THE PHILIPPINE REVIEW OF ECONOMICS
Vol. XLVII No. 2 December 2010 pp. 83-118

China's integration in East Asia: the role of intra-industry trade*

Elizabeth S. Tan
School of Economics, University of the Philippines Diliman

China's intra-industry trade (IIT) with East Asia was minimal during the early years of opening up from 1978 to 1993 but increased relative to inter-industry trade in the post-1993 years. Bilateral intra-industry trade (BIIT) with Japan and Korea was sustained in capital-intensive heavy industries such as metals and yarns; its BIIT with East Asian countries also increased tremendously starting 1993 in industries characterized by production networks. BIIT with the more developed partners has increasingly become more important through higher volume and higher shares of trade in a growing number of industries. While this is also true for its trade with ASEAN 4, IIT is less both in absolute and relative terms. The overall trend shows that China's integration to East Asia has not only increased but also deepened. China's IIT should be analysed in the context of its historical legacy from the planned period and the continued dominance of the central government in key strategic industries.

JEL classification: F14, F15
Keywords: China's trade integration, East Asian integration, intra-industry trade

* This paper was extracted from a longer research paper made possible through a merit research grant from the Institute of Pilipino Culture,Ateneo de Manila Unversity, Loyola Schools.

1. Introduction

In 2008, China celebrated 30 years of economic reform. It started with an open door policy in 1978 that moved the country from a comparative advantage defying (CAD) [Lin and Wang 2008] development strategy to become the world's biggest exporter in 2010, thereby amassing the world's largest international reserves: US$ 2.4 trillion. At the heart of this phenomenal, though not unprecedented, growth was an all-encompassing reform in its foreign trade regime within a broader structural macroeconomic reform. As trade with East Asian economies expanded, China integrated into the global economy through existing East Asian production networks. Hence, China's growth trade has to be analysed and woven into its integration with East Asia.

The objectives of the paper are to (a) describe China's integration in East Asia and (b) analyse China's pattern of intra-industry trade (IIT) and its role in regional integration. Section 2 narrates the story of China's participation in East Asia's regional economy; section 3 provides a review of literature on intra-industry trade theory; section 4 discusses the analytical framework and methodology. Sections 5 and 6 present and analyse the results of China's IIT with East Asia. Section 7 concludes the paper.

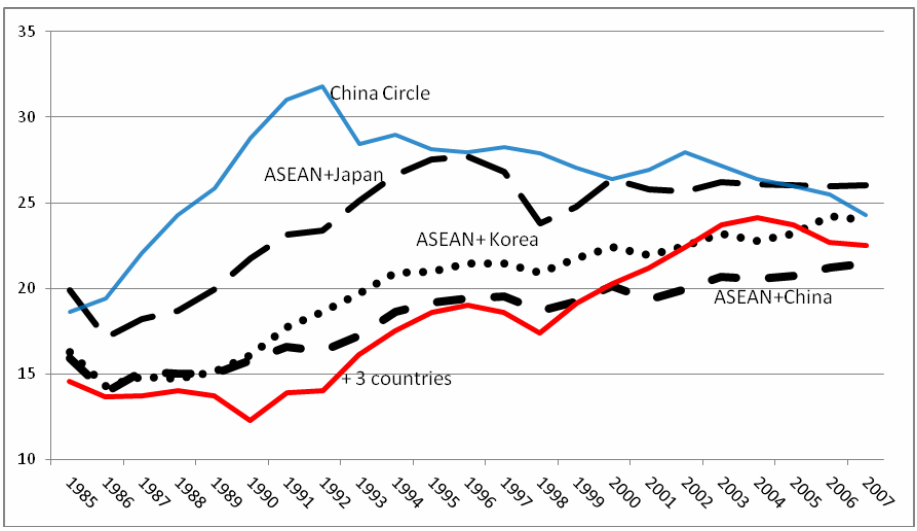
2. China's integration in the East Asian economy

East Asia refers to members of ASEAN (Cambodia, Brunei, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Vietnam), the ASEAN + 3 countries (the People's Republic of China [PRC)] Japan, and Korea), and the China Circle (the PRC; Taiwan, China; and Hong Kong SAR, China).

Intraregional trade share, a common indicator of integration, measures the percentage of trade within a region as a share of the region's trade with the world. As intraregional trade shares increase, the region is or becomes more integrated. The type of trade measured here is actually not just preferential trade but multilateral trade as well; hence, the integration measured is not the type of integration laid out by Viner.

Trade integration in East Asia is more de facto than de jure. Prior to the formation of the ASEAN Free Trade Area (AFTA) in 1992 and the surge of FTAs in the late '90s, intraregional trade shares have already been increasing. Among the China Circle countries, intraregional trade rose from 19 percent in 1985 to a peak of 32 percent in 1992; the declining range—25 percent to 29 percent from 1993 to 2007—occurred simultaneously with increasingly

higher shares among the ASEAN + 3 countries. Among the three ASEAN + 1 trade groups, the intraregional trade shares of ASEAN + China have been the lowest relative to ASEAN + Korea and ASEAN + Japan. This shows China is more integrated with Taiwan and Hong Kong relative to ASEAN (Figure 1). This is easily explained by the cultural and linguistic affinity as well as geographical proximity of Hong Kong and Taiwan to the PRC.



Source: Appendix Table 1.

Figure 1. Intraregional trade shares in East Asia (%)

China opened its doors[1] in 1978 by using initially export processing (EP) contracts that allowed processed trade—that is, duty-free importation of inputs to process goods purely for exports—between Hong Kong and autonomous provincial governments and became the basis for the establishment of four special economic zones (SEZs) in Guangdong and Fujian, two southern coastal provinces. Processed trade was substantial in labor-intensive light manufactured goods such as garments, toys, shoes, bags, accessories, etc.

[1] The Chinese language-written characters distinguish "opening up" from trade reform or liberalization and consider both different; however, most non-Chinese economists analysing Chinese external trade do not make this distinction and use opening up and trade reform interchangeably.

The Plaza Accord of 1985 set in motion the appreciation of East Asian currencies and, together with higher labor costs, engendered a search for alternative production bases. Japan started relocating to the newly industrializing economies (NIEs) and then to developing Southeast Asian (SEA) countries, whereas the NIES relocated to China and SEA countries. In 1986, China made two major policy decisions that were instrumental in its integration with the regional and global trading economies. First, the Coastal Development Strategy (CDS), which allowed firms in the coastal provinces of Zhejiang, Jiangsu, Guangdong, and Fujian to engage in EP contracts, was launched. Hong Kong and Taiwan, the two first movers, brought in raw materials, technology, and capital to jump-start the rebuilding of China's trade infrastructure, nonexistent at that time. Together with China's cheap labor, these foreign invested enterprises (FIEs) produced low-priced goods exported to the United States and the European Union. This was how China began integrating into the regional and global economies, through the existing trade-investment linkages of Hong Kong and Taiwan. By the late '80s, the relocation of production bases in light manufacturing industries from the NIEs to China and SEA has been completed.

By the early '90s, the relocation of information technology (IT) products began as well; unlike the previous wave, the relocation of IT production bases was spread over several but successive waves. It started with the most labor-intensive and least technology-intensive products to more technology-intensive and capital-intensive goods. Global competition has resulted in increasingly smaller slices of the chain, from low-tech labor-intensive production, to high-tech skill-intensive design, and to high-tech capital-intensive production. Hence, in this environment, there is a constant drive to relocate and restructure production networks. The most salient and successful relocation and restructuring of the PC manufacturing and assembly was the acquisition and takeover by Lenovo, originally "Legend" (*Lianxiang*), of IBM's PC division in 2004 [Lenovo website]. By then, the technology for PC assembly and manufacturing has matured, and comparative advantage was increasingly determined by labor cost and not technology.

Second, the Chinese yuan was depreciated from CN¥ 1.5 per US dollar to CN¥ 3.5 per US dollar in 1986, then to a rate of CN¥ 8.3 per US dollar in 1996; while the exchange rate was unified with full convertibility in the current account by 1994, it continued to be fixed at CN¥ 8.3 per US dollar till June 2004 with a closed capital account. In hindsight, the depreciation of the yuan could not have been more well-timed. China's comparative advantage in labor-intensive products was combined with a cheap currency; more

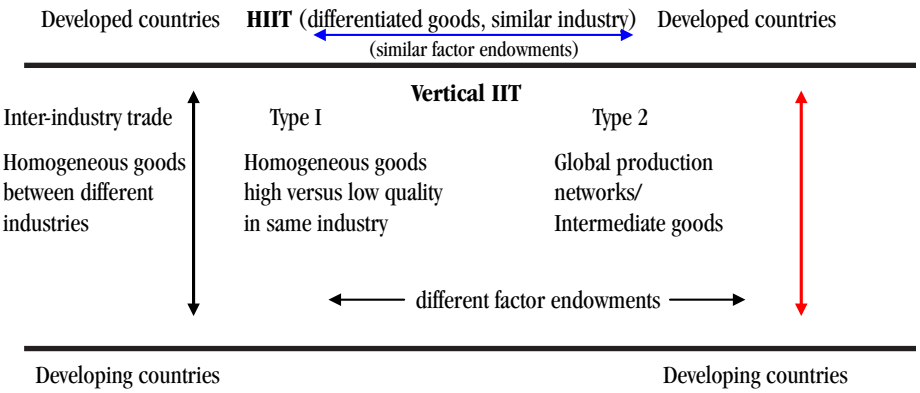
substantially, the yuan's role as a stabilizing currency became increasingly obvious in an environment of competitive devaluation during the 1997 Asian financial crisis and contributed to an early recovery in the region.This contributed to the realization by her neighbors that China has increasingly become an important part of the Asian economy—setting the stage for China's silent debut as a key player in the regional economy.

