
Product Fragmentation and Trade Patterns in East Asia*

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Abstract

International product fragmentation—the cross-border dispersion of component production/assembly within vertically integrated production processes—is an important feature of the deepening structural interdependence of the world economy. This paper examines the implications of this phenomenon for global and regional trade patterns, with special emphasis on countries in East Asia, using a new data set culled from the United Nations Commodity Trade Statistics Database. It is found that, while “fragmentation trade” has generally grown faster than total world trade in manufacturing, the degree of dependence of East Asia on this new form of international specialization is proportionately larger than that of North America and Europe. The upshot is that international product fragmentation has made East Asian growth increasingly reliant on extra-regional trade, strengthening the case for a global, rather than a regional, approach to trade and investment policymaking.

I. Introduction

Globalization—the deepening structural interdependence of the world economy—is one of the most-discussed sub-

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jects in the development policy debate in the last few decades. An important feature of the ongoing process of globalization is product fragmentation—the cross-border dispersion of component production/assembly within vertically integrated production processes.¹ For example, Japanese car producers export engine parts to their affiliates in Thailand, where these parts are assembled into engines using some other components procured from other countries in the region, and then exported back to Japan and other third-country markets. Computer producers in the United States increasingly rely on worldwide procurement networks spanning the globe for the production/assembly of most of the components embodied in the final product, and more recently some producers have begun to shift even final-stage assembly to some countries in Asia. German camera producers are now engaged only in design and marketing tasks, after shifting most segments of the production process to Japan and other Asian countries. Other products with significant international production sharing include television and radio receivers, optical products, musical equipment, watches, sewing machines, typewriters and other office equipment, aircraft parts, chemicals, pharmaceuticals, synthetic fibre, wearing apparel, and travel goods.

There is a sizable theoretical literature examining causes and modalities of international product fragmentation and its implications for trade flow analysis and trade policy (e.g., Baldwin 2001; Cantwell 1994; Deardorff 2001; Jones 2000; Jones and Kierzkowski 2001a, 2001b, 2001c; Venables 1999). Applied trade economists, however, have been rather slow in responding to this new form of international specialization. Trade flow analysis is still based on the traditional notion of a horizontal specialization scenario in which countries trade goods that are produced from start to finish in just one country. This gap in the empirical trade literature is primarily a result of the nature of readily accessible data on trade flows. The recent revisions to the United Nations (UN) trade data system have provided for countries to report data at a level suitable for separating “fragmentation trade” from the traditional form of commodity trade (“final trade”). However, this distinction has not yet been built into the readily available (published) data tabulations arising from the UN reporting system.

This paper aims to examine the extent, trends, and patterns of fragmentation trade and the implications of this new form of international specialization for analyzing

¹ This phenomenon has gone under alternative names, such as “vertical specialization” (Hummels, Ishii, and Yi 2001; Irwin 2002), “slicing the value chain” (Krugman 1995), “international production sharing” (Ng and Yeats 2001; Yeats 2001), and “outsourcing” (Rangan and Lawrence 1999; Hanson, Mataloni, and Slaughter 2001). Following Jones (2000), Jones and Kierzkowski (2001a, 2001b, 2001c), Venables (1999), Baldwin (2001), and others, we stick to the term “product fragmentation” in this paper.

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regional trade patterns, with special emphasis on the trade performance of countries in East Asia. The study is based on a systematic separation of trade in parts and components from total trade flows using UN trade data tapes. The East Asian experience is examined in the wider global setting, paying due attention to the involvement of other major trading nations/regions in assembly activities in the region.

There is a vast literature based on the standard trade data which unequivocally points to a persistent increase in intra-regional trade in East Asia (including, as well as excluding, Japan) from about the early 1980s (e.g., Kwan 2001; Drysdale and Garnaut 1997; Frankel and Wei 1997; Petri 1993). The evidence provided in this literature figures prominently in the current regional debate on forming regional trading arrangements covering some or all countries in East Asia. In particular, the proponents of the proposal by former Malaysian Prime Minister Mahathir Mohamad to form an East Asian Economic Caucus (EAEC) often refer to deepening economic interdependence reflected in intra-regional trade as evidence of its likely success. Increasing trade integration is also cited as an indicator of the potential benefits of monetary integration in the region (Kwan 2001). The hypothesis underpinning our analysis is that, in a context in which component trade is growing rapidly, conventional trade flow analysis, which is based on the (implicit) assumption that countries always trade in "goods," can lead to misleading inferences as to the nature and extent of trade integration among countries. The growth dynamism of component trade depends on the demand for the related final products, and there is ample evidence coming from the case study literature on multinational enterprises operating in the region that the demand for final products predominantly comes from the rest of the world, particularly from North America and countries in the European Union (EU).² Moreover, component trade presumably tends to infuse a significant (though not measurable) bias into the conventionally measured intra-regional trade ratio; when components cross borders several times at different stages of production, the officially recorded value of trade artificially rises with each crossing.

The paper is organized as follows: section 2 provides an overview of the phenomenon of international product fragmentation and its determinants in order to set the stage for the ensuing analysis. Section 3 discusses the procedure followed in extracting data from the UN trade data tapes and data quality. Section 4 examines the nature and extent of global trade in components and East Asia's role in this form of trade specialization. Section 5 deals with the implications of the rapid expansion of product fragmentation for analyzing intra- and extra-regional patterns of economic integration of East Asia. The final section presents the key policy inferences.

² See, for instance, Borrus (1997, 1999); Crosby and Nakamori (1991); Dobson and Chia (1997); Naughton (1999a, 1999b); McKendrick, Doner, and Haggard (2000).

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2. International product fragmentation: An introduction

The location in developing countries of relatively labor-intensive component production and assembly within vertically integrated international industries has been an important feature of the international division of labor since the late 1960s. The process started in the electronics and garment industries and subsequently spread into many other industries (Sharpton 1975; Finger 1975; Feenstra 1998). As already noted, component assembly operations are now transferred abroad in many industries in which the technology of production permits the separation of labor-intensive components from other stages of production. In general, industries that have the potential to break up the production process to minimize the transport cost involved are more likely to move to peripheral countries than other heavy industries.

International product fragmentation allows companies to unbundle stages of production so that each stage can be relocated in countries in which the intensively used inputs are cheap. The nature of factor intensity of the given segments and the relative prices of factors in comparison with their productivity jointly determine which country produces what components. Even then international product fragmentation will not occur if the extra costs associated with fragmentation outweigh the gain from the lower costs of the activity abroad. These extra costs may include transportation, communication, and other costs involved in coordinating the activity with what is still being done in the home country.

In this context, the expansion of international product fragmentation as a new facet of international production has been largely underpinned by three mutually reinforcing developments over the past few decades. First, rapid advancements in production technology have enabled the industry to slice up the value chain into finer, “portable” components. Second, technological innovations in communication and transportation have shrunk the distance that once separated the world’s nations and have improved the speed, efficiency, and economy of coordinating geographically dispersed production processes. This has facilitated the establishment of “services links” to combine various fragments of the production process in a timely and cost-efficient manner (Jones and Kierzkowski 1990, 2001a). Third, liberalization policy reforms in both home and host countries have considerably removed barriers to trade and investment.

There is an important two-way link between improvement in communication technology and the expansion of fragmentation-based specialization within global industries. The latter results in lowering of the cost of production and rapid market penetration of the final products through enhanced price competitiveness. Scale economies resulting in market expansion in turn encourage new technological ef-

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forts, enabling further product fragmentation. This two-way link has set the stage for fragmentation trade to increase more rapidly compared with conventional commodity-based trade (Jones 2000).

At the early stage, an important policy affecting the relocation of assembly activities was a provision in the tariff structures of the United States and other major industrialized countries (ICs) that allows companies to export material for processing overseas and to re-import the finished products, paying tariffs only on the value added abroad (not the exported intermediates) (Sharpton 1975; Finger 1975). The importance of these tariff concessions as a factor in promoting global sourcing has diminished over the years, however, by the process of trade liberalization in ICs and regional economic integration agreements.

Production outsourcing practices were initiated by multinational enterprises (MNEs) based in the United States. The involvement of Japanese and Western European MNEs in outsourcing began to gain importance from the late 1970s. More recently, MNEs from more advanced developing countries, notably those from East Asian newly industrialized economies (NIEs), have also joined this process of internationalization of production. In response to rapid domestic wage increases, the growing reluctance of domestic labor to engage in low-paid blue-collar employment, and stringent restrictions on the import of labor, firms in the electronics industry and other durable consumer goods industries in NIEs in East Asia have begun to produce components and subassembly activities in neighboring countries where labor costs are still low. Conventionally, international product fragmentation took the form of an MNE's building a subsidiary abroad to perform some of the functions that it once did at home. However, as production operations in host countries have become firmly rooted, MNEs have begun to subcontract some activities to pure local firms to which they provide detailed specifications and even fragments of their own technology. In recent years, outsourcing practices have begun to spread beyond the domain of MNEs. Many companies that are not parts of MNE networks now procure components globally through arm's-length trade. Technological innovations in communication (in particular, the Internet) have reduced the costs of outsourcing, particularly through reduced research costs. The process has also been facilitated by the standardization of some components, which has increased outsourcing flexibility. The bulk of fragmentation trade, however, still takes place under the rubric of MNEs (Rangan and Lawrence 1999; Hanson, Mataloni, and Slaughter 2001; Urata 2001).

At the formative stage of international product fragmentation, outsourcing predominantly took the form of locating small fragments of the production process in a low-cost country and re-importing the assembled components to be incorporated into

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the final product. Over time, the fragmentation process expanded to involve many countries in the assembly process at different stages, resulting in multiple border crossing of product fragments before getting incorporated in the final product. Recent years have witnessed two other important developments in the process, setting the stage for rapid expansion in the share of fragmentation-based trade in world trade.

First, as an outcome of advances in modular production (fixed-position automation) technology, some fragments of the production process in certain industries have become “standard fragments” that can be effectively used in a number of products.³ Examples include long-lasting cellular batteries, originally developed by computer producers and now widely used in cellular telephones and electronic organizers; transmitters, which are now used not only in radios (as originally designed) but also in PCs and missiles; and electronic chips, which have spread beyond the computer industry into consumer electronics, motor vehicle production, and many other product sectors (Jones 2000; Jones and Kierzkowski 2001a; Brown, Deardorff, and Stern 2003).

