be estimated. Therefore, the random effects procedure is employed. In the random effects model, other common gravity variables such as geographic distance are also included.

The results from the random effects procedure are reported in Tables 6 and 7 for PRC exports and imports, respectively.

Focusing first on PRC exports in Table 6, the gravity model works well for all equations, as indicated by the large size of R^2 . The PRC exports more to larger countries and countries that share common borders and a common language, and exports less to landlocked countries. On the other hand, geographic distance does not seem to matter with respect to the PRC's exports. This is in contrast with theoretical predictions and merits further investigation.

In line with the results from fixed effects estimation (Table 4), the PRC exports more to WTO member economies but less to its FTA partners.

Let us now assess whether the PRC exports more to the East Asian region, even after all possible natural and institutional causes of trade are controlled for. As shown in Column I, the PRC exports more to ASEAN6 countries; Hong Kong, China; and the Republic of Korea; but not to Japan. It also exports more to NAFTA member countries and less to EU15 member countries.

When total exports are split into manufactured and non-manufactured products, the PRC exports more manufactured products to ASEAN6 countries and Hong Kong, China and exports more non-manufactured products to ASEAN6 countries, Japan, and the Republic of Korea. Interestingly, when exports of final products and parts and components are estimated separately, the PRC exports more final products to ASEAN6 countries and more parts and components to ASEAN6 countries; Hong Kong, China; and the Republic of Korea. Thus, the PRC's trade linkages with East Asian countries, in terms of exports, are stronger for the parts and components trade than for final goods.

Table 7 presents the estimated results from the random effects procedure for the PRC's imports.

Again, the gravity model works well for all equations, as indicated by the large size of R^2 . The PRC imports more from larger countries and countries that share common borders and a common language, and imports less from landlocked countries. In contrast to exports, geographic distance is also significant and negative. Similar to the fixed effects results (Table 5), the PRC does not import more from WTO member economies or from its FTA partners.

The PRC imports more from ASEAN6 countries, but not from Hong Kong, China; Japan; or the Republic of Korea. Furthermore, the PRC does not import more from NAFTA member countries and it imports less from EU15 countries.

When total imports are split into manufactured and non-manufactured products, the PRC imports more manufactured products from ASEAN6 countries and less from Hong Kong, China. In addition, the PRC does not import more manufactured products from Japan or the Republic of Korea. On the other hand, the PRC imports more from NAFTA countries and the EU15.

Finally, when imports of final products and parts and components are estimated separately, the PRC does not import more final products from Hong Kong, China while it does import more parts and components from ASEAN6 countries, Japan, and the Republic of Korea. Interestingly, among these four regions of East Asia, the Republic of Korea yields the largest coefficient.

Thus, summarizing the results from Tables 6 and 7, we can conclude that the PRC's trade linkages with East Asian countries in terms of both exports and imports are stronger for parts and components than for final goods.

Table 6: Determinants of the People's Republic of China's Exports—Random Effects Model

	I	II	III	IV	V
	Total	Manufactured	Non- Manufactured	Final	Parts and Components
Lgdp_h	1.498*** (0.050)	1.669*** (0.050)	0.783*** (0.096)	1.667*** (0.051)	1.935*** (0.083)
Lgdp_p	0.912*** (0.040)	0.925*** (0.042)	0.803*** (0.049)	0.915*** (0.042)	0.955*** (0.049)
Ldistw	-0.169 (0.225)	-0.122 (0.228)	-0.976*** (0.230)	-0.126 (0.225)	-0.276 (0.276)
Contig	1.342*** (0.441)	1.256*** (0.475)	1.878*** (0.344)	1.292*** (0.469)	1.053** (0.517)
Landlocked	-0.604** (0.280)	-0.574** (0.286)	-1.421*** (0.331)	-0.604** (0.286)	-0.563* (0.328)
comlang_off	1.064*** (0.342)	1.081*** (0.331)	1.011*** (0.322)	1.059*** (0.318)	1.579*** (0.469)
WTO	0.330*** (0.081)	0.279*** (0.077)	0.483*** (0.147)	0.269*** (0.076)	0.589*** (0.152)
FTA	-0.263*** (0.052)	-0.240*** (0.057)	-0.338*** (0.079)	-0.303*** (0.053)	-0.125 (0.089)
EU15	-0.401** (0.200)	-0.358* (0.195)	-0.193 (0.205)	-0.334* (0.184)	-0.301 (0.291)
NAFTA	0.307** (0.149)	0.189 (0.150)	0.428*** (0.153)	0.151 (0.142)	0.672*** (0.243)
ASEAN6	0.881*** (0.283)	0.815*** (0.275)	1.370*** (0.274)	0.719*** (0.267)	1.501*** (0.425)
Japan	0.493 (0.617)	0.386 (0.604)	1.147** (0.538)	0.401 (0.616)	0.641 (0.655)
Hong Kong, China	1.473* (0.854)	1.663* (0.928)	-0.014 (0.611)	1.595 (0.972)	1.913** (0.847)
Korea, Rep. of	1.073* (0.626)	0.962 (0.642)	1.231** (0.567)	0.936 (0.635)	1.304* (0.791)
_cons	-56.973*** (2.662)	-62.630*** (2.695)	-30.172*** (3.362)	-48.587*** (2.659)	-58.699*** (3.711)
Number of observations	2,242	2,242	2,170	2,242	2,185
R ²	0.836	0.836	0.720	0.835	0.707