3. Review of literature

The pattern of world trade has been analysed traditionally using the theory of comparative advantage where trade is an exchange of goods between industries—that is, inter-industry—and generally occurs between developing and developed countries. Goods traded are homogenous under perfect competition. However, this type of trade cannot explain trade between developed countries with similar factor endowments. Krugman [1980], Dixit and Stiglitz [1977], and Lancaster [1980] emphasized the role of economies of scale under monopolistic competition; trade is an exchange of goods within an industry—horizontal intra-industry trade (HIIT)—and occurs because of the love of variety.

In subsequent developments, Falvey [1981], Falvey and Kierzkowski [1987], and Flam and Helpman [1987] showed that IIT can take place between countries with different income distribution (demand side) and different factor endowments (supply side), explaining why trade takes place in vertically differentiated finished products. Capital-abundant countries export or specialize in relatively high-quality products using capital-intensive technology, which are therefore more expensive. In contrast, relatively low-income/labor-abundant countries specialize in low-quality products, which are therefore cheaper. In stark contrast with HIIT, there are no economies of scale, but trade takes place under perfect competition, constant returns to scale, and fixed factor intensity. This is vertical IIT (VIIT) type I, and can be understood as an extension of the Heckscher-Ohlin (H-O) theory.

VIIT, type II, characterizing East Asian production networks and regional trade, is more appropriate in analysing the trade and investment linkages in East Asian economies. It is based on differences in factor endowments but more specifically on wages and technologies. Developing countries with abundant labor using low-technology production, export the cheaper products in the global production chain while developed countries with abundant capital and technology produce the more capital-intensive and/or technology-intensive products of the chain.



Source: Author's diagram based on section 2 of this paper; Krugman in Krugman and Obstfeld [2002]; Ando [2006].

Figure 2. Inter- and intra-industry trade

Measurement of IIT is largely attributed to Grubel and Lloyd [1975] who distinguished HIIT (the exchange of competing or substitute products) from VIIT (the exchange of products at different stages in the processing of a final product). Abd-el-Rahman [1991] provided the methodology to distinguish IIT into HIIT and VIIT by using differences in unit prices between imported and exported goods. This type of distinction is commonly used when analysing IIT of Organisation of Economic Co-operation and Development (OECD) developed countries with China (e.g., Hellvin [1996]; Hu and Ma [1999]; and Zhang, Witteloostuijn, and Zhou [2005]). Fontagne and Freudenberg [1997] extended the work of Abd-el-Rahman [1991] by using a range of unit price differentials between imports and exports in a particular category of goods to break down total trade into one-way trade, which captures inter-industry trade, VIIT, and HIIT. Ando [2006] applied this method to measure IIT in machineries industries in East Asia.

4. Framework and methodology

The intra-industry trade index is estimated using the Grubel and Lloyd [1975] formula shown in equations (1) and (2).

$$IIT_i^j = \frac{(X_i^j + M_i^j) - |X_i^j - M_i^j|}{(X_i^j + M_i^j)} \quad (1)$$

$$= 1 - \frac{|X_i^j - M_i^j|}{(X_i^j + M_i^j)} \quad (2)$$

$$\frac{|X_i k_j - M_i k_j|}{(X_i k_j + M_i k_j)} = 1 - \text{IIT}_i k_j \quad (3)$$

where $i = 1,2,3, \ldots$ n, is the ith industry; X and M are exports and imports, respectively; k is the exporting country; and j is the country destination of exports.

Equation (1) is a tautology and therefore is true by definition. Equation (2) shows that IIT is estimated as residual of total trade after accounting for $|X - M|$, which is inter-industry trade. When $X_i = M_i$, IIT becomes 1—that is, all trade in the ith industry is intra-industry trade. If $X_i = 0$ or $M_i = 0$, IIT equals 0 and all trade in the ith is inter-industry trade. When $X_i > M_i$ or $X_i < M_i$, the values of IIT are bound between 0 and 1; as IIT increases, trade in the ith industry becomes increasingly intra- rather inter-industry trade. The limitations of the index are: (a) if IIT is estimated at a higher level of aggregation, trade is summed over a wider group of industries, in effect grouping less similar products into an industry; (b) as a result of (a), within an increasingly broader group, it becomes increasingly more likely that a country will export and/or import the "same" variety of products, putting the values of X and M closer to each other, introducing an upward bias although what is more appropriately captured are goods/industries that are more heterogeneous; therefore, intra-industry trade is higher for a group of goods that are less similar!

There will be no adjustments to correct trade imbalances at the product level whether or not IIT index was estimated bilaterally or between bigger trade groups because if adjustments were made, then the rationale for measuring the IIT would be lost: a balanced trade implies that trade is purely intra-industry and assumes away the possibility of inter-industry trade.

5. China's intra-industry trade in East Asia

Trade data used are Standard International Trade Classification (SITC) revision 2 compiled by the UN Comtrade. The revision 2 series was used despite the availability of more recent data in the revision 3 series because the former has earlier and longer comparable trade data—that is, 1987-2006. Two, the value of the data in the 1980s is more important in understanding China's early years of integration into the regional and global economies. Given the arguments and constraints in section 4, China's bilateral IIT (BIIT) with 14 East Asian countries was computed at the three-digit level yielding

results for 200-260[2] industries. Estimates are grouped into different trends, the more interesting and important are those where IIT was sustained in all three periods, followed by the burst of new industries with high and increasing IIT during the second and third subperiods.

When does trade become intra- rather than inter-industry trade? Trade is of the intra-industry type if the average IIT index of an industry in any of the three subperiods is at least 50 percent. Any industry with an average IIT below 50 percent in all subperiods is not reported; and all industries with an SITC code starting with 0—that is, agriculture—are excluded even if their IIT is 50 percent. Only results for Japan, Hong Kong, Taiwan, Korea, and ASEAN 4 (i.e., Indonesia, Malaysia, Philippines, and Thailand) are reported and analysed. Cambodia, Myanmar, Laos, and Vietnam are excluded because trade in the first two subperiods was thin to begin with and industries with IIT were extremely few.

There are some common features in China's BIIT with Japan and Korea. In group A where BIIT is sustained over the three subperiods, the industries are generally capital-intensive[3] heavy industries such as chemicals, metallic and nonmetallic manufactures, textile yarn, and man-made fibers, with some industries in the food and light manufacturing (Tables 1 and 2). In group B where BIIT was sustained from 1993 to 2006, there is a progression toward (a) manufactured goods/finished goods; (b) goods in the transport sector and telecommunications equipment, office machines, and automated data processing equipment; and (c) residual petroleum products, base metals (such as iron and steel, tin, lead, and zinc), and chemical products. It is interesting to note that BIIT in industries in groups D and F decreased in the second and third subperiods, respectively. In group C, where BIIT started from 2001 to 2006, the products are in ships, boats, and floating structures, and parts for steam boilers and auxiliary plant. Worth noting is that while Korea had less industries with BIIT with China during the first period, 33 versus 7, there was tremendous increase, more than sevenfold, in the number of industries with IIT 50 percent and above in the second period (Table 4, groups B, C, E) while Japan had a 50 percent increase only (Table 2, groups B, C, E).

---

[2] The universal set is 261 industries using the SITC Revision 2 codes, but the total number of industries characterized by IIT varies and would depend first on whether or not there was trade for a particular year, an observation that changes from year to year.

[3] The observation of capital-intensity does not benefit from using K/L ratios.

Table 1. China's intra-industry trade index with Japan (%)

	1987-92	1993-2000	2001-06
A. Consistently above 50%			
515. Organo-inorganic and heterocyclic compounds	**57**	**63**	**65**
516. Other organic chemicals	**76**	**84**	**69**
541. Medicinal and pharmaceutical products	**63**	**68**	**83**
651. Textile yarn	**84**	**90**	**88**
663. Mineral manufactures, nes	**63**	**67**	**51**
665. Glassware	**59**	**90**	**73**
684. Aluminium	**73**	**72**	**83**
694. Nails, screws, nuts, bolts, rivets, etc., of iron, steel or copper	**67**	**71**	**63**
695. Tools for use in the hand or in machines	**59**	**83**	**59**
699. Manufactures of base metal, nes	**71**	**84**	**96**
895. Office and stationary supplies, nes	**59**	**69**	**91**
B. Above 50% after 1992			
269. Old clothing and other old textile articles; rags	18	**53**	**69**
277. Natural abrasives, nes	15	**52**	**58**
287. Ores and concentrates of base metals, nes	8	**74**	**69**
335. Residual petroleum products, nes and related materials	17	**62**	**65**
531. Synthetic dye, natural indigo, lakes	43	**85**	**97**
532. Dyeing and tanning extracts, and synthetic tanning materials	26	**77**	**51**
551. Essential oils, perfume and flavour materials	38	**52**	**76**
613. Furskins, tanned or dressed; pieces of furskin, tanned or dressed	32	**58**	**56**
628. Articles of rubber, nes	33	**71**	**65**
642. Paper and paperboard, precut, and articles of paper or paperboard	38	**84**	**79**
667. Pearl, precious and semi-precious stones, unworked or worked	10	**63**	**81**
683. Nickel	30	**60**	**81**
687. Tin	4	**54**	**90**
693. Wire products (excluding insulated electrical wire); fencing grills	33	**77**	**84**
716. Rotating electric plant and parts thereof, nes	49	**88**	**91**
764. Telecommunication equipment, nes; parts and accessories, nes	9	**73**	**94**
771. Electric power machinery, and parts thereof, nes	49	**85**	**81**
773. Equipment for distribution of electricity	9	**74**	**75**
872. Medical instruments and appliances, nes	17	**73**	**73**
881. Photographic apparatus and equipment, nes	17	**88**	**62**
884. Optical goods nes	30	**75**	**62**
885. Watches and clocks	14	**85**	**79**
893. Articles, nes of plastic materials	45	**90**	**80**
897. Gold, silver ware, jewelry and articles of precious materials, nes	22	**61**	**71**
898. Musical instruments, parts and accessories thereof	15	**80**	**65**

Table 1. (continued)