Second, there has been a noteworthy expansion of the coverage of global assembly operations from component production and assembly to assembly of final products (e.g., computers, cameras, TV sets, and motor cars). In final assembly, labor costs, while significant, are of secondary importance compared with the availability of world-class operators; technical and managerial skills; a good domestic basis of supplies and services; relatively free access to world-priced inputs, including capital; and excellent infrastructure. In other words, the locational decisions of MNEs in this sphere depend on the availability of a wider array of complementary inputs that enable their facilities to be efficient by world standards. In addition, given the heavy initial fixed costs, MNEs are hesitant to establish overseas plants in final assembly without considerable firsthand commercial experience in the host country. For these reasons, overseas production units of MNEs involved in such final-stage assembly are located in other industrialized countries or in more advanced newly industrializing economies (NIEs).⁴

Fragmentation of production and the emergence of new forms of international trade have begun to open up new opportunities for developing countries and transition

3 In the alternative case of “integral” production technology (which still remains the dominant mode of international product fragmentation), parts and components are product-specific.

4 In recent years, however, China has emerged as an important location for final assembly in many product lines, largely because of the vast domestic market for these products, which naturally reduces the risk of covering the initial establishment costs (Borras 1997).

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economies to participate in a finer international division of labor. For instance, a country need not set up a motor vehicle plant to benefit from the growth of the automobile industry: it is enough to be competitive in the production of a single part. At the early stages of international product fragmentation, some observers were skeptical about prospects for developing countries to rely on this form of international specialization for export expansion. They predicted that the process would be reversed because of rapid automation of production processes in developed countries (see Frobel, Heinrichs, and Kreye 1980; Cantwell 1994). In many high-tech industries (notably electronics and electrical products), however, rapid innovation and continuous technical change, which bring about a constant cycle of change and obsolescence, are formidable constraints on rapid automation as an alternative to offshore assembly. Therefore, the indications are that this form of internationalization of production will continue to expand, providing countries with the opportunity to find new niches for labor-intensive, export-oriented production (depending, of course, on their ability to provide an enabling domestic economic environment). Thus, international product fragmentation presents a challenge to those who believe in the so-called fallacy-of-composition argument against export-led industrialization in developing countries.

3. Data

This study makes use of data extracted from the UN trade data tapes based on Revision 3 of the Standard International Trade Classification (SITC Revision 3). In its original form (SITC Revision 1), the UN trade data reporting system did not provide for separating fragmentation trade (parts and components) from final goods. SITC Revision 2, introduced in the late 1970s (and implemented by most countries only in the early 1980s), adopted a more detailed commodity classification, which provided for separation of parts and components within the machinery and transport sector (SITC 7). About 60 individual three-, four-, and five-digit groups within SITC 7 consisted solely of components of manufactured equipment to be assembled. There was, however, considerable overlap between some advanced-stage assembly activities and related final goods within the sector in SITC Revision 2, which made it difficult to separate fragmentation trade from total trade (Ng and Yeats 2001).⁵

SITC Revision 3, introduced in the mid-1980s, marked a significant improvement over SITC Revision 2. In addition to redressing overlaps within SITC 7, this new version of SITC provided for separation of parts and components trade in the

⁵ For instance, the category “television tubes” was not separable from the category of “TVs,” and “computer processors” were lumped together with “computers.”

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miscellaneous-goods sector (SITC 8). These two sectors together accounted for around 70 percent of total world trade during the period under study.⁶ The list of parts and components is identified at the five-digit level for these two sectors, which provide the basis of our empirical analysis. The list contains a total of 225 five-digit products—168 products belonging to SITC 7 and 57 belonging to SITC 8.⁷

It is important to note that, despite its significant improvement over the previous version, SITC Revision 3 does not provide for the construction of data series covering the entire range of activities involving product fragmentation. As already noted, there is evidence that international product fragmentation has been expanding beyond SITC 7 and SITC 8 to other areas, in particular pharmaceutical and chemical products (falling under SITC 5) and machine tools and various metal products (SITC 6). Moreover, assembly activities in software trade, which have recorded impressive expansion in recent years, are lumped together with “special transactions” under SITC 9. So the tabulations presented here of the magnitude of trade in parts and components are biased downward. The magnitude of the downward bias, however, is unlikely to be substantial because products belonging to SITC sectors 7 and 8 account for over 70 percent of total manufacturing trade (see note 6) and also because outsourcing activities are presumably not yet widespread within the other SITC sectors (Yeats 2001; Feenstra 1998).

The analysis is based on data tabulated for three selected years: 1992, 1996, and 2000. Although SITC Revision 3 was introduced in the mid-1980s, there was a substantial time lag in the implementation of the system by reporting countries. We use 1992 as the starting point of our data tabulation because by this time countries accounting for over 95 percent of total world manufacturing trade had adopted the new system. Year 2000 is the most recent one for which trade data are available for all reporting countries. Given the prohibitive cost of tabulating data covering the entire period (1992–2000), 1996 was chosen as the most appropriate interim year for intertemporal comparison. As a further check on the time pattern of component trade, however, the analysis incorporates time-series data on the share of parts and components in total manufacturing in selected East Asian countries.

⁶ Share of SITC 7 and SITC 8 in total manufacturing trade (SITC 5 through SITC 8 less SITC 68):

Sector	Exports			Imports		
	1992	1996	2000	1992	1996	2000
SITC 7	50.4	50.4	53.2	53.8	52.1	55.1
SITC 8	18.1	17.2	16.7	16.9	15.5	15.0
SITC 7 + 8	68.5	67.6	69.9	70.7	67.6	70.1

⁷ The list is available in Athukorala (2003), appendix A-5.

The prime focus of the empirical analysis of this paper is on East Asia, defined to include Japan as well as developing countries in the region. The latter include the NIEs in North Asia (South Korea, Taiwan, and Hong Kong), China, and members of the Association of Southeast Asian Nations (ASEAN). Among the ASEAN countries, only the six largest economies (Indonesia, Malaysia, the Philippines, Thailand, Singapore, and Vietnam) are covered in the statistical analysis; Brunei, Cambodia, Laos, and Myanmar are ignored because of lack of data. The East Asian experience is examined in the wider global context, focusing specifically on the comparative experience of that region and on the North American Free Trade Area and the EU. The UN data system does not cover Taiwan (because it is not a UN member). Vietnam has not yet started reporting data under the SITC classification. Singapore has not been reporting data on its bilateral trade with Indonesia since 1964 for political reasons. In these cases, partner import and export data are based on partner country export and import records, respectively. As regards the commodity coverage, the focus here is on manufacturing trade. Following the standard practice in trade flow analysis, the products are defined here to include all goods belonging to SITC sections 5 to 8, net of SITC 68 and 67 (nonferrous metal).

4. Trends and patterns of product fragmentation

World trade in parts and components (henceforth referred to as “components” for brevity) increased from US\$337 million in 1992 to US\$1,086 billion in 2000, recording an annual average growth rate of 18 percent (table 1). The share of these products in total world manufacturing trade increased from 21 percent to 25 percent between these two years.

The share of East Asia (including Japan) in total world exports of components increased persistently from 34.5 percent in 1992 to 39.5 percent in 2000. This increase continued despite a persistent decline, from 17.9 percent to 12.6 percent, in the share accounted for by Japan, the dominant economy in the region. The share of developing East Asia (East Asia excluding Japan) increased from 16.6 to 26.8 percent between these two years. Within the group, all reporting countries except Singapore recorded increases in world market share. Rapid increase in assembly exports from China (a fivefold increase in export value, from US\$4 billion to over US\$19 billion, resulting in an increase in market share from 1.1 percent to 3.0 percent) is particularly noteworthy. Contrary to the popular perception that China is “crowding out” the rest of the East Asian countries, this increase has been within an overall increase in exports from other newcomers in the region. Component trade of Vietnam is also growing, but it still accounts for only a minor fraction of regional trade.

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Table 1. World trade in parts and components, 1992–2003 (%)

	Exports			Imports			Trade balance ^a		
	1992	1996	2000	1992	1995	2000	1992	1996	2000
East Asia	34.5	38.3	39.5	31.0	32.8	33.1	24.1	11	13.4
Japan	17.9	15.5	12.6	4.5	4.7	4.7	78.7	68.4	61.9
Developing East Asia	16.6	22.8	26.8	26.5	28.0	28.4	-34.8	-28.1	-9.4
China	1.1	1.7	3.0	3.5	2.9	4.9	-168.5	-78.5	-71.4
Hong Kong	2.2	0.9	0.5	3.3	4.6	4.9	-29.8	-408.9	-837
South Korea	3.0	3.8	4.3	3.8	3.3	3.3	-9.5	10.5	20.3
Taiwan	2.7	4.5	5.4	3.3	2.8	3.2	-4.4	36	38.7
ASEAN	7.7	11.8	13.6	12.6	14.5	12.0	-37.4	-27.8	8.5
Indonesia	0.2	0.3	0.5	1.2	0.9	0.3	-525.2	-259.3	26.1
Malaysia	2.6	3.4	3.7	3.5	3.8	3.6	-13.0	-16.0	0.4
Philippines	0.4	1.2	2.1	0.7	1.5	1.2	-38.4	-24.0	39.0
Singapore	3.4	5.6	5.5	5.0	6.0	5.1	-25.2	-10.3	3.8
Thailand	1.1	1.2	1.7	2.2	2.3	1.6	-60.3	-89.5	4.4
Vietnam	—	—	0.1	—	0.1	0.1	-1,275	-371.7	-155.6
South Asia	0.2	0.2	0.1	0.7	0.4	0.5	-172.0	-146.3	-230.2
Oceania	—	0.4	0.4	0.2	1.3	1.0	-355.1	-218.5	-198.1
NAFTA	28.2	24	23.9	33.5	25.8	27.5	-0.1	-11.8	-18.9
USA	22.1	18.7	17.9	23.2	17.7	17.7	11.8	1.7	-1.9
Canada	4.2	3.3	3.1	7.7	5.2	5.1	-53.9	-61.2	-65.9
Mexico	1.8	1.9	2.8	2.6	2.9	4.7	-20.8	-58.2	-74.4
Europe	36.3	35.8	33.2	30.6	36	33.1	8.2	4.3	13.1
EU	32.8	34.0	30.9	28.1	33.8	21.5	10	7.6	28.3
Latin America	0.6	0.6	2.1	1.3	2.2	3.7	-75.2	-255.8	-81.2
Middle East	—	0.5	0.7	2.3	1.2	0.8	-6,793.6	-166.3	-5.8
Africa	0.1	0.2	—	0.4	0.9	—	-479.2	-319.4	-236.9
World	100	100	100	100	100	100			
World (US\$ billion) ^b	336.8	756.9	1,086.4	336.8	756.9	1,086.4			
Share of parts and components in world manufacturing trade	20.7	21.7	25.4	21.7	21.4	24.5			

Source: Compiled from the United Nations Commodity Trade Statistics Database (UN Comtrade Database).