ASEAN = Association of Southeast Asian Nations, EU = European Union, NAFTA = North American Free Trade Area, PRC = People's Republic of China, WTO = World Trade Organization.

Notes: Estimates are made with random effects model. Robust standard errors are in parentheses. ***, **, and * show 1%, 5%, and 10% significance, respectively.

Source: Author's observations.

Table 7: Determinants of the People's Republic of China's Imports—Random Effects Model

	I	II	III	IV	V
	Total	Manufactured	Non- Manufactured	Final	Parts and Components
Lgdp_h	1.328*** (0.129)	0.821*** (0.132)	1.689*** (0.122)	0.633*** (0.134)	1.084*** (0.191)
Lgdp_p	1.232*** (0.077)	1.493*** (0.081)	0.913*** (0.078)	1.473*** (0.084)	1.293*** (0.108)
Ldistw	-0.953** (0.422)	-1.722*** (0.382)	0.014 (0.420)	-2.001*** (0.434)	-1.373* (0.710)
Contig	1.362*** (0.478)	1.642*** (0.499)	2.565*** (0.572)	1.489*** (0.554)	-0.021 (0.953)
Landlocked	-0.224 (0.467)	-0.503 (0.447)	-0.566 (0.576)	-0.700 (0.491)	-0.688 (0.653)
comlang_off	1.814*** (0.430)	2.205*** (0.566)	1.712*** (0.538)	2.310*** (0.636)	2.805** (1.279)
WTO	-0.483*** (0.165)	-0.204 (0.182)	-0.214 (0.216)	-0.309 (0.199)	-0.301 (0.266)
FTA	0.151 (0.235)	0.289 (0.241)	-0.874*** (0.148)	0.151 (0.224)	0.836** (0.397)
EU15	0.164 (0.282)	1.093*** (0.304)	-0.439 (0.355)	1.147*** (0.317)	3.244*** (0.513)
NAFTA	-0.123 (0.227)	0.737*** (0.238)	-0.382 (0.295)	0.610*** (0.229)	2.285*** (0.625)
ASEAN6	1.237*** (0.394)	1.043** (0.523)	2.641*** (0.420)	0.571 (0.670)	3.323*** (1.189)
Japan	-0.272 (0.814)	-0.960 (0.827)	0.491 (0.889)	-1.378 (0.920)	2.751** (1.330)
Hong Kong, China	-1.081 (1.132)	-1.804* (0.969)	-1.621 (1.179)	-2.279* (1.172)	2.297 (2.030)
Korea, Rep. of	1.079 (1.008)	0.476 (0.999)	2.564** (1.160)	-0.056 (1.103)	3.633** (1.755)
_cons	-54.053*** (5.354)	-41.245*** (5.373)	-66.405*** (5.091)	-19.476*** (5.596)	-36.650*** (8.674)
Number of observations	2,120	1,996	1,965	1,915	1,459
R ²	0.707	0.762	0.549	0.757	0.692

ASEAN = Association of Southeast Asian Nations, EU = European Union, NAFTA = North American Free Trade Area, PRC = People's Republic of China, WTO = World Trade Organization.