	1987-92	1993-2000	2001-06
C. Above 50% after 2000			
273. Stone, sand and gravel	1	13	**54**
514. Nitrogen-function compounds	31	49	**51**
522. Inorganic chemical elements, oxides and halogen salts	26	35	**63**
523. Other inorganic chemicals; compounds of precious metals	43	42	**56**
553. Perfumery, cosmetics, toilet preparations, etc.	16	42	**61**
585. Other artificial resins and plastic materials	44	39	**63**
591. Pesticides, disinfectants	3	25	**85**
625. Rubber tires, tire cases, inner and flaps, for wheels of all kinds	1	46	**76**
685. Lead	15	14	**61**
686. Zinc	35	44	**64**
711. Steam boilers and auxiliary plant; and parts thereof, nes	3	33	**57**
721. Agricultural machinery (excluding tractors) and parts thereof, nes	7	18	**78**
741. Heating and cooling equipment and parts thereof, nes	1	26	**91**
745. Other non-electric machinery, tools and mechanical apparatus, nes	3	27	**51**
759. Parts, nes of and accessories for machines of headings 751 or 752	6	46	**75**
784. Motor vehicle parts and accessories, nes	41	48	**51**
793. Ships, boats and floating structures	11	49	**68**
873. Meters and counters, nes	5	32	**62**
899. Other miscellaneous manufactured articles, nes	46	44	**65**
931. Special transactions, commodity not classified according to class	27	13	**65**
D. Below 50% after 2000			
122. Tobacco, manufactured	**69**	**55**	36
411. Animal oils and fats	**67**	**62**	11
431. Animal and vegetable oils and fats, processed, and waxes	**51**	**69**	46
598. Miscellaneous chemical products, nes	**76**	**65**	42
652. Cotton fabrics, woven (not including narrow or special fabrics)	**80**	**67**	48
662. Clay and refractory construction materials	**50**	**74**	31
E. Alternating			
244. Cork, natural, raw and waste	2	**52**	43
691. Structures and parts, nes, of iron, steel or aluminium	32	**67**	17
752. Automatic data processing machines and units thereof	4	**75**	28
761. Television receivers	40	**55**	7
772. Electrical apparatus for making and breaking electrical circuits	25	**52**	45
775. Household type equipment, nes	13	**53**	20
812. Sanitary, plumbing, heating, lighting fixtures and fittings, nes	13	**64**	50
847. Clothing accessories, of textile fabrics, nes	11	**84**	35
871. Optical instruments and apparatus	12	**83**	39

Table 1. (continued)

	1987-92	1993-2000	2001-06
F. Below 50% after 1992			
288. Non-ferrous base metal waste and scrap, nes	**51**	28	5
512. Alcohols, phenols etc., and their derivatives	**73**	50	38
513. Carboxylic acids, and their derivatives	**65**	41	32
562. Fertilizers, manufactured	**61**	21	2
592. Starches, insulin and wheat gluten; albuminoidal substances; glues	**60**	36	47
612. Manufactures of leather or of composition leather, nes; etc.	**54**	25	18
634. Veneers, plywood, "improved" wood and other wood, worked, nes	**54**	28	17
653. Fabrics, woven, of man-made fibers (not narrow or special fabrics)	**68**	16	14
654. Textile fabrics, woven, other than cotton or man-made fibers	**56**	40	45
655. Knitted or crocheted fabrics (including tubular, etc., fabrics)	**76**	19	12
656. Tulle, lace, embroidery, ribbons, trimmings and other small wares	**58**	43	38
681. Silver, platinum and other metals of the platinum group	**53**	35	21
696. Cutlery	**83**	35	18
697. Household equipment of base metal, nes	**60**	42	5
786. Trailers, and other vehicles, not motorized, nes	**57**	15	7
894. Baby carriages, toys, games and sporting goods	**59**	28	15
Source:Author's computation based on UN Comtrade data.			

Table 2. China's intra-industry trade index with Korea (%)

	1987-92	1993-2000	2001-06
A. Consistently above 50%			
598. Miscellaneous chemical products, nes	**52**	**61**	**51**
651. Textile yarn	**58**	**84**	**90**
653. Fabrics, woven, of man-made fibers (not narrow or special fabrics)	**55**	**59**	**52**
678. Tube, pipes and fittings, of iron or steel	**53**	**72**	**86**
771. Electric power machinery, and parts thereof, nes	**51**	**93**	**83**
B. Above 50% after 1992			
514. Nitrogen-function compounds	25	77	**63**
516. Other organic chemicals	33	**84**	**90**
531. Synthetic dye, natural indigo, lakes	19	**64**	**74**
553. Perfumery, cosmetics, toilet preparations, etc.	14	**70**	**86**
584. Regenerated cellulose; derivatives of cellulose; vulcanized fiber	37	**70**	**70**
592. Starches, insulin and wheat gluten; albuminoidal substances; glues	31	**62**	**72**
612. Manufactures of leather or of composition leather, nes; etc.	44	**86**	**91**
613. Furskins, tanned or dressed; pieces of furskin, tanned or dressed	40	**70**	**54**
628. Articles of rubber, nes	41	**55**	**56**

Table 2. (continued)

	1987-92	1993-2000	2001-06
652. Cotton fabrics, woven (not including narrow or special fabrics)	32	**91**	**83**
654. Textile fabrics, woven, other than cotton or man-made fibers	26	**75**	**68**
663. Mineral manufactures, nes	27	**78**	**89**
664. Glass	50	**64**	**76**
665. Glassware	9	**74**	**87**
684. Aluminium	36	**68**	**75**
695. Tools for use in the hand or in machines	29	**72**	**65**
716. Rotating electric plant and parts thereof, nes	12	**74**	**81**
749. Non-electric parts and accessories of machinery, nes	41	**51**	**64**
752. Automatic data processing machines and units thereof	12	**77**	**74**
759. Parts, nes of and accessories for machines of headings 751 or 752	22	**71**	**57**
764. Telecommunication equipment, nes; parts and accessories, nes	24	**71**	**65**
775. Household type equipment, nes	7	**72**	**54**
778. Electrical machinery and apparatus, nes	46	**80**	**71**
812. Sanitary, plumbing, heating, lighting fixtures and fittings, nes	20	**85**	**57**
872. Medical instruments and appliances, nes	38	**73**	**68**
873. Meters and counters, nes	16	**55**	**70**
881. Photographic apparatus and equipment, nes	37	**75**	**86**
885. Watches and clocks	29	**89**	**87**
895. Office and stationary supplies, nes	31	**85**	**91**
897. Gold, silver ware, jewelry and articles of precious materials, nes	6	**67**	**70**
899. Other miscellaneous manufactured articles, nes	32	**72**	**86**
C. Above 50% after 2000			
111. Non-alcoholic beverages, nes	20	20	**69**
112. Alcoholic beverages	0	24	**72**
122. Tobacco, manufactured	1	1	**57**
251. Pulp and waste paper	13	47	**55**
267. Other man-made fibers suitable for spinning, and waste	7	27	**67**
277. Natural abrasives, nes	8	43	**73**
522. Inorganic chemical elements, oxides and halogen salts	21	36	**72**
541. Medicinal and pharmaceutical products	15	44	**60**
642. Paper and paperboard, precut, and articles of paper or paperboard	13	14	**57**
659. Floor coverings, etc.	20	44	**69**
672. Ingots and other primary forms, of iron or steel	27	45	**62**
673. Iron and steel bars, rods, shapes and sections	12	36	**61**
683. Nickel	0	30	**53**
686. Zinc	26	15	**54**
691. Structures and parts, nes, of iron, steel or aluminium	8	36	**78**
692. Metal containers for storage and transport	13	48	**64**

Table 2. (continued)

	1987-92	1993-2000	2001-06
693. Wire products (excluding insulated electrical wire); fencing grills	20	46	**61**
694. Nails, screws, nuts, bolts, rivets, etc., of iron, steel or copper	31	38	**51**
699. Manufactures of base metal, nes	47	41	**76**
711. Steam boilers and auxiliary plant; and parts thereof, nes	2	27	**62**
744. Mechanical handling equipment, and parts thereof, nes	48	25	**71**
745. Other non-electric machinery, tools and mechanical apparatus, nes	16	37	**60**
751. Office machines	14	46	**66**
773. Equipment for distribution of electricity	4	47	**73**
793. Ships, boats and floating structures	3	35	**64**
882. Photographic and cinematographic supplies	26	44	**71**
893. Articles, nes of plastic materials	17	40	**53**
D. Below 50% after 2000			
894. Baby carriages, toys, games and sporting goods	**50**	**72**	28
E. Alternating			
244. Cork, natural, raw and waste	0	**54**	19
265. Vegetable textile fibers, excluding cotton, jute, and waste	0	**56**	43
291. Crude animal materials, nes	4	**57**	35
335. Residual petroleum products, nes and related materials	21	**51**	15
551. Essential oils, perfume and flavour materials	3	**67**	47
625. Rubber tires, tire cases, inner and flaps, for wheels of all kinds	24	**55**	35
633. Cork manufactures	0	**59**	22
634. Veneers, plywood, "improved" wood and other wood, worked, nes	14	**53**	33
662. Clay and refractory construction materials	8	**63**	12
682. Copper	17	**51**	50
687. Tin	0	**64**	23
696. Cutlery	22	**84**	34
697. Household equipment of base metal, nes	49	**84**	41
713. Internal combustion piston engines, and parts thereof, nes	26	**67**	26
721. Agricultural machinery (excluding tractors) and parts thereof, nes	21	**55**	41
762. Radio-broadcast receivers	33	**72**	10
772. Electrical apparatus for making and breaking electrical circuits	31	**63**	42
847. Clothing accessories, of textile fabrics, nes	21	**63**	44
848. Articles of apparel, clothing accessories, non-textile, headgear	35	**58**	43
871. Optical instruments and apparatus	20	**57**	13
884. Optical goods nes	13	**65**	40
898. Musical instruments, parts and accessories thereof	46	**73**	39
F. Below 50% after 1992			
874. Measuring, checking, analysis, controlling instruments, nes, parts	**67**	49	36
Source:Author's computation based on UN Comtrade data.			