Note: — = zero or negligible.

a. The trade balance (exports – imports) is reported as a percentage of exports.

b. By definition, percentage shares in exports and imports for a given year should be identical. The minor differences seem to reflect recording errors and differences in measurement arising from the use of the cost, insurance, and freight (CIF) price for reporting imports and the free-on-board (FOB) price for reporting exports. The FOB price includes the cost of loading the goods aboard a vessel.

Japan's share in world component trade on the import side is much smaller than that on the export side. The former has remained largely unchanged at around 5 percent. This reflects the unique role played by Japan in world manufacturing trade in undertaking assembly activities in overseas locations (mostly in East Asia). When Japan is excluded, market share changes of individual East Asian countries on the import side closely mirror those on the export side.

Some observers predicted that the formation of NAFTA and the integration of some of the newly emerged countries from the former Soviet Union with the rest of the Europe could adversely affect developing East Asia's relative position in world assembly activities (USITC 1999; Kierzkowski 2001). These countries' proximity to industrial countries where final assembly activities are located and their relatively low wages by a regional standard (though they are not low when compared with those

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Table 2. Annual compensation per worker in manufacturing, 1990–98 (US\$ per month)

	1990	1991	1992	1993	1994	1995	1996	1997	1998
All countries	2,257	2,408	2,529	2,518	2,560	2,652	2,693	2,578	2,539
Canada	3,156	3,343	3,350	3,432	3,589	3,553	3,570	3,506	3,413
Europe	3,074	3,283	3,600	3,388	3,503	3,724	3,728	3,616	3,618
Latin America	903	920	1,009	1,146	1,175	1,147	1,253	1,343	1,284
Mexico	579	666	765	843	854	749	746	831	—
East Asia	1,788	1,950	1,963	2,141	2,129	2,115	2,138	1,883	1,787
China	178	217	213	317	293	395	428	513	533
Hong Kong	774	866	855	n.a.	850	844	1,219	1,077	1,178
India	348	315	323	335	318	427	463	461	474
Indonesia	388	409	436	414	483	466	475	459	395
Japan	3,808	4,108	4,373	4,902	5,723	5,934	5,849	5,343	5,054
South Korea	1,134	1,449	1,346	1,635	1,743	2,059	2,313	2,351	2,007
Malaysia	387	420	488	570	573	569	665	657	652
Philippines	314	370	467	499	565	580	647	623	598
Singapore ^a	810	911	1,067	1,264	1,477	1,424	1,623	1,469	1,720
Taiwan	1,162	1,337	1,639	1,638	1,695	1,914	n.a.	2,032	1,970
Thailand	343	428	502	569	508	523	568	508	472
Oceania	1,982	2,142	—	2,304	—	—	3,082	3,024	2,907
Australia	2,331	2,446	2,412	2,377	2,517	2,694	2,520	2,400	2,334
New Zealand	1,633	1,838	—	2,230	—	—	3,645	3,647	3,480

Source: Compiled from the Survey of U.S. Direct Foreign Investment Abroad, Bureau of Economic Analysis, Department of Commerce, Washington D.C. (various issues).

Note: Annual compensation = salary or wages plus other remuneration (including superannuation contribution) paid by foreign affiliates of U.S. multinational enterprises. — = data were suppressed in the original source for confidentiality, n.a. = not available.

a. Covers only workers in industrial machinery sector.

in some the East Asian countries) were considered added advantages over East Asian countries. Interestingly, this prediction is not supported by the data. World market shares of Mexico and the rest of Europe (i.e., Europe excluding the EU) have increased, but at a much slower rate than that of developing East Asia.

One possible explanation is that, despite rapid industrialization for over a decade, the average manufacturing wage in East Asia still remains low compared with those in Europe and North America (table 2). Moreover, significant differences in wages among the countries in the region have provided the basis for rapid expansion of an intra-regional product-sharing system in the region, giving rise to increased cross-border trade in parts and components. The substantial wage differential among countries in the region naturally makes intra-regional specialization especially profitable. Also, as first-comers in this area of international specialization, countries in East Asia (particularly Singapore, South Korea, Taiwan, and Malaysia) offer considerable agglomeration advantages for companies that are already located there. Decisions by MNEs operating in assembly activities to locate in a given country are strongly influenced by the presence of other key market players in that country (Barry and Bradley 1997; Ruane and Gorg 2001). Also, there is a general tendency for MNE affiliates to become increasingly embedded in host countries the longer they are present there and the more conducive the overall investment climate of the host country becomes over time. They may respond sluggishly to relative cost

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changes once they have invested substantial resources in domestic production facilities and in establishing information links (Rangan and Lawrence 1999).

In all countries/regions covered in our data tabulations, component trade is heavily concentrated in the machinery and transport equipment sector (SITC 7) (table 3). This sector accounts for over 90 percent of the combined component trade of SITC 7 and SITC 8 (miscellaneous manufacturing). Within SITC 7, both component exports and imports of East Asia are heavily concentrated in electronics and electrical industries. Four SITC three-digit industries of parts and accessories of office machinery (SITC 759), telecommunication equipment (SITC 764), apparatus for electrical circuits (SITC 772), and household electrical equipment (SITC 776), account for over 80 percent of the total trade of developing East Asia in SITC 7 and SITC 8. There is little variation among the individual East Asian countries in terms of trade composition. These electronics and electrical products are also the major areas of activity in other countries/regions. But the trade patterns of these countries/regions are characterized by a greater presence of other items such as engines and motors (SITC 714), industrial machinery (SITC 728), and internal combustion machines (SITC 713), for which transportation cost is presumably an important consideration for production location. Overall, these differences are consistent with our earlier inference about East Asia's competitive edge in fragmentation-based production in electrical and electronics industries.

Japan has persistently recorded a large trade surplus in assembly trade, reflecting the heavy involvement of Japanese companies in overseas assembly activities to maintain their competitiveness in final trade in third-country markets (table 1, last three columns). This is in contrast to the United States, whose assembly trade has remained virtually in balance because of the heavy dependence of U.S. firms on overseas assembly of components in order to maintain competitiveness in the domestic market (Borrus 1999). Among the individual East Asian countries, the trade positions of Malaysia, the Philippines, and Singapore have turned from deficits to surpluses in recent years. As we will see later, this reflects growing cross-border trade in assembly products within the region.

Table 4 presents comparative statistics on the share of components in total manufacturing exports and imports in 1992, 1996, and 2000 and their contribution to growth of manufacturing trade between these years. It is evident that the degree of dependence of East Asian countries as a group on component trade is much higher than that of all other regions in the world. In 2000, components accounted for 32.0 percent of total manufacturing exports from developing East Asia, compared with the world average of 25.4 percent, 28.1 percent for NAFTA, and 18.9 percent for the EU.

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Table 3. Percentage composition of parts and components exports and imports by three-digit SITC categories, 2000

SITC Description	CHN	HKG	KOR	IND	MAL	PHL	SGP	THAI	JPN	DEA	EAS	NAF	USA	EU	World
(A) Exports															
7 Machinery and equipment	91.9	84.1	98.1	93.9	98.6	99.5	98.5	96.9	95.0	97.0	96.3	94.8	90.8	93.6	94.2
713 Internal combustion engines	0.8	0.3	0.4	0.8	0.1	0.2	0.4	0.6	4.2	0.4	1.8	3.7	4.7	3.1	2.6
714 Engines and motors, nonelectric	0.2	0.0	0.3	0.0	0.1	0.0	0.1	0.1	0.9	0.1	0.4	3.0	0.7	3.9	2.6
716 Rotating electrical engine	0.8	1.1	0.3	0.4	0.1	0.0	0.2	0.4	0.7	0.3	0.4	0.5	1.2	0.6	0.6
723 Civil engineering/constructors' equipment	0.6	0.1	0.5	0.7	0.1	0.0	1.5	0.1	0.4	0.6	0.5	0.9	0.9	1.3	1.3
724 Textile and leather machinery	0.6	0.2	0.4	0.1	0.0	0.0	0.1	0.0	0.4	0.2	0.3	0.1	0.1	0.8	0.5
728 Specialized industrial machinery	0.4	0.4	0.8	0.4	0.6	0.3	0.9	0.1	1.4	0.6	0.9	2.0	0.2	2.4	1.8
735 Parts and accessories for office machinery	0.4	0.1	0.1	0.0	0.1	0.1	0.1	0.0	0.6	0.1	0.3	0.7	0.1	0.6	0.6
737 Metalworking machinery	0.3	0.2	0.1	0.1	0.0	0.0	0.1	0.0	0.3	0.1	0.2	0.4	0.1	0.6	0.5
741 Heating and cooling equipment	0.8	0.2	0.5	1.2	0.2	0.2	0.3	0.9	0.7	0.4	0.6	1.0	2.1	1.5	1.1
742 Pumps for liquid elevators	0.3	0.0	0.1	0.2	0.0	0.0	0.1	0.0	0.3	0.1	0.2	0.5	0.2	0.8	0.5
744 Mechanical handling equipment	0.5	0.1	0.2	0.2	0.1	0.0	0.1	0.1	0.4	0.2	0.3	1.2	0.5	1.2	0.8
745 Nonelectrical machine tools and apparatus	0.3	0.2	0.1	0.4	0.0	0.0	0.1	0.0	0.2	0.1	0.2	0.5	0.5	1.3	0.7
749 Nonelectrical parts of machinery	0.2	0.1	0.1	0.1	0.0	0.1	0.3	0.0	0.3	0.1	0.2	0.1	0.4	0.9	0.5
759 Parts and accessories for office machinery	20.3	13.0	22.1	20.6	34.3	11.3	19.5	37.1	12.6	23.2	19.2	9.3	11.3	10.8	13.6
764 Telecommunication equipment, n.e.s.	18.2	8.8	7.5	27.3	4.9	2.0	5.1	5.7	7.5	7.6	7.6	12.8	10.4	7.1	7.4
771 Electrical power machinery	1.2	4.0	0.5	0.2	0.2	0.0	0.3	0.8	0.4	0.6	0.5	0.2	0.7	0.4	0.5
772 Apparatus for switching/protecting electrical circuits	11.3	6.9	3.1	9.7	6.6	7.3	5.7	10.7	10.0	6.8	8.0	4.4	17.4	9.0	8.4
776 Household electrical equipment, n.e.s.	17.9	44.0	54.4	15.3	48.4	74.9	59.7	33.4	31.8	49.1	42.6	10.2	10.4	15.2	26.1
778 Thermionic, cold cathodes or photo cathode valves and tubes	6.1	2.9	1.0	7.8	1.0	0.1	1.2	1.4	4.7	1.9	2.9	0.9	7.1	2.5	2.7
784 Electrical machinery/apparatus, n.e.s.	3.7	0.0	3.9	4.8	0.4	2.6	0.8	2.9	13.0	2.2	6.2	32.2	19.6	17.8	13.6
785 Motorcycles and cycles	2.2	0.0	0.1	2.6	0.3	0.1	0.5	1.3	1.1	0.7	0.8	0.1	0.1	0.5	0.5
792 Aircraft and associated equipment	1.2	0.0	0.4	0.4	0.5	0.1	0.9	0.3	1.1	0.6	0.8	4.8	0.3	5.4	3.9
Other	2.2	1.6	1.1	0.8	0.4	0.1	0.4	0.6	1.8	0.8	1.2	4.3	1.6	5.0	3.0
8 Miscellaneous manufactured articles	8.1	15.9	1.9	6.1	1.4	0.5	1.5	3.1	5.0	3.0	3.7	5.2	9.2	6.4	5.8
821 Furniture and parts thereof	1.0	0.0	0.2	1.8	0.3	0.2	0.0	0.4	0.2	0.3	0.3	3.6	7.1	1.5	1.4
846 Clothing accessories of textile fabrics	0.4	6.8	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.3	0.2	0.0	0.1	0.1	0.6
851 Footwear	1.3	0.0	0.8	1.4	0.0	0.0	0.0	0.3	0.0	0.4	0.3	0.0	0.3	0.5	0.7
874 Measuring, analyzing and checking equipment	0.9	0.5	0.2	0.1	0.5	0.1	0.9	0.1	2.2	0.5	1.1	0.8	0.8	1.9	1.7
881 Photographic equipment, n.e.s.	0.4	4.1	0.1	0.5	0.2	0.1	0.2	0.9	0.6	0.4	0.5	0.0	0.1	0.2	0.6
891 Arms and ammunition	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.2	0.0	0.4	0.5
Other	4.0	4.5	0.5	2.2	0.5	0.1	0.3	1.4	1.8	1.1	1.4	0.5	0.9	1.8	0.3
7 + 8 Total	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