Notes: Estimates are made with random effects model. Robust standard errors are in parentheses. ***, **, and * show 1%, 5%, and 10% significance, respectively.

Source: Author's observations.

5. Concluding Observations

The rapid integration of the PRC into global production sharing has become an important feature of global trade, development, and production networks. The purpose of this paper is to examine the characteristics of the PRC's trade in terms of production sharing, and to provide a more complete description of the PRC's trade in parts and components. We observed and analyzed the PRC's parts and components trade, and then we used an augmented gravity model to identify its main determinants.

At a broader level, given the central importance of the parts and components trade in the PRC's overall trade, and given the central importance of trade in the PRC's growth and development, we believe that our study can substantially deepen and broaden our understanding of the PRC's trade, growth, and development. More specifically, our study helps us to better understand the primary drivers of the PRC's parts and components trade, as well as the structure of this trade by identifying, for example, the most important product groups and trading partners. While the literature contains a large number of studies that look at the issue of the PRC's parts and components trade from the perspective of specific industries or partner countries, what is lacking is a more comprehensive study that provides an overall picture. We hope that our study marks a useful step in filling this major gap in the literature.

In terms of empirical results, we found that the shares of parts and components in the PRC's exports and imports have grown very rapidly. Their share in the PRC's imports is much higher than the world average. In contrast, their share in the PRC's exports was far below the world level in the early 1990s but has since increased to reach the world average. Thus, the parts and components trade has become an increasingly significant element of the PRC's trade.

Significantly, the PRC's imports of parts and components far exceed its exports, confirming the PRC's role as a major world production center. At the same time, the rapid growth of the PRC's parts and components exports shows that the PRC is also becoming an increasingly important manufacturing base for parts and components. The data indicate that SITC 77 (electrical machinery and apparatus) is a pivotal sector in the PRC's parts and components trade, accounting for a large share of both exports and imports.

We also find that the PRC's parts and components trade has a relatively high degree of regional concentration. Japan; Hong Kong, China; the Republic of Korea; ASEAN; NAFTA; and the EU are the PRC's major trading partners. Exports and imports show different structural characteristics. Notwithstanding the high regional concentration, parts and components trade with the rest of the world is also large and growing in relative importance.

Another finding is that the degree of production sharing with the PRC is larger for East Asian countries than for NAFTA or the EU. The PRC's trade linkages with East Asian countries, in terms of both exports and imports, are stronger for parts and components than for final goods.

The data indicate that the shares of parts and components in the PRC's exports and imports has declined since 2007, even though there was no reduction in the total amount of imports and exports. Significantly, this change in structure happened before the global economic crisis of 2008/09. This begs the following questions: was the decrease caused by the PRC's macroeconomic structural adjustment in 2007 to prevent its economy from overheating? Or does it have any possible relation with the global crisis? These questions should be addressed and studied in greater depth.

The PRC has become a globally significant trading power and investment destination within the context of regional economic integration in East Asia. The growth of the parts and components trade is closely related to the production processes of multinational firms. Therefore, it would also be useful to analyze the driving forces behind the PRC's parts and components trade at the firm level.

Finally, the PRC and Taipei,China have close trade relations, and Taipei,China is widely seen as one of the PRC's main economic partners. However, unfortunately the UN Comtrade database does not include data for Taipei,China. Its inclusion in the database would allow for a more complete analysis of the PRC's parts and components trade.

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The Role of the People's Republic of China in International Fragmentation and Production Networks: An Empirical Investigation

The central objective of this paper is to provide a complete description of the People's Republic of China's (PRC) parts and components trade. In order to do so, we systematically separate parts and components from final goods in the PRC's total trade flows in our empirical analysis. Our analysis indicates that the PRC is a major global production center not only of final goods but increasingly also of parts and components.

About the Asian Development Bank

ADB's vision is an Asia and Pacific region free of poverty. Its mission is to help its developing member countries reduce poverty and improve the quality of life of their people. Despite the region's many successes, it remains home to two-thirds of the world's poor: 1.8 billion people who live on less than \$2 a day, with 903 million struggling on less than \$1.25 a day. ADB is committed to reducing poverty through inclusive economic growth, environmentally sustainable growth, and regional integration.

Based in Manila, ADB is owned by 67 members, including 48 from the region. Its main instruments for helping its developing member countries are policy dialogue, loans, equity investments, guarantees, grants, and technical assistance.