BIIT of China with Taiwan started only in the second and third subperiods with some qualifications (Table 3). The political stalemate between China and Taiwan prevented each other from trading directly; most trade was transhipped through Hong Kong. However, similar to Korea and Japan, the number of industries with IIT index of at least 50 percent, industry groups B and E, increased tremendously during the second period, followed by industry group C with IIT 50 percent and above toward the last period. The industries characterized by IIT are generally capital-intensive intermediate goods with a few in the light manufacturing industries.

Hong Kong's BIIT with China is sui generis as it provides a link to understanding China's BIIT with the rest of East Asia: its trade, investment, financial, and legal infrastructure was used to bridge China and the rest of the world and vice versa, especially prior to China's entry to the World Trade Organization (WTO). Moreover, Hong Kong's trade and investment openness, simulating free-trade conditions, was radically different from China's highly restrictive and labyrinthine trade regimes. The number of industries with at least 50 percent IIT during the first period in industry groups A, D, and F was substantially more relative to Japan, Korea, and Taiwan, individually (Table 4). Nevertheless, there were more industries with decreasing IIT with China during the second and third periods, and the number of industries with increasing IIT in the third period was sparse. The more interesting pattern seems to be that during the first period, China's BIIT with Hong Kong was substantial in accessories and parts for capital machineries, transport equipment, office and automatic data processing machines, but BIIT dropped either toward the second and/or third period (industry groups D and F). In contrast, Japan, Korea, and Taiwan experienced high BIIT in these sectors much later.

China's BIIT with ASEAN 4 in industry group A is similar with Japan and Korea, mostly in capital-intensive heavy industries such as synthetic rubber, glass, and aluminum. There is some similarity with Hong Kong, in parts and accessories for capital machineries and telecommunication equipment early on, but unlike Hong Kong's, the BIIT with ASEAN 4 was sustained in subsequent periods (Table 5, groups A and F) and more such industries appeared during the second period (Table 5, group B). The trend is suggestive of the substitution of Hong Kong for ASEAN 4 in regional production networks.

The existence of IIT during the first subperiod is due to China's industrial legacy from the planned economy era when the country

Table 3. China's intra-industry trade index with Taiwan (%)

	1987-92	1993-2000	2001-06
B. Above 50 after 1992			
248. Wood, simply worked, and railway sleepers of wood	38	**65**	**79**
277. Natural abrasives, nes	28	**57**	**68**
292. Crude vegetable materials, nes	46	**53**	**59**
514. Nitrogen-function compounds	20	**77**	**71**
515. Organo-inorganic and heterocyclic compounds	45	**68**	**89**
522. Inorganic chemical elements, oxides and halogen salts	39	**90**	**92**
523. Other inorganic chemicals; compounds of precious metals	45	**81**	**89**
531. Synthetic dye, natural indigo, lakes	25	**76**	**75**
541. Medicinal and pharmaceutical products	46	**64**	**63**
551. Essential oils, perfume and flavour materials	43	**52**	**54**
585. Other artificial resins and plastic materials	10	**56**	**51**
659. Floor coverings, etc.	45	**66**	**53**
672. Ingots and other primary forms, of iron or steel	7	**56**	**62**
679. Iron, steel casting, forging and stamping, in the rough state, nes	25	**78**	**83**
686. Zinc	18	**56**	**69**
692. Metal containers for storage and transport	26	**56**	**72**
695. Tools for use in the hand or in machines	19	**80**	**70**
696. Cutlery	22	**63**	**57**
752. Automatic data processing machines and units thereof	4	**57**	**87**
759. Parts, nes of and accessories for machines of headings 751 or 752	8	**76**	**62**
771. Electric power machinery, and parts thereof, nes	27	**92**	**92**
775. Household type equipment, nes	12	**83**	**83**
812. Sanitary, plumbing, heating, lighting fixtures and fittings, nes	21	**61**	**62**
848. Articles of apparel, clothing accessories, non-textile, headgear	33	**88**	**79**
872. Medical instruments and appliances, nes	6	**68**	**79**
885. Watches and clocks	33	**85**	**92**
894. Baby carriages, toys, games and sporting goods	46	**89**	**93**
895. Office and stationary supplies, nes	25	**63**	**92**
897. Gold, silver ware, jewelry and articles of precious materials, nes	37	**67**	**62**
899. Other miscellaneous manufactured articles, nes	20	**61**	**94**
C. Above 50 after 2000			
244. Cork, natural, raw and waste	0	22	**60**
278. Other crude minerals	18	47	**57**
287. Ores and concentrates of base metals, nes	35	19	**57**
291. Crude animal materials, nes	33	26	**61**
625. Rubber tires, tire cases, inner and flaps, for wheels of all kinds	1	34	**52**

Table 3. (continued)

	1987-92	1993-2000	2001-06
633. Cork manufactures	14	41	**90**
642. Paper and paperboard, precut, and articles of paper or paperboard	7	46	**81**
662. Clay and refractory construction materials	19	22	**57**
663. Mineral manufactures, nes	25	41	**74**
667. Pearl, precious and semi-precious stones, unworked or worked	42	47	**52**
678. Tube, pipes and fittings, of iron or steel	35	48	**69**
684. Aluminium	27	16	**53**
691. Structures and parts, nes, of iron, steel or aluminium	19	45	**70**
693. Wire products (excluding insulated electrical wire); fencing grills	35	39	**69**
713. Internal combustion piston engines, and parts thereof, nes	11	7	**67**
721. Agricultural machinery (excluding tractors) and parts thereof, nes	1	17	**78**
723. Civil engineering, contractors' plant and equipment and parts, nes	18	33	**72**
749. Non-electric parts and accessories of machinery, nes	3	31	**59**
764. Telecommunication equipment, nes; parts and accessories, nes	10	36	**56**
773. Equipment for distribution of electricity	6	39	**74**
785. Cycles, scooters, motorized or not; invalid carriages	4	32	**78**
847. Clothing accessories, of textile fabrics, nes	42	35	**63**
882. Photographic and cinematographic supplies	34	35	**80**
893. Articles, nes of plastic materials	5	40	**63**
896. Works of art, collectors' pieces and antiques	9	34	**56**
D. Below 50 after 2000			
635. Wood manufactures, nes	**55**	**51**	21
E. Alternating			
247. Other wood in the rough or roughly squared	28	**66**	16
271. Fertilizers, crude	7	**61**	47
273. Stone, sand and gravel	40	**81**	26
335. Residual petroleum products, nes and related materials	15	**69**	19
511. Hydrocarbons, nes, and derivatives	5	**56**	31
516. Other organic chemicals	13	**52**	43
553. Perfumery, cosmetics, toilet preparations, etc.	48	**61**	30
612. Manufactures of leather or of composition leather, nes; etc.	2	**56**	37
634. Veneers, plywood, "improved" wood and other wood, worked, nes	19	**70**	44
658. Made-up articles, wholly or chiefly of textile materials, nes	44	**74**	19
661. Lime, cement, and fabricated construction materials	5	**58**	31
665. Glassware	50	**54**	32
676. Rails and railway track construction materials, of iron or steel	9	**51**	12
687. Tin	24	**54**	28

Table 3. (continued)

	1987-92	1993-2000	2001-06
697. Household equipment of base metal, nes	25	**76**	38
751. Office machines	25	**50**	38
761. Television receivers	**60**	48	**55**
784. Motor vehicle parts and accessories, nes	38	**71**	46
821. Furniture and parts thereof	**53**	45	54
F. Below 50 after 1992			
334. Petroleum products, refined	**51**	37	12
Source:Author's computation based on UN Comtrade data.			

Table 4. China's intra-industry trade index with Hong Kong (%)

	1987-92	1993-2000	2001-06
A. Consistently above 50%			
269. Old clothing and other old textile articles; rags	**59**	**92**	**57**
531. Synthetic dye, natural indigo, lakes	**53**	**80**	**57**
533. Pigments, paints, varnishes and related materials	**80**	**72**	**56**
584. Regenerated cellulose; derivatives of cellulose; vulcanized fiber	**80**	**87**	**75**
592. Starches, insulin and wheat gluten; albuminoidal substances; glues	**51**	**77**	**55**
598. Miscellaneous chemical products, nes	**76**	**84**	**65**
641. Paper and paperboard	**72**	**75**	**82**
653. Fabrics, woven, of man-made fibers (not narrow or special fabrics)	**83**	**74**	**57**
656. Tulle, lace, embroidery, ribbons, trimmings and other small wares	**69**	**68**	**53**
874. Measuring, checking, analysis, controlling instruments, nes, parts	**62**	**79**	**61**
B. Above 50% after 1992			
211. Hides and skins, excluding furs, raw	16	**80**	**54**
523. Other inorganic chemicals; compounds of precious metals	32	**58**	**52**
583. Polymerization and copolymerization products	32	**73**	**63**
633. Cork manufactures	38	**53**	**57**
694. Nails, screws, nuts, bolts, rivets, etc., of iron, steel or copper	43	**68**	**57**
718. Other power generating machinery and parts thereof, nes	43	**71**	**62**
724. Textile and leather machinery, and parts thereof, nes	21	**60**	**54**
726. Printing, bookbinding machinery, and parts thereof, nes	32	**64**	**52**
737. Metalworking machinery (other than machine-tools), and parts, nes	24	**54**	**69**
776. Thermionic, microcircuits, transistors, valves, etc.	47	**85**	**63**
C. Above 50% after 2000			
541. Medicinal and pharmaceutical products	32	38	**88**
551. Essential oils, perfume and flavour materials	22	38	**85**
931. Special transactions, commodity not classified according to class	3	21	**66**

Table 4. (continued)