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Table 3. (Continued)

SITC Description	CHN	HKG	KOR	IND	MAL	PHL	SGP	THAI	JPN	DEA	EAS	NAF	USA	EU	World
(B) Imports															
7 Machinery and equipment	96.0	94.0	96.2	93.8	97.7	97.9	97.4	97.2	93.1	96.3	95.8	94.6	93.2	93.5	94.3
713 Internal combustion engines	1.1	0.6	1.3	7.8	0.4	0.3	0.7	2.4	0.8	1.2	0.9	4.5	4.0	2.9	2.5
714 Engines and motors, nonelectric	0.2	1.4	0.5	0.2	0.3	0.8	0.6	1.0	3.8	0.8	1.1	2.9	2.0	3.6	2.4
716 Rotating electrical engine	1.1	1.1	0.3	0.6	0.3	0.6	0.4	0.6	0.4	0.8	0.6	0.3	0.9	0.5	0.6
723 Civil engineering/constructors' equipment	0.8	0.3	0.2	7.5	0.2	0.3	2.0	0.2	0.4	1.0	0.7	1.1	1.6	1.1	1.0
728 Specialized industrial machinery	0.9	0.6	1.5	3.4	1.4	2.5	1.7	0.3	1.3	1.5	1.2	1.5	1.5	1.6	1.4
735 Parts and accessories for office machinery	0.3	0.1	0.5	0.4	0.4	0.1	0.5	0.1	0.7	0.4	0.4	0.5	0.3	0.6	0.5
741 Heating and cooling equipment	0.5	0.4	0.3	2.3	0.5	0.4	0.4	0.4	0.6	0.6	0.5	1.8	1.6	1.3	1.0
742 Pumps for liquid elevators	0.2	0.1	0.2	2.3	0.1	0.1	0.3	0.1	0.2	0.2	0.2	0.7	0.6	0.7	0.5
744 Mechanical handling equipment	0.3	0.3	0.2	0.8	0.1	0.1	0.3	0.2	0.3	0.3	0.3	0.7	0.9	1.0	0.7
745 Nonelectrical machine tools and apparatus	0.2	0.2	0.2	0.9	0.1	0.2	0.2	0.1	0.4	0.2	0.2	0.7	1.2	1.0	0.6
747 Taps, cocks, valves and similar apparatus	0.2	0.1	0.3	0.4	0.1	0.1	0.2	0.1	0.3	0.2	0.2	0.6	0.6	0.5	0.4
759 Parts and accessories for office machinery	11.2	20.6	10.3	1.1	9.0	16.2	17.8	17.9	18.7	17.7	15.2	7.0	15.6	15.2	14.1
764 Telecommunication equipment, n.e.s.	14.9	13.6	6.5	2.5	6.1	9.5	4.8	3.6	9.7	11.1	9.2	4.8	10.7	7.2	7.7
771 Electrical power machinery	1.0	2.0	0.5	0.2	0.9	0.6	0.4	0.4	0.3	1.1	0.8	0.1	0.1	0.3	0.5
772 Apparatus for switching/protecting electrical circuits	10.2	8.1	6.5	5.6	9.5	5.2	6.6	10.5	5.9	10.0	7.8	7.5	6.8	8.1	8.6
775 Electro-diagnostic apparatus	0.3	0.6	0.1	0.2	0.2	0.0	0.1	0.1	0.2	0.3	0.2	0.2	0.2	0.3	0.3
776 Household electrical equipment, n.e.s.	39.6	37.9	57.0	2.4	63.5	55.8	55.1	48.0	38.9	59.9	47.4	15.0	8.5	17.8	28.1
778 Thermionic, cold cathodes or photo cathode valves and tubes	3.0	3.2	2.5	3.2	1.6	1.7	1.0	1.3	1.3	2.7	2.0	1.6	2.8	2.7	2.5
784 Electrical machinery/apparatus, n.e.s.	4.0	0.8	3.4	30.9	0.8	1.8	1.2	7.7	4.0	3.3	2.9	33.4	14.5	16.9	13.3
785 Motorcycles and cycles	0.4	0.5	0.1	7.4	0.2	0.2	0.3	0.4	0.5	0.5	0.4	0.3	0.5	0.8	0.6
792 Aircraft and associated equipment	1.0	0.3	1.5	3.9	0.6	0.1	1.4	0.0	2.1	1.1	1.1	4.6	11.5	4.2	2.9
Other	4.1	0.9	1.9	7.6	1.3	1.2	1.3	1.4	2.0	-19.1	1.9	4.5	6.5	4.9	3.7
8 Miscellaneous manufactured articles	4.0	6.0	3.8	6.2	2.3	2.1	2.6	2.8	6.9	3.7	4.2	5.4	6.8	6.5	5.7
821 Furniture and parts thereof	0.2	0.2	0.1	0.2	0.2	0.1	0.1	0.1	1.3	0.2	0.3	2.7	0.9	1.8	1.5
846 Clothing accessories of textile fabrics	0.1	0.8	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.3	0.2	0.0	0.0	0.0	0.6
848 Clothing accessories of other than textile fabrics	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5
851 Footwear	0.5	0.6	0.3	2.3	0.0	0.1	0.0	0.2	0.4	0.4	0.3	0.1	0.4	0.6	0.5
874 Measuring, analyzing and checking equipment	0.8	0.7	1.5	0.9	1.4	0.2	1.7	0.8	2.8	1.3	1.4	1.5	2.4	1.8	1.5
881 Photographic equipment, n.e.s.	1.2	1.4	0.3	0.3	0.4	0.7	0.3	0.3	0.5	0.9	0.7	0.1	0.2	0.2	0.5
Other	1.1	2.2	1.6	2.4	0.3	0.9	0.4	1.4	1.8	0.6	1.3	1.0	2.8	2.1	0.5
7 + 8 Total	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Source: Compiled from the United Nations Commodity Trade Statistics Database (UN Comtrade Database).

Note: The five-digit SITC parts and components items are aggregated at the three-digit level, n.e.s. = not elsewhere specified, DEA = developing East Asia.

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Table 4. Share of parts and components in manufacturing trade

Country/region	Share of parts and components (%)			Export growth (%) 1992-2000	Contribution of parts and components to export growth (%) 1992-2000
	1992	1996	2000		
(A) Exports					
East Asia	21.3	28.0	32.0	3.8	43.5
Japan	22.9	30.2	30.6	1.8	50.4
Developing East Asia	19.7	26.7	32.8	5.1	41.9
China	6.7	9.8	14.5	6.7	17.9
Hong Kong	21.5	26.7	25.8	-3.2	16.3
South Korea	17.8	25.2	30.6	4.5	41.0
Taiwan	20.1	28.8	37.8	5.8	47.4
ASEAN	26.4	35.0	44.4	5.6	55.0
Indonesia	4.0	7.4	14.2	4.4	22.7
Malaysia	40.4	42.6	49.7	6.2	54.3
Philippines	23.9	52.5	64.0	9.0	74.3
Singapore	28.2	39.7	49.6	4.9	64.5
Thailand	21.2	23.4	35.9	4.8	46.7
Vietnam	2.0	5.2	8.7	21.0	8.9
South Asia	4.7	4.9	0.7	14.4	0.3
Oceania	6.4	18.9	15.2	12.6	16.3
NAFTA	26.2	27.2	28.1	4.1	30.0
USA	26.9	30.5	31.6	3.3	37.5
Canada	19.4	19.7	18.0	4.2	16.8
Mexico	21.5	19.4	21.1	8.1	21.0
Europe	13.9	16.2	17.5	3.6	21.4
EU	15.5	17.7	18.9	3.9	22.2
Latin America	8.6	11.7	10.2	11.6	10.5
Middle East	3.0	13.6	18.9	13.9	20.5
Africa	6.9	8.0	8.6	8.0	9.2
World	20.7	21.7	25.4	4.2	29.5
(B) Imports					
East Asia	22.8	27.9	35.4	4.4	45.9
Japan	15.4	19.3	24.2	4.1	32.1
Developing East Asia	24.8	30.2	38.4	4.5	49.3
China	19.5	21.1	33.5	5.4	42.0
Hong Kong	15.1	20.4	28.2	5.2	36.7
South Korea	26.7	27.4	38.9	3.6	52.1
Taiwan	29.6	35	37.3	5.1	42.5
ASEAN	30.4	39.3	48.6	3.6	68.2
Indonesia	20.5	23.8	19.4	-0.1	63.6
Malaysia	37.9	47.5	58.8	4.2	77.5
Philippines	32.6	43.6	55.1	6.9	64.4
Singapore	32.0	42.8	51.7	3.9	70.7
Thailand	26.6	32.9	39.8	2.6	62.0
Vietnam	4.2	11.1	19.1	10.1	22.1
South Asia	14.0	14.6	7.2	7.9	5.0
Oceania	10.4	15.2	15.6	12.9	16.2
NAFTA	20.4	23.6	22.8	4.8	24.6
USA	18.2	21.7	19.4	4.7	20.3
Canada	24.6	28.7	26.3	3.8	28.0
Mexico	19.1	30.6	30.7	7.3	35.1
Europe	15.2	16.6	18.7	3.4	22.8
EU	16.0	18.9	20.3	2.4	28.0
Latin America	14.4	14.6	15.1	12.6	15.2
Middle East	23.6	18.5	16.7	2.3	3.5
Africa	11.8	14.5	10.7	6.7	10.2
World	21.7	21.4	24.5	5.9	26.0