	1987-92	1993-2000	2001-06
D. Below 50% after 2000			
233. Synthetic rubber, latex, etc.; waste, scrap of unhardened rubber	**54**	**62**	24
511. Hydrocarbons, nes, and derivatives	**77**	**59**	14
532. Dyeing and tanning extracts, and synthetic tanning materials	**56**	**63**	34
554. Soap, cleansing and polishing preparations	**68**	**61**	33
628. Articles of rubber, nes	**62**	**60**	39
655. Knitted or crocheted fabrics (including tubular, etc., fabrics)	**65**	**55**	25
682. Copper	**68**	**57**	28
684. Aluminium	**66**	**52**	18
713. Internal combustion piston engines, and parts thereof, nes	**64**	**64**	15
716. Rotating electric plant and parts thereof, nes	**88**	**55**	31
742. Pumps for liquids; liquid elevators; and parts thereof, nes	**75**	**80**	36
744. Mechanical handling equipment, and parts thereof, nes	**75**	**72**	31
749. Non-electric parts and accessories of machinery, nes	**53**	**75**	46
759. Parts, nes of and accessories for machines of headings 751 or 752	**67**	**64**	10
772. Electrical apparatus for making and breaking electrical circuits	**88**	**57**	32
773. Equipment for distribution of electricity	**86**	**61**	37
778. Electrical machinery and apparatus, nes	**80**	**55**	24
872. Medical instruments and appliances, nes	**78**	**63**	24
881. Photographic apparatus and equipment, nes	**76**	**62**	30
885. Watches and clocks	**83**	**51**	31
892. Printed matter	**51**	**83**	47
E. Alternating			
267. Other man-made fibers suitable for spinning, and waste	**51**	42	**55**
334. Petroleum products, refined	**52**	45	**86**
621. Materials of rubber	**79**	48	**62**
683. Nickel	**57**	49	**56**
728. Other machinery, equipment, for specialized industries; parts nes	**60**	48	**83**
368. Musical instruments, parts and accessories thereof	**81**	46	**76**
282. Waste and scrap metal of iron or steel	36	**54**	1
411. Animal oils and fats	20	**55**	13
582. Condensation, polycondensation and polyaddition products	36	**53**	23
611. Leather	50	**62**	19
657. Special textile fabrics and related products	31	**71**	43
674. Universals, plates, and sheets, of iron or steel	44	**53**	20
681. Silver, platinum and other metals of the platinum group	40	**69**	9
692. Metal containers for storage and transport	38	**67**	24

Table 4. (continued)

	1987-92	1993-2000	2001-06
736. Metalworking machine-tools, parts and accessories thereof, nes	47	**72**	48
741. Heating and cooling equipment and parts thereof, nes	32	**64**	20
743. Pumps, compressors; centrifuges; filtering apparatus; etc., parts	46	**76**	43
745. Other non-electric machinery, tools and mechanical apparatus, nes	26	**62**	27
774. Electro-medical and radiological equipment	44	**67**	46
873. Meters and counters, nes	48	**55**	31
883. Cinematograph film, exposed and developed	28	**51**	5
F. Below 50% after 1992			
122. Tobacco, manufactured	**70**	18	11
341. Gas, natural and manufactured	**51**	23	4
423. Fixed vegetable oils, soft, crude refined or purified	**69**	14	2
513. Carboxylic acids, and their derivatives	**70**	48	17
514. Nitrogen-function compounds	**53**	34	22
516. Other organic chemicals	**50**	30	30
562. Fertilizers, manufactured	**67**	29	6
585. Other artificial resins and plastic materials	**50**	9	26
613. Furskins, tanned or dressed; pieces of furskin, tanned or dressed	**71**	24	5
634. Veneers, plywood, "improved" wood and other wood, worked, nes	**72**	35	8
642. Paper and paperboard, precut, and articles of paper or paperboard	**87**	49	15
652. Cotton fabrics, woven (not including narrow or special fabrics)	**64**	48	40
661. Lime, cement, and fabricated construction materials	**54**	26	1
663. Mineral manufactures, nes	**62**	32	5
664. Glass	**71**	44	31
665. Glassware	**58**	35	26
667. Pearl, precious and semi-precious stones, unworked or worked	**73**	27	14
691. Structures and parts, nes, of iron, steel or aluminium	**69**	19	3
695. Tools for use in the hand or in machines	**50**	29	19
699. Manufactures of base metal, nes	**77**	45	23
721. Agricultural machinery (excluding tractors) and parts thereof, nes	**73**	48	18
751. Office machines	**64**	11	6
752. Automatic data processing machines and units thereof	**76**	32	4
761. Television receivers	**52**	6	2
762. Radio-broadcast receivers	**61**	3	0
764. Telecommunication equipment, nes; parts and accessories, nes	**76**	48	18
771. Electric power machinery, and parts thereof, nes	**78**	47	23
784. Motor vehicle parts and accessories, nes	**91**	31	5
791. Railway vehicles and associated equipment	**62**	38	23

Table 4. (continued)

	1987-92	1993-2000	2001-06
793. Ships, boats and floating structures	**51**	17	5
812. Sanitary, plumbing, heating, lighting fixtures and fittings, nes	**54**	22	7
871. Optical instruments and apparatus	**69**	43	27
882. Photographic and cinematographic supplies	**83**	47	14
893. Articles, nes of plastic materials	**77**	37	21
894. Baby carriages, toys, games and sporting goods	**67**	11	2
Source:Author's computation based on UN Comtrade data.			

Table 5. China's intra-industry trade index with ASEAN 4 (Indonesia, Malaysia, Philippines, Thailand) (%)

	1987-92	1993-2000	2001-06
A. Consistently above 50%			
233. Synthetic rubber, latex, etc.; waste, scrap of unhardened rubber	**64**	**57**	**53**
291. Crude animal materials, nes	**69**	**66**	**52**
533. Pigments, paints, varnishes and related materials	**62**	**86**	**84**
554. Soap, cleansing and polishing preparations	**70**	**66**	**53**
628. Articles of rubber, nes	**63**	**80**	**85**
642. Paper and paperboard, precut, and articles of paper or paperboard	**65**	**61**	**61**
664. Glass	**74**	**71**	**73**
684. Aluminium	**61**	**74**	**59**
728. Other machinery, equipment, for specialized industries; parts nes	**50**	**70**	**63**
741. Heating and cooling equipment and parts thereof, nes	**72**	**79**	**55**
743. Pumps, compressors; centrifuges; filtering apparatus; etc., parts	**55**	**73**	**78**
764. Telecommunication equipment, nes; parts and accessories, nes	**67**	**71**	**78**
773. Equipment for distribution of electricity	**65**	**66**	**93**
B. Above 50% after 1992			
292. Crude vegetable materials, nes	49	**78**	**65**
334. Petroleum products, refined	25	**58**	**77**
532. Dyeing and tanning extracts, and synthetic tanning materials	20	**63**	**78**
598. Miscellaneous chemical products, nes	23	**70**	**91**
633. Cork manufactures	11	**55**	**65**
651. Textile yarn	41	**54**	**73**
674. Universals, plates, and sheets, of iron or steel	50	**61**	**56**
716. Rotating electric plant and parts thereof, nes	3	**65**	**86**
749. Non-electric parts and accessories of machinery, nes	28	**63**	**77**
759. Parts, nes of and accessories for machines of headings 751 or 752	38	**56**	**86**

Table 5. (continued)

	1987-92	1993-2000	2001-06
772. Electrical apparatus for making and breaking electrical circuits	29	**69**	**64**
778. Electrical machinery and apparatus, nes	44	**74**	**94**
872. Medical instruments and appliances, nes	24	**54**	**61**
874. Measuring, checking, analysis, controlling instruments, nes, parts	15	**57**	**80**
881. Photographic apparatus and equipment, nes	31	**52**	**71**
892. Printed matter	41	**69**	**57**
C. Above 50% after 2000			
211. Hides and skins, excluding furs, raw	2	12	**52**
223. Seeds and oleaginous fruit, whole or broken, for other fixed oils	21	50	**55**
273. Stone, sand and gravel	17	46	**58**
322. Coal, lignite and peat	4	17	**64**
423. Fixed vegetable oils, soft, crude refined or purified	5	34	**53**
515. Organo-inorganic and heterocyclic compounds	14	5	**63**
516. Other organic chemicals	27	40	**77**
613. Furskins, tanned or dressed; pieces of furskin, tanned or dressed	6	30	**61**
686. Zinc	18	40	**76**
736. Metalworking machine-tools, parts and accessories thereof, nes	3	40	**89**
751. Office machines	14	21	**51**
763. Gramophones, dictating machines and other sound recorders	29	21	**52**
771. Electric power machinery, and parts thereof, nes	30	40	**93**
784. Motor vehicle parts and accessories, nes	36	25	**52**
848. Articles of apparel, clothing accessories, non-textile, headgear	1	40	**58**
871. Optical instruments and apparatus	1	36	**71**
884. Optical goods nes	19	45	**79**
885. Watches and clocks	4	23	**86**
897. Gold, silver ware, jewelry and articles of precious materials, nes	9	46	**54**
898. Musical instruments, parts and accessories thereof	33	43	**79**
931. Special transactions, commodity not classified according to class	12	8	**63**
D. Below 50% after 2000			
512. Alcohols, phenols etc., and their derivatives	**52**	**51**	17
692. Metal containers for storage and transport	**58**	**62**	47
727. Food-processing machines (non-domestic) and parts thereof, nes	**76**	**65**	42
E. Alternating			
514. Nitrogen-function compounds	**68**	45	**78**
592. Starches, insulin and wheat gluten; albuminoidal substances; glues	**57**	25	**57**
611. Leather	**68**	34	**55**
111. Non-alcoholic beverages, nes	29	**54**	39

Table 5. (continued)

	1987-92	1993-2000	2001-06
265. Vegetable textile fibers, excluding cotton, jute, and waste	20	**64**	3
411. Animal oils and fats	26	**62**	48
511. Hydrocarbons, nes, and derivatives	33	**57**	42
635. Wood manufactures, nes	38	**54**	41
653. Fabrics, woven, of man-made fibers (not narrow or special fabrics)	36	**69**	36
656. Tulle, lace, embroidery, ribbons, trimmings and other small wares	44	**54**	29
657. Special textile fabrics and related products	43	**74**	43
665. Glassware	31	**53**	44
667. Pearl, precious and semi-precious stones, unworked or worked	32	**69**	31
677. Iron or steel wire (excluding wire rod), not insulated	6	**52**	39
691. Structures and parts, nes, of iron, steel or aluminium	36	**52**	37
725. Paper and paper manufacture machinery, and parts thereof, nes	19	**71**	48
726. Printing, bookbinding machinery, and parts thereof, nes	24	**71**	40
745. Other non-electric machinery, tools and mechanical apparatus, nes	42	**66**	23
752. Automatic data processing machines and units thereof	12	**70**	33
761. Television receivers	29	**51**	10
776. Thermionic, microcircuits, transistors, valves, etc.	47	**62**	19
821. Furniture and parts thereof	33	**68**	28
893. Articles, nes of plastic materials	44	**65**	45
F. Below 50% after 1992			
287. Ores and concentrates of base metals, nes	**52**	31	3
612. Manufactures of leather or of composition leather, nes; etc.	**55**	21	30
625. Rubber tires, tire cases, inner and flaps, for wheels of all kinds	**65**	13	25
641. Paper and paperboard	**59**	24	30
652. Cotton fabrics, woven (not including narrow or special fabrics)	**53**	36	31
659. Floor coverings, etc.	**60**	45	45
721. Agricultural machinery (excluding tractors) and parts thereof, nes	**54**	40	15
812. Sanitary, plumbing, heating, lighting fixtures and fittings, nes	**66**	35	29
Source:Author's computation based on UN Comtrade data.			

adopted a comparative advantage defying industrialization; reform of many state-owned enterprises (SOEs) prior to 1993 was one without losers and concentrated only in introducing changes in managerial and incentives systems, implicitly suggesting there was no market-driven exit of industries; moreover, the subsidy from the central government was only altered in form but not in substance—from a direct budgetary grant to bank loans. The period when SOEs were allowed to fail, imposing the hard budget constraint,

came only after the 1993 Enterprise Law was passed. More important are the industries in group A, where BIIT is sustained in all three subperiods (e.g., intermediate goods such as chemicals, textile yarn, metal and nonmetal manufactures, and light machineries).

The increase in IIT in numerous capital-intensive heavy industries during the second period, 1993-2000, is due to China's industrial restructuring in the early '90s. In its initial phase of transition prior to 1993, China went on a reverse industrial catching up in labor-intensive light manufacturing industries—in line with its natural comparative advantage. By the early '90s, the catching up was complete and China shifted back to capital-intensive and high-technology industrialization. The Company Law was passed in 1994, providing the legal framework for SOEs to convert to modern-day corporations through different forms of ownership. Moreover, in 1997 the 15th Communinst Party Congress adopted a policy of "grasping the large and letting the small go": policymakers focused on the centrally controlled firms and refinanced and reorganized them into even bigger firms. The focus then was on industries with substantial economies of scale, energy (power generation and distribution), natural resources, metallurgy, military and national defense, and telecommunications.

China's BIIT with Korea and Taiwan supports the story of relocation of production networks to China and the participation of other countries. Prior to 1993, trade in SITC 752 (automatic data processing machines) and SITC 759 (parts and accessories for machines in 751 and 752) with Korea and Taiwan was inter-industry, initially with China as the net importer. In the next two subperiods, BIIT with Taiwan and Korea increased in both industries, with China beginning to export as well. Enter ASEAN 4: BIIT for SITC 759 increased to 56 percent and 86 percent during the second and third periods (Table 6).

Without estimating a breakdown of total IIT into HIIT and VIIT, the estimated BIIT, which is actually total IIT, may be used to illustrate and support the relocation of production networks to China in the early '90s for IT and electronic products, telecommunications equipment, and the transport sector—mostly in motor vehicles.

Prior to 1993, trade in SITC 752 (automatic data processing machines, and parts and accessories for machines) with Korea and Taiwan was inter-industry initially, with China as the net importer. In the next two periods, BIIT with Taiwan and Korea increased in both industries, with China beginning to export as well. Similarly, ASEAN 4's BIIT increased to 56 percent and 86 percent.

Table 6. China's BIIT (%) with East Asian countries in industries characterized by production networks

SITC 3 digit	Japan			**Korea**			Hong Kong		
	1987 - 1992	1993 - 2001	2001 - 2006	**1987 - 1993**	**1993 - 2002**	**2001 - 2007**	1987 - 1992	1993 - 2001	2001 - 2006
751. Office machines	19	35	26	**14**	**46**	**66**	64	11	6
752. Automatic data processing machines and units thereof	4	75	28	**12**	77	**74**	76	32	4
759. Parts, nes of and accessories for machines of headings 751 or 752	6	46	75	**22**	**71**	**57**	67	64	10
761. Television receivers	40	55	7	**24**	**42**	**15**	52	6	2
762. Radio-broadcast receivers	37	25	5	**33**	**72**	**10**	61	3	0
763. Gramophones, dictating machines and other sound recorders	5	44	49	**28**	**22**	**12**	21	8	2
764. Telecommunication equipment, nes; parts and accessories, nes	9	73	94	**24**	**71**	**65**	76	48	18
771. Electric power machinery, and parts thereof, nes	49	85	81	**51**	**93**	**83**	78	47	23
776. Thermionic, microcircuits, transistors, valves, etc.	4	20	20	**1**	**27**	**24**	47	85	63
781. Passenger motor vehicles (excluding buses)	0	0	0	**0**	**0**	**1**	43	15	1
783. Road motor vehicles, nes	0	0	0	**0**	**0**	**6**	46	7	0
784. Motor vehicle parts and accessories, nes	41	48	51	**32**	**40**	**26**	91	31	5

SITC 3 digit	**Taiwan**			ASEAN 4			**Philippines**		
	1987 - 1992	**1993 - 2001**	**2001 - 2006**	1987 - 1993	1993 - 2002	2001 - 2007	**1987 - 1992**	**1993 - 2001**	**2001 - 2006**
751. Office machines	**25**	**50**	**38**	21	51	16	**3**	**14**	**78**
752. Automatic data processing machines and units thereof	**4**	**57**	**87**	12	70	33	**15**	**41**	**19**
759. Parts, nes of and accessories for machines of headings 751 or 752	**8**	**76**	**62**	38	56	86	**0**	**51**	**45**
761. Television receivers	**60**	**48**	**55**	29	51	10	**2**	**0**	**5**
762. Radio-broadcast receivers	**11**	**6**	**2**	31	6	34	**0**	**0**	**0**
763. Gramophones, dictating machines and other sound recorders	**7**	**46**	**14**	29	21	52	**0**	**0**	**20**
764. Telecommunication equipment, nes; parts and accessories, nes	**10**	**36**	**56**	67	71	78	**51**	**48**	**84**
771. Electric power machinery, and parts thereof, nes	**27**	**92**	**92**	40	93	11	**15**	**21**	**86**
776. Thermionic, microcircuits, transistors, valves, etc.	**6**	**16**	**14**	47	62	19	**21**	**73**	**14**
781. Passenger motor vehicles (excluding buses)	**10**	**16**	**24**	3	36	27	**0**	**6**	**36**
783. Road motor vehicles, nes	**0**	**0**	**0**	1	10	9	**0**	**3**	**8**
784. Motor vehicle parts and accessories, nes	**38**	**71**	**46**	0	3	8	**43**	**3**	**13**

Source:Author's computation based on UN Comtrade data;Tables 1-5.

The interplay of IIT among China's trading partners is best viewed at the 4 digit within SITC 752 (i.e., SITC 7525, peripheral units, including control and adapting units) where BIIT is above 50 percent for Korea, Taiwan, and ASEAN 4. Peripherals are the accessories that go with the machines. Accessories are generally easier to produce with low technology content. This type of IIT is usually analysed within the context of VIIT. BIIT in SITC 759 is really dominated by trade in SITC 7599 (parts and accessories for machines of headings 751 and 752) where China's BIIT is preserved with Japan, Taiwan, Korea, and the Philippines.

The same pattern is observed for telecommunications equipment, parts, and accessories (SITC 764), which are inputs to SITC 761, 762, and 763. BIIT with Japan and Korea registered 70-80 percent in the latter two periods while BIIT started much earlier with ASEAN 4 and the Philippines; however, trade in the finished goods SITC 761, 762, and 763 is inter-industry with all countries. China's BIIT in thermionic, microcircuits, transistors, and valves (SITC 776), input to a broad group of electronic/digital products, started in the first period with ASEAN 4 and Hong Kong; however, it was only sustained with Hong Kong until the third subperiod. The most probable explanation for these decreases in BIIT is that China has become the dominant exporter in an industry where technology has relatively matured and comparative advantage is largely driven by labor costs. The surprise is in parts for motor vehicles (SITC 784), which are components into SITC 781 and 783. The IIT with Japan, Korea, and Taiwan are borderline cases; but trade in the finished goods, SITC 781 and 783, are almost purely inter-industry trade.

6. Analysis of China's intra-industry trade

Analysing all industries with BIIT with China is out of the scope of this research paper.

This section chooses two industries where their BIIT with China has been sustained throughout the 1986-2007 period.

Take SITC 684 (aluminum): BIIT was 73 percent, 72 percent, 83 percent with Japan. China exported and/or was a net exporter of SITC 6841 (aluminum and alloys, unwrought) while it imported and/or was a net importer of SITC 6842 (aluminum and alloys, worked). For all nonferrous metals industries (SITC 681-687) where BIIT was greater than 50 percent, the pattern with other countries is similar: China is exporting and/or a net exporter of a less processed product while importing and/or a net importer

of more refined/processed products. However, at SITC 4 digit, BIIT is not uniformly less than or greater than 50 percent (Table 7).