Source: Compiled from the United Nations Commodity Trade Statistics Database (UN Comtrade Database).

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Of the total increment in manufactured exports from East Asia between 1992 and 2000, over two-fifths came from exports of components. The comparable figures for NAFTA and the EU were 30 percent and 22 percent, respectively. For South Asia, Africa, the Middle East, and Latin America (excluding Mexico), both the export share and relative growth contribution estimates are much smaller (less than 10 percent in most cases) compared with those in these three regions. The patterns on the import side by and large mirror the export story.

At the individual-country level, Malaysia, the Philippines, Singapore, and Thailand stand out in developing East Asia for their heavy dependence on product fragmentation for export dynamism. The share of components in total manufacturing exports has increased rapidly in these four countries, reaching about 50 percent in Malaysia, the Philippines, and Singapore, and over 35 percent in Thailand by 2000. Between 1992 and 2000, components exports accounted for 74 percent of total export increment in the Philippines, 64 percent in Singapore, 54 percent in Malaysia, and 47 percent in Thailand. Between these two years, the share of components in total manufacturing exports more than doubled in China (from 6.7 percent to 14.5 percent) and more than tripled in Vietnam (2.0 percent to 8.7 percent). In both countries, however, the relative contribution of these exports to the increment in total manufacturing exports between the two years remained modest (17.9 percent in China and 8.9 percent in Vietnam) because of the low starting bases. Interestingly, even in Taiwan and South Korea, the relative importance of components in total manufacturing exports (and imports) has increased over the years, contradicting the popular belief that these countries have shifted palpably from component production to final goods production over the years.

5. Fragmentation and trade patterns

We observed in the previous section the growing importance of fragmentation trade for trade expansion in East Asia, relative to the overall global experience and experiences of countries in other major regions. The purpose of this section is to examine intra-regional trade patterns in the region by explicitly taking into account this important development in the economic landscape.

The discussion is based on data on regional bilateral trade flows reported in tables 5–8. Table 5 depicts regional patterns of trade in total manufacturing and in total manufacturing net of components (“final trade”). Table 6 reports percentage shares of components in bilateral flows of total manufacturing exports. Growth rates of manufacturing trade during 1992–2000 and the percentage contribution of component trade to growth in trade between the two years are reported in table 7.

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Table 5. Direction of manufacturing trade (%)

Region/ country	World (US\$ bn)										World (US\$ bn)									
	Year	EAS	JPN	DEA	ASEAN	NAFTA	USA	EU	Other		EAS	JPN	DEA	ASEAN	NAFTA	USA	EU	Other		
(A) Trade (exports + imports)																				
A1: Total manufacturing trade																				
East Asia (EAS) ^a	1992	47.1	12.3	34.9	11.2	26.3	24.6	16.6	9.9	1,110.3	45.3	11.5	33.8	9.3	25.6	23.9	17.8	11.4	867.3	
	1996	51.5	12.9	38.5	14.4	23.0	20.8	16.5	9.0	1,883.1	49.2	12.0	37.2	11.7	22.0	20.0	17.9	10.9	1,386.5	
	2000	52.3	12.0	40.2	14.4	23.7	21.9	15.3	8.7	2,312.1	48.3	11.4	36.9	10.7	24.1	22.3	16.7	10.9	1,536.9	
Japan (JPN)	1992	32.0	0.0	32.0	10.9	32.2	29.4	22.4	13.4	412.0	39.5	0.0	39.5	9.6	30.6	27.9	23.8	15.2	325.1	
	1996	41.4	0.0	41.4	16.3	30.2	28.3	18.3	10.1	560.0	39.5	0.0	39.5	14.3	28.4	26.7	20.0	12.1	411.3	
	2000	42.5	0.0	42.5	14.4	31.2	28.9	17.5	8.8	644.3	39.3	0.0	39.3	11.7	31.0	28.9	19.1	10.6	460.6	
Developing East Asia (DEA) ^b	1992	56.1	19.6	36.5	11.3	22.8	21.8	13.2	7.9	698.4	54.1	18.4	35.8	9.1	22.5	21.5	14.2	9.1	542.2	
	1996	55.7	18.4	37.3	13.6	20.0	17.7	15.7	8.6	1,323.0	53.4	17.2	36.2	10.6	19.2	17.1	16.9	10.4	945.2	
	2000	56.0	16.7	39.4	14.4	20.8	19.2	14.5	8.7	1,667.8	52.2	16.3	35.9	10.3	21.1	19.5	15.7	11.1	1,076.3	
ASEAN	1992	51.1	20.2	30.9	18.2	23.3	22.2	17.8	7.8	256.9	47.5	19.4	28.0	15.4	23.0	21.7	20.0	9.6	183.5	
	1996	55.2	19.2	36.0	20.7	20.7	19.9	17.1	7.0	525.4	51.3	18.8	32.5	16.7	20.4	19.6	19.4	8.9	329.5	
	2000	56.8	16.5	40.3	23.6	20.8	19.8	14.8	7.5	591.6	52.1	17.3	34.8	19.0	20.7	19.5	16.9	10.3	317.6	
NAFTA ^c	1992	31.0	13.6	17.4	5.4	39.2	19.6	18.8	11.0	980.5	31.5	13.4	18.0	5.0	37.6	19.2	19.4	11.5	755.3	
	1996	30.0	11.3	18.7	6.8	43.1	21.9	16.3	10.6	1,470.5	28.6	10.6	18.0	5.9	43.4	22.1	16.7	11.4	1,100.4	
	2000	27.8	9.3	18.5	5.7	46.3	24.2	16.3	9.5	2,202.4	26.2	8.8	17.4	4.4	46.4	24.1	17.1	10.3	1,652.7	
USA	1992	38.3	16.7	21.7	6.9	25.8	0.0	22.4	13.4	730.6	38.7	16.3	22.3	6.3	24.3	0.0	23.0	14.1	564.0	
	1996	38.4	14.4	24.0	8.8	28.5	0.0	20.0	13.1	1,066.2	36.7	13.6	23.1	7.7	28.7	0.0	20.5	14.1	795.7	
	2000	36.5	12.1	24.4	7.7	30.9	0.0	20.6	12.0	1,532.9	34.4	11.6	22.8	5.9	31.1	0.0	21.6	12.9	1,152.1	
European Union (EU)	1992	8.5	3.8	4.6	1.4	7.8	7.0	70.8	13.0	1,773.2	8.6	3.9	4.7	1.4	7.3	6.6	71.2	12.9	1,524.1	
	1996	11.3	3.7	7.6	2.9	9.1	8.2	61.0	18.7	2,910.0	10.8	3.5	7.3	2.6	8.4	7.6	62.0	18.9	2,377.6	
	2000	11.6	3.6	8.0	2.6	11.4	10.2	58.2	18.8	3,310.0	10.8	3.4	7.4	2.1	10.9	9.8	59.6	18.7	2,661.4	
World	1992	28.7	9.7	18.9	6.2	26.2	18.1	32.8	12.4	2,710.0	26.9	8.9	17.9	5.1	24.6	17.5	34.9	13.6	2,114.3	
	1996	25.3	7.5	17.8	6.5	20.4	15.1	39.1	15.2	6,900.0	23.3	6.8	16.5	5.3	19.3	14.2	41.1	16.3	5,415.1	
	2000	25.7	7.0	18.8	6.2	23.8	17.1	36.1	14.4	8,570.0	22.3	6.2	16.2	4.3	23.2	16.8	38.7	15.7	6,430.8	
(B) Exports																				
A2: Manufacturing exports																				
East Asia (EAS) ^a	1992	39.5	4.7	34.9	12.2	30.4	28.2	17.4	12.7	649.5	37.5	4.8	32.8	10.1	29.7	27.6	18.4	14.4	511.5	
	1996	45.7	7.2	38.5	16.4	26.6	23.4	15.7	12.0	994.3	43.2	7.7	35.5	13.1	25.9	23.1	16.4	14.5	715.7	
	2000	43.7	7.5	36.1	13.8	28.5	26.1	16.6	11.3	1,297.3	38.4	7.6	30.8	9.9	29.9	27.6	17.5	14.2	881.9	
Japan (JPN)	1992	31.1	0.0	31.1	11.3	32.7	29.3	20.8	15.4	312.8	29.0	0.0	29.0	9.8	31.5	28.2	21.8	17.7	241.1	
	1996	40.7	0.0	40.7	17.3	30.8	28.6	16.2	12.4	3,747.7	38.0	0.0	38.0	14.7	29.8	27.9	17.0	15.2	261.7	
	2000	38.2	0.0	38.2	13.6	33.9	31.2	17.1	10.9	4,351.1	33.9	0.0	33.9	10.4	35.0	32.5	17.8	13.3	302.1	
Developing East Asia (DEA) ^b	1992	47.2	9.1	38.3	12.9	28.3	27.1	14.2	10.2	336.8	45.1	9.1	36.3	10.3	28.1	26.9	15.3	11.4	270.3	
	1996	48.8	11.6	37.2	15.9	24.0	20.3	15.4	11.8	619.7	46.1	12.1	34.1	12.2	23.6	20.3	16.1	14.1	454.0	
	2000	46.4	11.3	35.1	14.0	25.7	23.6	16.3	11.6	862.2	40.8	11.5	29.3	9.7	27.2	25.0	17.3	14.7	579.7	
ASEAN	1992	41.3	9.0	32.3	20.3	28.7	27.3	18.9	11.1	1,173.3	37.0	8.7	28.3	16.6	28.7	27.0	21.1	13.2	86.3	
	1996	50.6	11.4	39.2	24.5	24.0	22.8	16.8	8.6	2,459.9	46.1	12.5	33.7	19.1	24.9	23.6	18.1	10.9	1,591.9	
	2000	50.3	11.0	39.3	23.1	23.7	22.2	16.8	9.2	3,224.4	43.2	12.3	30.9	17.2	25.2	23.7	18.5	13.1	1,791.3	
NAFTA ^c	1992	18.6	6.4	12.2	4.5	45.3	22.0	19.9	16.2	429.4	18.2	6.6	11.6	3.7	44.8	23.1	20.2	16.9	316.8	
	1996	20.2	6.6	13.6	5.5	49.0	26.4	15.7	15.1	643.1	18.5	6.6	11.9	4.2	50.4	29.1	15.3	15.8	468.4	
	2000	16.7	5.0	11.7	4.4	55.7	31.4	15.9	11.7	892.4	13.7	4.7	9.0	2.6	58.3	34.9	15.7	12.2	641.2	