Table 7. China's BIIT in selected industries (%)

Japan	1987-1992	1993-2000	2001-2006
681. Silver, platinum and other metals of platinum group	53	35	21
682. Copper	40	10	15
683. Nickel	30	60	81
684. Aluminium	73	72	83
685. Lead	15	14	61
686. Zinc	35	44	64
687. Tin	4	54	90
651. Textile yarn	84	90	88
652. Cotton fabrics, woven (not including narrow or special fabrics)	80	67	48
Korea			
681. Silver, platinum and other metals of platinum group	0	12	20
682. Copper	17	51	50
683. Nickel	0	30	53
684. Aluminium	36	68	75
685. Lead	1	7	14
686. Zinc	26	15	54
687. Tin	0	64	23
651. Textile yarn	58	84	90
652. Cotton fabrics, woven (not including narrow or special fabrics)	32	91	83
Taiwan			
681. Silver, platinum and other metals of platinum group	0	0	42
682. Copper	8	11	20
683. Nickel	5	21	26
684. Aluminium	27	16	53
685. Lead	8	25	18
686. Zinc	18	56	69
687. Tin	24	54	28
651. Textile yarn	6	8	9
652. Cotton fabrics, woven (not including narrow or special fabrics)	7	7	22

Table 7. (continued)

ASEAN 4			
681. Silver, platinum and other metals of the platinum group	1	32	1
682. Copper	43	33	29
683. Nickel	8	18	39
684. Aluminium	61	74	59
685. Lead	1	1	2
686. Zinc	18	40	76
687. Tin	26	20	16
651. Textile yarn	41	54	73
652. Cotton fabrics, woven (not including narrow or special fabrics)	53	36	31
653. Fabrics, woven, of man-made fibers (not narrow or special fabrics)	36	69	36
Source:Tables 1-5.			

It is often assumed that China is a developing country with scarce capital and abundant labor. One of the results of China's planned economy was the establishment of a comprehensive industrial system focused on heavy industries, a fact largely overlooked in analysing China's IIT. Within heavy industries, the unevenness was due to an overemphasis on coarse processing rather than refined processing [Lin, Cai, and Li 2003]. Moreover, China leapfrogged the normal route to industrialization by adopting comparative advantage defying strategy in many key pillar heavy industries; it was on hold between 1978 and 1992, when China went on a reverse industrial catching up consistent with its natural comparative advantage. In 1993, it resumed its industrial restructuring and reform focused on capital-intensive industries and high-technology sectors. In 2003, state ownership of these industries was transferred to the State Asset Supervision and Administration Commission (SASAC), which exercised central government's ownership rights; the most powerful is the Central SASAC which exercises direct ownership in key sectors such as energy (power generation, transmission, and distribution), petroleum industries (exploration, refining, and distribution), national defense, metallurgy, natural monopolies, public sector services, telecommunications, and some high-technology sectors.

The case on textile yarn is important for many reasons. BIIT has been high and sustained with Japan, Korea, and ASEAN 4 for 20 years; it is an input to fabrics and garments, one of China's largest exports. With ASEAN 4, BIIT started in the mid-'90s and then increased substantially toward the

last period, largely due to trade with Malaysia and Thailand. The BIIT with Hong Kong went beyond the 50 percent threshold only in 1992 and 1993, then dropped below 50 percent in the years before and after the mid-'90s, and declined toward the late '90s. Trade with Taiwan in textile yarn is inter-industry, and China was the net importer of synthetic fiber (SITC 6514). The Philippines' case was borderline, around 27 percent, 44 percent, and 30 percent in the three periods, with very low volume of trade in all 4-digit codes.

China's textile and garments industry is the largest in the world and is vertically integrated: from cotton, silk, and flax growing and cultivation and animal husbandry for wool, to spinning, weaving, and finally garments. Trade in SITC 84 (clothing and garments) with all other countries is inter-industry, with China as the net exporter. Therefore, it would not be surprising that China needs to import these intermediate goods. However, the high and sustained BIIT in yarn and fabrics cannot be explained by these impressionistic factors.

Data extracted at 4 digit for SITC 651 (textile yarn) reveal an interesting pattern of exchange. BIIT at the 4 digit does not drop as expected,[4] but remains at 50 percent and above for several SITC 4-digit industries toward the early and mid-'90s. The pattern of exchange is even more interesting: China has been exporting initially yarns from natural cotton, silk, and wool but importing synthetic yarns from Japan, which explains the high BIIT in SITC 651. But from 1996 onward, China started to export synthetic yarn to Japan. For Korea and ASEAN 4, their BIIT is also preserved at the several SITC 4-digit products.

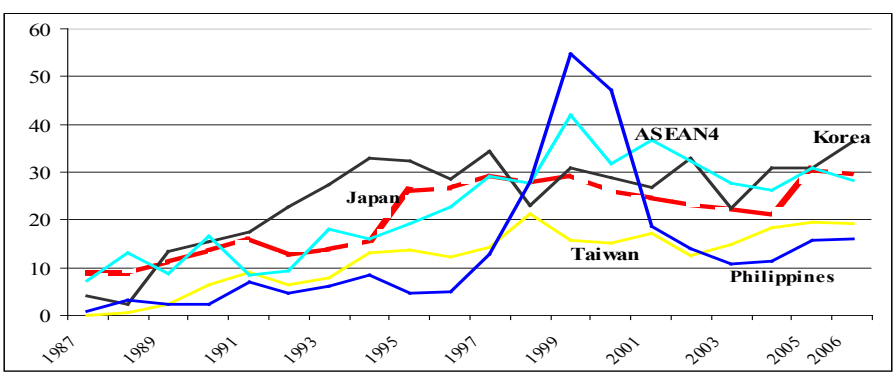
Fibers from which yarn is made have come from natural sources (such as cotton, silk, flax, and wool) and man-made fibers from plant cellulose; synthetic fibers from hydrocarbons began replacing cotton, the dominant source of yarn. Nevertheless, the yarn industry has also been driven by continuous innovation since the '60s, creating an explosion of new products starting from synthetic fibers to the innovation of microfibers, with applications beyond the textile and fabric industries. China's technological gap in the early years of opening up was particularly high. A safe assumption is that China was not able to access the new technology because its economy was closed up until the late '70s. China's high IIT in yarn can be explained by a desire to acquire technology, thereby allowing foreign investments to establish manufacturing enterprises in the industry; it would not be surprising if export of synthetic yarns was substantially

[4] This computational bias has been dealt with in section 4 of this paper.

made by FIEs. In the late '80s, China barely exported SITC 6514, 6515, and 6516 (different types of synthetic yarn) to East Asia. However, by the mid-'90s and onward, China started exporting these synthetic fibers (mostly SITC 6514) to Japan, thus BIIT at SITC 6514, 6515, and 6516, and even 6513, started to increase to the point where trade becomes intra-industry. An area for further research would be to find out if the exports of synthetic yarn at some point can be increasingly attributed to domestic firms.

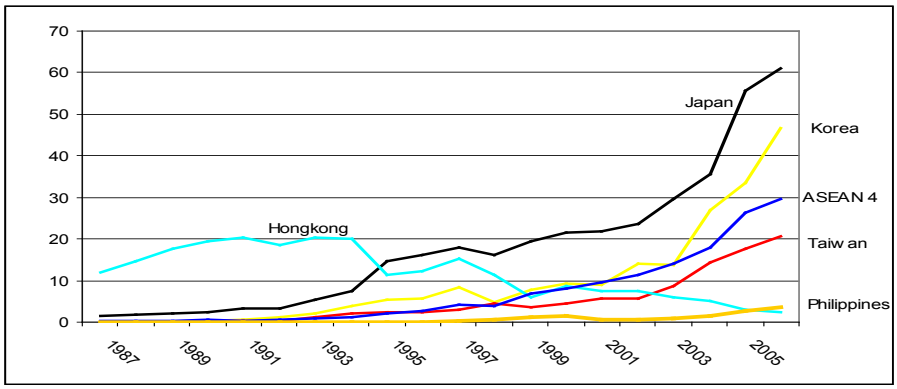
The pattern of BIIT in SITC 652 (cotton fabrics, woven) with Japan and Korea repeats the pattern of the metals industry. BIIT in the three periods goes like this: with Japan, it was 80 percent, 67 percent, 48 percent; with Korea, 32 percent, 91 percent, 83 percent; with ASEAN 4, 53 percent, 36 percent, 31 percent (Table 7). China was a net importer of a more processed cotton fabric (SITC 6522, bleached, dyed, or otherwise finished) but a net exporter of a less processed cotton fabric (SITC 6521, unbleached, not mercerized). However, the BIIT with Korea eventually went over the 50 percent threshold for bleached cotton—that is, China was beginning to export the more processed fabric. In its trade with ASEAN 4, China was a net exporter of the more processed fabric.

To wrap up, the volume of intra-industry versus inter-industry trade of China with East Asia is estimated from 1987 to 2006. The assumptions are as follows: (a) an industry is defined at SITC 3-digit level; (b) IIT should be greater than 50 percent; if not, it is classified as inter-industry trade. This procedure is done for each industry, for every country/trade bloc every year. Needless to say, the shares and volume of IIT will change if IIT is computed at 2- or 4-digit level and/or if the threshold is higher or lower. The results are shown in Figures 2 and 3.



Source: Appendix Table 2.

Figure 2. China's BIIT with East Asia (% of total trade)



Source: Appendix Table 2.

Figure 3. Volume of China's intra-industry trade in East Asia (US$ billion)

Japan has the highest share of IIT in its total trade with China in the late '80s; toward the early '90s, Korea caught up and surpassed Japan from the mid to the late '90s with a peak share of 36 percent in 2006. For ASEAN 4, the share of IIT in its total trade is surprisingly higher initially than that of Korea and Taiwan. Even if the figure is adjusted for a number of countries, IIT for each country would be approximately 1.5 percent of its total trade. The share of the Philippines was the least till the late '90s but spiked to very high shares in 1999 and 2000 and then ratcheted downward toward the remaining years of 2000.

Except for Hong Kong, the volume of intra-industry trade shows an upward trend for all trading partners, with a much faster rate of increase in the last five years (Figure 3). This means that in the early years, China's integration with East Asia was predominantly through inter-industry trade but the trend points to the increasing role of intra-industry trade with all of its trading partners. There is a difference though: for Japan, Korea, and Taiwan, the share of IIT in total trade is increasing both in absolute (by volume of trade) and relative terms (by percent share in total trade). For ASEAN 4 and the Philippines, the share of IIT in total trade is only increasing in absolute terms but decreasing in relative terms. Overall, the role of IIT in China's integration was highest for Japan and Korea, the former due to its volume of IIT and the latter due to its share of IIT in total trade. Taiwan had a lesser role both in terms of the volume of total trade as well as the share of IIT.