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Table 5. (Continued)

Region/ country	World (US\$ bn)											World (US\$ bn)										
	Year	EAS	JPN	DEA	ASEAN	NAFTA	USA	EU	Other	EAS	JPN	DEA	ASEAN	NAFTA	USA	EU	Other					
USA	1992	23.9	8.2	15.7	5.8	30.9	0.0	25.0	20.2	320.5	23.7	8.6	15.1	4.8	29.2	0.0	25.7	21.4	231.9			
	1996	27.6	9.2	18.4	7.5	31.9	0.0	21.0	19.5	447.7	26.3	9.5	16.8	5.9	31.5	0.0	21.2	21.0	311.3			
	2000	24.6	7.4	17.2	6.6	36.7	0.0	22.5	16.2	582.9	21.4	7.4	14.0	4.1	37.3	0.0	23.6	17.7	394.4			
European Union (EU)	1992	4.5	1.4	3.2	1.4	7.1	5.9	69.5	18.9	836.7	4.4	1.4	3.0	1.3	6.6	5.6	70.2	18.9	705.7			
	1996	8.9	2.4	6.5	2.7	8.5	7.6	59.2	23.4	1,560.0	8.6	2.5	6.1	2.4	8.2	7.3	60.0	23.2	1,283.3			
	2000	7.1	2.0	5.2	1.8	11.6	10.2	58.7	22.6	1,720.0	6.4	2.1	4.3	1.3	11.6	10.2	60.1	21.9	1,394.8			
World	1992	23.3	4.3	19.0	6.8	28.8	19.9	31.0	17.0	1,360.0	21.4	4.2	17.2	5.4	27.1	19.8	32.9	18.6	1,057.5			
	1996	20.3	4.3	16.1	6.8	21.2	15.9	38.4	20.1	3,360.0	18.4	4.3	14.1	5.2	20.2	15.5	40.1	21.3	2,632.0			
	2000	19.2	4.0	15.2	5.8	26.1	19.5	36.7	18.0	4,140.0	15.1	3.7	11.4	3.6	26.0	20.3	39.4	19.5	3,087.2			
(C) Imports																						
A3: Manufacturing imports																						
East Asia (EAS) ^a	1992	38.0	23.1	34.9	9.7	20.5	19.6	15.5	6.0	460.8	56.4	21.2	35.2	8.2	19.6	18.6	17.0	7.1	355.8			
	1996	57.9	19.3	38.6	12.1	19.0	17.9	17.4	5.7	888.7	56.0	16.9	39.1	10.2	17.7	16.7	19.5	6.9	640.8			
	2000	63.3	17.8	45.4	15.1	17.6	16.6	13.8	5.4	1,014.8	61.6	16.5	45.1	11.8	16.2	15.2	15.6	6.5	655.1			
Japan (JPN)	1992	34.7	0.0	34.7	9.6	30.9	29.7	27.3	7.1	99.2	34.7	0.0	34.7	8.9	28.0	26.7	29.5	7.8	83.9			
	1996	42.9	0.0	42.9	14.2	29.0	27.7	22.5	5.6	1,854.4	42.2	0.0	42.2	13.5	26.1	24.7	25.2	6.5	1,496.6			
	2000	51.4	0.0	51.4	16.1	25.7	24.1	18.5	4.5	2,092.2	49.6	0.0	49.6	14.3	23.5	21.9	21.5	5.4	1,585.5			
Developing East Asia (DEA) ^b	1992	64.3	29.4	34.9	9.8	17.7	16.9	12.3	5.7	361.6	63.1	27.8	35.3	8.0	17.0	16.1	13.1	6.8	271.9			
	1996	61.8	24.4	37.5	11.6	16.4	15.3	16.1	5.7	703.4	60.2	22.0	38.1	9.2	15.2	14.2	17.7	7.0	491.2			
	2000	66.3	22.5	43.9	14.8	15.5	14.6	12.6	5.6	805.6	63.4	21.8	43.7	11.0	13.9	13.1	13.7	6.9	496.5			
ASEAN	1992	59.4	29.7	29.7	16.5	18.7	18.0	16.8	5.1	1,397.5	56.7	28.9	27.8	14.2	17.9	17.0	19.1	6.3	97.2			
	1996	59.2	26.0	33.2	17.3	17.9	17.4	17.4	5.5	2,795.2	56.2	24.9	31.3	14.4	16.3	15.8	20.5	7.0	1,691.6			
	2000	64.7	23.2	41.5	24.1	17.5	16.8	12.4	5.5	2,692.2	63.7	23.8	39.9	21.2	14.8	14.1	14.7	6.8	1,383.3			
NAFTA ^c	1992	40.6	19.2	21.3	6.1	34.4	17.8	18.0	7.0	551.1	41.1	18.4	22.7	6.0	32.5	16.3	18.8	7.6	438.5			
	1996	37.7	14.9	22.8	7.8	38.5	18.5	16.7	7.1	827.4	36.0	13.6	22.4	7.2	38.2	16.9	17.7	8.1	632.0			
	2000	35.4	12.3	23.1	6.6	39.9	19.3	16.7	8.0	1,310.0	34.2	11.4	22.7	5.5	38.8	17.2	17.9	9.1	1,011.4			
USA	1992	49.6	23.3	26.4	7.8	21.8	0.0	20.4	8.1	410.2	49.1	21.7	27.4	7.4	20.8	0.0	21.1	8.9	332.1			
	1996	46.3	18.3	28.0	9.7	26.0	0.0	19.3	8.4	618.5	43.4	16.3	27.1	8.8	26.9	0.0	20.1	9.7	484.4			
	2000	43.8	15.1	28.7	8.3	27.3	0.0	19.5	9.4	949.9	41.2	13.8	27.4	6.8	27.8	0.0	20.6	10.4	757.7			
European Union (EU)	1992	12.0	6.1	5.9	1.5	8.4	8.0	71.9	7.6	936.5	12.2	6.0	6.2	1.6	7.8	7.4	72.1	7.8	818.4			
	1996	14.0	5.2	8.9	3.1	9.7	9.0	63.1	13.2	1,350.0	13.4	4.7	8.7	2.8	8.5	7.9	64.3	13.8	1,094.4			
	2000	16.5	5.3	11.2	3.4	11.2	10.3	57.6	14.7	1,590.0	15.6	4.8	10.8	3.0	10.2	9.4	59.0	15.2	1,266.6			
World	1992	34.2	15.3	18.9	5.5	23.5	16.2	34.6	7.7	1,350.0	32.4	13.6	18.7	4.8	22.0	15.3	37.0	8.6	1,056.8			
	1996	29.9	10.6	19.4	6.2	19.7	14.3	39.8	10.5	3,540.0	28.0	9.3	18.7	5.3	18.5	12.9	41.9	11.6	2,783.1			
	2000	31.8	9.7	22.1	6.6	21.7	14.9	35.4	11.0	4,430.0	29.0	8.4	20.5	5.0	20.6	13.6	38.1	12.3	3,343.6			

Source: Compiled from the UN Comtrade Database using the commodity/country classification described in the text (section 3).

- a. Including Japan.
- b. Including ASEAN.
- c. Including USA.

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Table 6. Share of parts and component contents in regional manufacturing trade flows (%)