7. Conclusions

The role of IIT in China's integration with East Asia was minimal initially but has increased relative to inter-industry trade over the years. BIIT trade with Japan, Korea, and Taiwan has increasingly become more important through higher volume and higher shares of trade in a growing number of industries. While this is also true for its trade with ASEAN 4, IIT is less both in absolute and relative terms. The overall trend shows China's integration with East Asia has not only increased but also deepened.

China's sustained BIIT in capital-intensive heavy industries, contrary to theoretical expectations, should be analysed in the context of its historical legacy from the planned period to the continued dominance and/or monopoly of the central government in these key "jewel" industries. Further research could concentrate on government ownership as a key factor in the existence of IIT in many capital-intensive industries.

References

Abd-el-Rahman, K. [1991] "Firms' competitive and national comparative advantages as joint determinants of trade composition", *Weltwirtschaftliches Archive* **127**(1): 83-97.

Ando, M. [2006] "Fragmentation and vertical intra-industry trade in East Asia", *The North American Journal of Economics and Finance* **17**(3): 257-281.

Asian Development Bank (ADB) [2007] *The Boao Forum for Asia annual report 2007: progress of regional cooperation and integration in Asia and the Pacific*. Manila: ADB.

Asian Development Bank (ADB) [2009] *The Boao Forum for Asia annual report 2009: Asia at the face of the global financial crisis*. Manila: ADB.

Dixit, A.K. and J. Stiglitz [1977] "Monopolistic competition and optimum product diversity", *American Economic Review* **67**: 297-308.

Falvey, R.E. [1981] "Commercial policy and intra-industry trade", *Journal of International Economics* **11**: 495-511.

Falvey, R.E. and H. Kierzkowski [1987] "Product quality, intra-industry trade and (im)perfect competition" in: H. Kierzkowske, ed., *Protection and competition in international trade: essays in honour of W.M. Corden*. Oxford: Basil Blackwell.

Flam, H. and E. Helpman [1987] "Vertical product differentiation and north-south trade", *American Economic Review* **77**: 810-822.

Fontagne, L. and M. Freudenberg [1997] *Intra-industry trade: methodological issues reconsidered*. CEPII Working Paper 97-01.

Gaulier, G., F. Lemoine, and D. Unal-Kesenci [2005] "China's integration in East Asia: production sharing, FDI and high tech trade", CEPII Working Paper 2005-09.

Gaulier, G., F. Lemoine, and D. Unal-Kesenci [2006] "China's emergence and the reorganization of trade flows in Asia", CEPII Working Paper 2006-05.

Greenway, D. and C. Milner [1981]. "Trade imbalance effects in the measurement of intra-industry trade", *Review of World Economics* **117**(4): 756-762.

Grubel, H.G and D.J. Lloyd [1975] *Intra-industry trade: the theory and measurement of international trade in differentiated products*. London: Macmillan.

Hamilton, C. and P. Kniest [1991] "Trade liberalisation, structural adjustment and intra-industry trade: a note", *Weltwirtschaftlichies Archiv* **127**(2): 357-367.

Hellvin, L. [1996] "Vertical intra-industry trade between China and OECD countries", OECD Development Center Working Paper 114.

Hu, X. and Y. Ma [1999] International intra industry trade of China. *Review of World Economics* **135**(1): 82-101.

Jones, R. and A. Krueger, eds. [1990] *The political economy of international trade: essays in honor of R.E. Baldwin*. Oxford.

Jones, R. and H. Kierzkowski [2001] "A framework for fragmentation" in: S.W. Arndt and H. Kierezkowski, eds., *Fragementation: new production patterns in the world economy*. Oxford University Press.

Krugman, P. [1980] *Rethinking international trade*. Cambridge: MIT Press.

Krugman, P.R. and M. Obstfeld [2002]. *International economics theory and policy*. Fifth edition. Addision-Wesley Publishing Company.

Lancaster, K. [1980] "Intra industry trade under perfect monopolistic competition", *Journal of International Economic* **10**: 151-176.

Lin, J.Y., F. Cai, and Z. Li [2003] *The China miracle: development strategy and economic reform*. Revised edition.

Lin, J.Y. and Y. Wang [2008] "China's integration with the world: development as a process of learning and industrial upgrading", World Bank Policy Research Working Paper 4799.

Lloyd, P.J. and H.G. Grubel [2003] *Intra-industry trade*. Edward Elgar Publishing Limited.

Naughton, B. [2007] *The Chinese economy: transitions and growth*. MIT Press.

Ng, F. and A. Yeats [2003] "Major trade trends in East Asia: what are their implications for regional cooperation and growth", World Bank Policy Research Working Paper 3084.

Tan, E.S. [2008] "Regionalism in East Asia: the ASEAN + 1 initiatives", *The Philippine Review of Economics* **45**(1): 127-138.

Wei, S.J., G.J. Wen, and H. Zhou, eds. [2002] *The globalization of the Chinese economy*. Edward Elgar Publishing Limited.

Xing, Y. "Foreign direct Investment and China's bilateral intra-industry trade with Japan and the US", Bank of Finland, BOFIT Discussion Papers I/2007, Institute for Economies in Transition.

Zhang, J., A. van Witteloostuijn, and C. Zhou [2005] "Chinese bilateral intra-industry trade: a panel data study for 50 countries in the 1992-2001 period", *Review of World Economics* **141**(3): 510-540.

Appendix Table 1. Intraregional trade in East Asia

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
East Asia 15	36.9	35.6	38.1	39.8	40.7	41.5	44.7	46.0	47.0	48.7	49.8
China Circle	18.6	19.4	22.1	24.3	25.8	28.8	31.0	31.8	28.5	29.0	28.1
ASEAN	17.9	16.3	17.0	16.5	16.2	17.0	18.1	18.5	19.6	21.3	21.1
ASEAN+China	15.9	13.9	15.1	15.0	15.0	15.8	16.6	16.4	17.2	18.6	19.2
ASEAN+Japan	19.9	17.1	18.2	18.7	19.9	21.7	23.1	23.4	25.1	26.6	27.5

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
East Asia 15	49.8	49.5	46.9	48.6	50.7	50.4	52.3	53.5	53.6	53.1	52.4	51.9
China Circle	**27.9**	**28.3**	**27.9**	**27.0**	**26.4**	**26.9**	**28.0**	**27.2**	**26.4**	**26.0**	**25.5**	**24.3**
ASEAN	21.3	21.4	21.1	21.8	22.7	22.2	22.7	24.4	24.4	24.9	25.6	25.4
ASEAN+China	19.4	19.5	18.7	19.2	20.1	19.3	20.0	20.7	20.5	20.8	21.2	21.4
ASEAN+Japan	27.7	26.8	23.8	24.8	26.4	25.8	25.7	26.2	26.1	26.0	25.9	26.1

Source of basic data: UN Comtrade online data base.
China Circle: The PRC; Taiwan, China; and Hongkong, China

Appendix Table2. China's intra-industry trade in East Asia, 1987-2006

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Japan (%)	9.1	9.0	11.5	13.7	16.2	12.7	14.1	15.7	26.1	26.8
Total trade ($ B)	16	19	19	17	20	25	39	48	57	60
Korea (%)	4.1	2.3	13.5	15.4	17.6	22.7	27.3	32.8	32.3	28.6
Total trade ($B)	0.01	0.29	0.90	1.94	3.24	5.03	7.80	12	16	20
Taiwan (%)	0.1	0.6	2.4	6.5	8.9	6.4	7.8	13.1	13.8	12.3
Total trade	1	1	2	3	4	7	14	16	18	19
Hong Kong (%)	54.2	55.1	58.1	57.5	59.2	47.5	50.0	43.4	23.0	22.1
Total trade ($ B)	22	27	30	34	34	39	41	46	50	55
ASEAN 4 (%)	7.4	13.1	8.7	16.6	8.5	9.3	18.0	16.1	19.2	22.7
Total trade ($ B)	2	3	3	4	5	5	6	8	11	12
Philippines (%)	0.8	3.1	2.4	2.4	7.1	4.7	6.1	8.5	4.7	5.0
Total trade ($ B)	0.4	0.4	0.3	0.3	0.4	0.4	0.5	0.7	1.2	1.4
Total trade With East Asia ($B)	44	57	63	69	85	104	103	132	152	161

Appendix Table2. (continued)

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Japan (%)	29.4	28.0	29.3	26.2	24.9	23.3	22.3	21.3	30.5	29.7
Total trade ($ B)	61	58	66	83	87	101	133	167	183	205
Korea (%)	34.5	22.9	30.8	28.7	26.9	33.0	22.3	31.0	30.9	36.3
Total trade ($B)	24	21	25	33	34	43	61	87	108	129
Taiwan (%)	14.4	21.3	15.7	15.1	17.3	12.6	15.0	18.4	19.4	19.2
Total trade	20	21	23	30	32	44	58	78	91	107
Hong Kong (%)	26.0	26.9	19.0	20.4	18.0	16.9	13.7	12.2	7.2	4.5
Total trade ($ B)	58	42	32	43	42	44	43	41	41	52
ASEAN 4 (%)	29.2	27.7	41.8	31.8	36.6	32.3	27.7	26.3	31.0	28.2
Total trade ($ B)	14	14	17	25	26	35	51	69	85	105
Philippines (%)	12.7	27.9	54.8	47.3	18.5	14.0	10.9	11.4	15.6	15.9
Total trade ($ B)	1.7	2.0	2.3	3.1	3.5	5.1	9.2	13.2	17.4	23.3
Total trade With East Asia ($B)	181	169	186	237	249	310	413	544	642	761
Source:Author's computation from Tables 1-5.Threshold for IIT is greater than 50 percent.										