Exporter/ importer	Year	Exports										Imports									
		EAS	JPN	DEA	ASEAN	NAF	USA	EU	World	EAS	JPN	DEA	ASEAN	NAF	USA	EU	World				
East Asia (EA) ^a	1992	25.2	20.2	25.8	34.9	23.1	22.9	16.8	21.3	24.9	29.0	22.1	35.1	26.5	26.9	15.6	22.8				
	1996	32.1	24.0	33.6	42.4	29.9	29.1	24.5	28.0	30.3	36.9	27.0	39.5	32.9	32.9	19.2	27.9				
	2000	40.2	31.3	42.0	51.3	28.6	28.3	28.2	32.0	37.1	40.3	35.9	49.6	40.4	40.7	26.7	35.4				
Japan (JPN)	1992	28.3	—	28.3	33.4	25.6	25.7	19.3	22.9	15.4	—	15.4	22.1	23.5	23.7	8.5	15.4				
	1996	34.9	—	34.9	40.6	32.4	31.9	26.5	30.2	20.6	—	20.6	23.2	27.6	28.1	9.4	19.3				
	2000	38.4	—	38.4	46.8	28.2	27.5	27.6	30.6	26.8	—	26.8	32.8	30.7	31.1	11.6	24.2				
Developing East Asia (DEA) ^b	1992	23.3	20.2	23.9	36.1	20.3	20.1	13.4	19.7	26.3	29.0	23.9	38.7	27.9	28.5	19.9	24.8				
	1996	30.7	24.0	32.8	43.7	27.9	26.8	23.3	26.7	32.0	36.9	28.9	44.7	35.4	35.2	22.8	30.2				
	2000	40.9	31.3	44.0	53.5	28.9	28.8	28.6	32.8	39.2	40.3	38.7	54.3	44.6	44.8	32.5	38.4				
ASEAN	1992	33.9	28.5	35.4	39.7	26.5	27.1	17.8	26.4	33.5	32.2	34.9	40.0	33.5	34.1	21.2	30.4				
	1996	40.7	29.1	44.1	49.3	32.6	32.7	29.7	35.0	42.4	41.9	42.8	49.5	44.7	45.0	28.6	39.3				
	2000	52.2	38.0	56.2	58.7	40.8	40.7	38.7	44.4	49.4	47.1	50.7	54.6	56.4	56.8	38.9	48.6				
NAFTA ^c	1992	28.0	23.6	30.3	39.3	27.1	22.2	25.2	26.2	19.5	23.9	15.5	22.2	25.0	26.9	16.8	20.4				
	1996	33.1	27.4	35.9	45.0	25.0	19.7	29.3	27.2	26.9	30.4	24.6	29.5	24.3	30.1	19.3	23.6				
	2000	40.9	31.5	44.9	57.2	24.8	20.1	28.8	28.1	25.5	27.9	24.2	35.2	24.8	31.0	17.1	22.8				
USA	1992	28.3	24.0	30.6	40.1	31.6	—	25.5	27.6	19.8	24.4	15.7	22.6	22.8	—	16.4	19.0				
	1996	33.7	28.1	36.4	45.6	31.5	—	29.7	30.5	26.6	30.1	24.4	29.3	18.9	—	18.5	21.7				
	2000	41.1	31.9	45.1	57.6	31.1	—	29.1	32.3	25.0	27.1	23.8	34.9	18.9	—	15.9	20.2				
European Union (EU)	1992	18.4	11.9	21.1	21.8	21.1	20.3	14.8	15.6	10.7	13.3	8.0	9.1	18.9	19.3	12.4	12.6				
	1996	20.3	13.0	23.0	27.9	21.2	20.7	16.6	17.7	22.5	26.5	20.1	27.1	28.5	28.6	17.5	18.9				
	2000	27.1	14.6	31.9	38.7	19.0	18.4	17.0	18.9	24.4	27.8	22.9	29.8	27.8	27.5	18.4	20.3				
World	1992	28.5	23.0	29.8	39.1	26.6	22.5	17.3	22.2	25.8	30.0	22.4	32.6	26.8	26.4	16.5	21.7				
	1996	29.3	21.2	31.5	39.7	25.2	23.4	18.1	21.7	26.5	31.1	24.0	32.6	26.3	29.1	17.2	21.4				
	2000	41.2	30.4	44.1	53.8	25.6	22.3	20.1	25.4	31.3	34.6	29.9	43.3	28.4	31.1	18.8	24.5				

Source: Compiled from the UN Comtrade Database using the commodity/country classification described in the text (section 3).

- a. Including Japan.
- b. Including ASEAN.
- c. Including USA.

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Table 7. The growth of manufacturing trade and the contribution of trade in Parts and components to trade growth (%)

Exporter/importer	EAS	JPN	DEA	ASEAN	NAFTA	USA	EU	World	EAS	JPN	DEA	ASEAN	NAFTA	USA	EU	World
	Contribution of parts and components to export growth															
East Asia (EAS) ^a	4.4	6.5	4.0	4.6	3.5	3.4	3.6	3.8	52.6	36.4	57.1	64.2	35.0	34.5	40.9	42.8
Japan (JPN)	2.9	—	2.9	2.8	2.0	2.1	0.7	1.8	52.7	—	52.7	66.9	34.1	31.2	86.2	50.1
Developing East Asia (DEA) ^b	5.1	6.5	4.7	5.7	4.7	4.4	6.0	5.2	52.5	36.4	58.9	63.4	35.3	35.8	36.4	41.1
ASEAN	6.8	6.8	6.8	6.4	4.5	4.5	5.0	5.6	60.0	42.1	65.1	67.6	52.1	51.6	53.1	54.7
NAFTA ^c	3.4	2.7	3.8	4.0	5.2	6.1	2.8	4.1	55.8	44.1	59.6	74.4	23.3	19.0	34.2	29.9
USA	3.5	2.7	3.8	4.0	4.3	—	2.7	3.3	55.9	44.5	59.6	73.9	30.7	—	34.8	38.1
EU	6.6	6.0	6.8	5.5	6.8	7.1	3.0	4.0	31.1	16.0	36.5	48.8	18.1	17.7	20.0	22.0
World	5.1	5.8	5.0	5.3	5.7	6.1	7.2	6.2	49.6	34.4	54.0	63.0	25.1	22.2	21.1	27.0
	Contribution of parts and components to import growth															
East Asia (EAS) ^a	4.9	2.9	5.9	6.9	3.5	3.4	3.7	4.4	45.9	56.3	43.3	55.6	56.2	56.6	38.5	46.0
Japan (JPN)	6.4	—	6.4	7.1	3.1	3.0	1.9	4.1	32.2	—	32.2	37.0	40.3	41.4	18.9	32.2
Developing East Asia (DEA) ^b	4.6	2.9	5.7	6.8	3.7	3.6	4.5	4.4	49.2	56.3	46.8	60.9	62.3	62.3	42.5	49.4
ASEAN	4.1	2.2	5.5	5.8	3.2	3.3	1.9	3.6	63.8	76.9	60.0	62.7	85.0	85.0	81.2	68.2
NAFTA ^c	4.0	2.3	5.3	5.2	5.7	5.3	4.4	4.8	31.1	35.8	29.7	43.6	24.7	33.6	17.3	24.5
USA	4.0	2.2	5.2	5.0	5.9	—	4.4	4.7	29.9	32.5	29.1	43.2	16.8	—	15.4	21.1
EU	4.7	2.2	6.5	7.6	4.5	4.3	1.7	2.9	34.8	57.7	29.6	37.1	34.9	34.4	35.1	31.4
World	6.3	4.1	7.6	7.7	6.2	6.1	6.8	6.7	34.0	38.8	32.5	46.9	29.1	33.5	19.8	25.8

Source: Compiled from the UN Comtrade Database using the commodity/country classification described in the text (section 3).

a. Including Japan.

b. Including ASEAN.

c. Including USA.

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Table 8. Bilateral trade balances (as a percentage of exports)

Region/country	Year	Trading partner region/country							World
		EAS	JPN	DEA	ASEAN	NAFTA	USA	EU	
(A) Trade in total manufacturing									
ASEAN	1992	-41.7	-74.6	-8.8	3.5	29.1	27.6	-5.8	-16.1
	1996	-24.8	-61.3	3.8	24.8	18.0	15.1	-15.5	-12.0
	2000	-6.8	-43.0	13.4	15.2	62.6	58.5	62.5	19.8
East Asia (EAS)	1992	-4.0	-71.1	40.9	76.1	108.7	102.1	57.8	41.0
	1996	-11.6	-57.9	11.6	51.5	56.1	46.4	0.9	11.9
	2000	-11.8	-46.2	1.7	17.6	107.1	101.2	53.7	27.8
Japan (JPN)	1992	182.6	—	182.6	272.3	233.0	211.7	140.7	215.3
	1996	91.7	—	91.7	145.3	114.2	108.6	45.5	102.1
	2000	54.6	—	54.6	75.6	174.5	168.6	92.7	108.0
Developing East Asia (DEA)	1992	-31.6	-71.1	2.2	23.2	49.1	49.3	7.4	-6.9
	1996	-30.5	-57.9	-12.6	21.2	29.1	16.8	-15.6	-11.9
	2000	-25.1	-46.2	-14.3	1.2	78.0	72.3	38.9	7.0
NAFTA	1992	-64.3	-74.2	-55.3	-42.8	2.4	-3.7	-13.8	-22.1
	1996	-58.4	-65.5	-53.7	-45.0	-1.2	10.7	-26.9	-22.3
	2000	-67.9	-72.4	-65.4	-54.2	-4.8	11.0	-35.2	-31.9
USA	1992	-62.3	-72.4	-53.4	-41.7	10.5	—	-4.6	-21.9
	1996	-56.9	-63.7	-52.5	-43.9	-11.0	—	-21.4	-27.6
	2000	-65.5	-70.1	-63.2	-51.3	-17.7	—	-29.2	-38.6
European Union (EU)	1992	-66.3	-79.9	-52.3	-20.2	-25.3	-34.2	-13.7	-10.7
	1996	-26.9	-46.4	-15.5	-0.8	1.8	-2.9	8.3	15.6
	2000	-53.3	-60.2	-50.0	-44.6	12.2	6.5	10.2	8.2
(B) Trade in parts and components									
ASEAN	1992	-69.7	-345.2	-8.1	2.8	1.9	1.5	-26.0	-37.4
	1996	-38.3	-271.7	6.6	19.7	-16.2	-19.4	-13.8	-27.8
	2000	-1.5	-117.5	20.5	19.2	15.0	12.0	38.1	8.5
East Asia (EAS)	1992	-2.7	-394.9	39.1	42.8	45.0	41.9	41.3	24.0
	1996	-6.7	-265.2	28.1	38.6	29.4	22.9	22.3	11.0
	2000	-4.8	-139.0	16.0	17.9	31.8	28.5	38.4	13.4
Japan (JPN)	1992	80.7	—	80.7	82.3	72.4	70.4	81.7	78.7
	1996	69.1	—	69.1	76.7	60.2	57.8	75.6	68.4
	2000	54.8	—	54.8	60.1	60.4	57.9	78.2	61.9
Developing East Asia (DEA)	1992	-64.6	-394.9	2.1	13.1	8.1	5.2	-37.8	-35.1
	1996	-50.1	-265.2	-0.8	15.4	1.8	-12.2	-16.1	-28.1
	2000	-28.0	-139.0	-2.6	-0.3	13.2	9.7	18.0	-9.4
NAFTA	1992	-94.6	-292.1	-14.4	1.0	9.7	-25.4	23.0	-0.1
	1996	-95.1	-221.9	-47.9	-19.3	1.6	-38.1	10.0	-11.8
	2000	-93.9	-222.1	-55.8	-34.5	-5.2	-39.1	8.6	-18.9
USA	1992	-85.5	-268.5	-10.5	3.2	34.7	—	32.6	11.8
	1996	-83.6	-194.6	-41.0	-14.5	32.7	—	20.6	1.7
	2000	-76.1	-184.1	-43.4	-24.4	26.4	—	23.1	-1.9
European Union (EU)	1992	-72.6	-452.8	20.2	47.7	-20.0	-44.2	3.0	9.8
	1996	-51.2	-280.9	-3.3	2.0	-32.3	-42.4	2.6	7.6
	2000	-92.6	-377.7	-43.2	-39.0	-30.7	-40.1	1.7	0.5
(C) Trade in manufacturing net of parts and components									
ASEAN	1992	-72.5	-273.0	-10.6	3.8	30.0	29.1	-1.8	-12.6
	1996	-29.2	-111.5	1.3	20.1	30.5	29.0	-20.2	-6.1
	2000	-13.7	-49.8	0.6	4.7	54.7	54.0	38.7	22.9
East Asia (EAS)	1992	-4.6	-207.6	25.5	43.4	54.2	53.1	35.7	30.4
	1996	-16.1	-97.5	1.4	30.6	38.8	35.3	-6.1	10.5
	2000	-19.1	-61.6	-8.7	11.9	59.7	58.9	33.6	25.7
Japan (JPN)	1992	58.3	—	58.3	68.6	69.1	67.1	52.9	65.2
	1996	36.4	—	36.4	47.3	50.0	49.4	15.3	42.8
	2000	23.2	—	23.2	28.0	64.8	64.6	36.6	47.5
Developing East Asia (DEA)	1992	-40.6	-207.6	-2.2	22.0	39.3	40.0	13.8	-0.6
	1996	-41.1	-97.5	-21.0	19.1	30.6	24.2	-19.2	-8.2
	2000	-37.4	-61.6	-27.8	2.8	56.3	55.0	32.0	14.4
NAFTA	1992	-212.9	-286.5	-171.1	-124.0	-0.4	2.3	-29.1	-38.4
	1996	-162.5	-177.7	-154.1	-133.1	-2.1	21.4	-56.3	-34.9
	2000	-292.1	-281.5	-297.7	-230.6	-5.0	22.3	-79.6	-57.7
USA	1992	-196.9	-260.3	-160.6	-121.8	-2.1	—	-17.6	-43.2
	1996	-156.7	-168.2	-150.2	-131.8	-33.0	—	-47.3	-55.6
	2000	-269.9	-257.7	-276.4	-215.2	-43.2	—	-67.7	-92.1
European Union (EU)	1992	-224.2	-388.9	-144.6	-45.6	-37.6	-54.0	-19.2	-16.0
	1996	-33.1	-57.7	-22.7	-1.9	11.0	7.3	8.7	14.7
	2000	-121.9	-112.3	-126.5	-106.8	20.6	16.5	10.8	9.2

Source: Compiled from the UN Comtrade Database using the commodity/country classification described in the text (section 3).

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Table 8 reports bilateral trade balances (measured as a percentage of exports) of total manufacturing, components, and net trade. The same data disaggregated by the individual economies in East Asia are reported in the corresponding four tables (tables A-1 through A-4) in the statistical appendix of Athukorala (2003). A number of interesting inferences emerge from a careful comparative treatment of the data presented in these tables.

In terms of the conventionally used trade data, intra-regional manufacturing trade (exports + imports) in East Asia is significant and growing rapidly (table 5, panel B1). The share of total intra-regional trade in East Asia increased from 47.1 percent in 1992 to 52.3 percent in 2000. Intra-regional trade in developing East Asia increased from 36.5 percent to 39.4 percent between these two years. For ASEAN the magnitude of these figures is much smaller, but they point to an impressive, persistent increase over the years (from 18.2 percent to 23.6 percent). Interestingly, in all three years (1992, 1996, and 2002) (see table 5) the degree of intra-regional trade in East Asia (including Japan) is significantly larger than the comparable estimates for NAFTA (East Asia: 47.1 percent, 51.5 percent, and 52.3 percent; NAFTA: 39.2 percent, 43.1 percent, and 46.3 percent). The estimates for the EU are larger in magnitude (70.8 percent, 61.0 percent, 58.2 percent), but they have been falling over the years unlike in East Asia. Overall, in terms of conventionally used trade data, the ongoing process of regional integration in East Asia looks remarkable. These figures need to be interpreted cautiously, however, for two reasons.

First, unlike that in the EU and NAFTA, the East Asian intra-regional trade ratio camouflages a significant asymmetry in regional trade patterns on the import and export sides. In 2000, intra-regional import flows amounted to 63 percent of total manufacturing imports of East Asia, up from 58 percent in 1996. Interregional share in total regional exports was significantly lower, around 45 percent in both years (table 5, panels A and B). In other words, the region is much more heavily dependent on extra-regional trade for its growth dynamism than is (misleadingly) suggested by the total regional trade share, and this dependence has remained virtually unchanged for the last decade. This imbalance in intra-regional trade is largely a reflection of the unique nature of Japan's involvement in fragmentation trade in East Asia. As already noted, Japan's trade relations with the rest of East Asia are predominantly in the form of using the region as an assembly base for meeting demand in the region and, more importantly, for exporting to the rest of the world. As can be seen in table 8, Japan has persistently maintained a trade surplus with all East Asian countries in both total manufacturing trade and trade in components, of which the latter is much larger.

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Second, the measured degree of intra-regional trade integration needs to be qualified for the growing importance of cross-border trade in components. As can be seen in table 6, component trade accounts for a significant and growing share of intra-regional trade in manufacturing in East Asia, on both the export and import sides. Moreover, the share of components in intra-regional trade is much larger than the comparable figures for the region's extra-regional trade. In 2000, components accounted for 40.2 percent of intra-East Asian exports, compared to 32 percent of the region's total exports. Between 1992 and 2000, trade in components accounted for 53 percent of growth in total exports and 46 percent of growth in total imports in East Asia. The significance of component trade looms even larger for developing East Asia and for ASEAN. At the individual-country level, cross-border component trade accounts for more than one-half of total imports and exports in Singapore, Malaysia, and the Philippines, and more than one-third in Thailand (Athukorala 2003, table A-3). South Korea and Taiwan are also involved in sizable cross-border trade with the other countries in the region. For all East Asian countries, between 1992 and 2000 the share of components in both intra-regional exports and intra-regional imports increased at a much faster rate compared with that in exports to and imports from countries outside the region.

Given these observed patterns of dependence on component exchange, it is only natural that the degree of intra-regional trade dependence in East Asia turns out to be significantly lower when we focus on data on final trade (total manufacturing trade, net of parts and components) (table 5). The intra-regional share in final trade in 2000 was 48.3 percent, compared with 52.3 percent of total trade. More importantly, the alternative intra-regional trade share based on final trade remained virtually unchanged between 1992 and 2000, in sharp contrast to the persistent increase recorded by the conventionally used trade share (which covers both components and final goods). Although this difference is observable for both exports and imports, the magnitude of the difference is much larger on the export side.

The difference in magnitude between regional trade shares estimated in gross and net terms is much larger for developing East Asia and ASEAN compared with estimates for the entire region. In 2000 over 60 percent of final goods exports from developing Asia found markets in countries outside the East Asian region, up from 55 percent in 1992. A similar pattern is observable for the ASEAN countries. For all East Asian countries, Japan is a much smaller market for final goods exports, accounting for less than 10 percent in all cases, compared with the United States and the EU. It is also interesting to note that, unlike in the case of East Asia (or developing East Asia and ASEAN), the estimated intra-regional trade shares for NAFTA and the EU are remarkably resilient to the inclusion or exclusion of component trade.

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In summary, the estimates presented in this section support our hypothesis that, in a context in which fragmentation-based trade is expanding rapidly, standard trade flow analysis can lead to misleading inferences regarding the ongoing process of economic integration through trade. When data on assembly trade are excluded from trade flows, our estimates suggest that extra-regional trade is much more important than intra-regional trade for the continued growth dynamism of East Asia, both including and excluding Japan. Thus, the ongoing process of product fragmentation seems to have strengthened the case for a global, rather than a regional, approach to trade and investment policymaking.

6. Conclusion and inferences

There is clear evidence that fragmentation trade is expanding more rapidly than conventional final goods trade. The degree of dependence on this new form of international specialization is proportionately larger in East Asia compared with North America and Europe. This seems to be the outcome of relatively more favorable policy setting for international production and of agglomeration benefits arising from the early entry into this new form of specialization and from considerable intercountry wage differentials in the region.

A notable recent development in international product fragmentation in the region has been the rapid integration of China into regional production networks. This development is an important counterpoint to the popular belief that China's global integration would crowd out opportunities for export-led industrialization for other countries in the region.

The evidence harnessed in this paper on intra-regional patterns of trade flows has implications for the ongoing debate on forming regional trading blocs within the region. Fragmentation trade has played a pivotal role in the continuing dynamism of the East Asian economies and their increasing intra-regional economic interdependence. But this new form of international specialization could not be sustained purely as an East Asian phenomenon because of the growing importance of extra-regional markets for final goods. Put simply, growing trade in components has made the East Asian region increasingly reliant on extra-regional trade for its growth dynamism. In this context, these countries would be better off upholding universal principles of economic openness. The Asia-Pacific Economic Cooperation agenda is certainly preferable to any East Asian regional grouping that included or excluded Japan. In terms of opportunities for trade expansion through international product fragmentation, however, the ideal policy choice appears to be multilateral liberalization through the World Trade Organization process. The ongoing process

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of product fragmentation seems to have strengthened the case for a global, rather than a regional, approach to trade and investment policymaking.⁸ Trade-distorting measures involved in regional trade agreements (RTAs) are detrimental to gains from fragmentation trade (Baldwin 2001). In particular, such trade can be burdened by transaction costs associated with rules of origin in RTAs. Moreover, maintaining barriers to trade against nonmembers (while allowing free trade among members) can thwart the “natural” expansion of fragmentation trade across countries.

Fragmentation-based specialization has the potential to magnify the gains from unilateral and multilateral trade and investment liberalization. In this sequential mode of production, activities at separate stages have thin margins and therefore are highly sensitive to even small tariffs. When a component crosses multiple borders, even low tariff rates are magnified as they are repeatedly applied to the goods-in-process. Thus, in the presence of growing opportunities for fragmentation trade, further trade liberalization could yield substantial gains. Of course, to be effective, opening up of the border needs to be appropriately combined with policy initiatives to dismantle/harmonize barriers behind borders, such as regulations, national standards, competition policies, and government procurements.

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