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How India Fits into Global Production Sharing: Experience, Prospects, and Policy Options

ABSTRACT Global production sharing—the breakup of the production processes into separate stages, with each country specializing in a particular stage of the production sequence—is a phenomenon of major significance that is increasingly manifesting itself in patterns of global production and trade. This paper examines India's role in global production sharing from a comparative East Asian perspective in order to contribute to the contemporary policy debate in India on the link between export performance and "jobless growth" in domestic manufacturing in India. The analysis reveals that India has so far failed fitting into global production networks in electronics and electrical goods, which have been the prime movers of export dynamism in China and the other high-performing East Asian countries. Further reforms to improve the overall investment climate is even more important for reaping gains from this new form of international exchange compared to the standard labor-intensive exports. There is also a strong case, based on the experiences in East Asia and elsewhere, for combining further reforms with a proactive investment promotion campaign to attract multinational enterprises engaged in global production networks.

Keywords: *Global Production Sharing, Production Fragmentation, Foreign Direct Investment, Export Performance*

JEL Classification: *F21, F23, F53, O33*

1. Introduction

Global production sharing—the breakup of the production processes into separate stages, with each country specializing in a particular stage of the production sequence—has been an increasingly important facet

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of economic globalization over the past four decades.[1] This process of international division of labor opens up opportunities for countries to specialize in different slices (tasks) of the production process in line with their relative cost advantages. Global production sharing is heavily concentrated within industries which are commonly classified as high-tech and capital-intensive, such as electronic, electrical goods, and transport equipment. However, economic theory postulates, and the East Asian experience illustrates, that in a labor abundant economy, tasks undertaken within global production networks tend to be relatively more labor-intensive (and hence "pro–poor"). Moreover, trade based on global production sharing, that is parts and components and final assembly traded within global production networks, has been growing at a much faster rate compared to traditional labor-intensive products such as apparel, footwear and sport goods.

The purpose of this paper is to examine India's role in global production sharing from a comparative East Asian perspective, with a view to broaden our understanding of why India is lagging behind China and other emerging East Asian economies in benefitting from this new form of international exchange. The paper is motivated by the growing emphasis in the contemporary policy debate in India on the link between emerging export patterns and "jobless growth" of domestic manufacturing (Bhagwati and Panagariya 2013; Joshi 2008; Panagariya 2008, 2013; Panagariya and Sundaram 2013). Although the rate of export growth has been much faster during the past two decades, India still remains a small player in world manufacturing trade, and the composition of manufacturing exports has continued to exhibit a bias on capital- and skill-intensive products (Veeramani 2012). Recent studies of India's export performance, and the failure of emerging export patterns to reflect the country's comparative advantage in labor-intensive production, have largely focused on the country's relative performance in the standard labor-intensive manufactured goods such as clothing and footwear. The implications of the ongoing process of global production sharing for effective integration of the Indian economy into global manufacturing networks and the related policy issues have not been systematically explored. This paper aims to fill this gap, focusing specifically on merchandise exports.[2]

The paper is structured as follows: Section 2 provides a stage-setting analytical overview of the process of global production sharing, patterns, and determinants of network trade, and emerging opportunities for countries

1. In the recent international trade literature an array of alternative terms have been used to describe this phenomenon, including international production fragmentation, intra-process trade, vertical specialization, slicing the value chain, and offshoring.

2. India's role in production sharing in the global software services industry has been extensively studied. See Arora (2008) and the works cited therein.

to specialize in line with their relative cost advantage. Section 3 surveys India's export performance during the reform period in order to provide the context for the ensuing analysis. Section 4 examines emerging patterns of world network trade and India's comparative performance, paying particular attention to complementarities in production sharing between India and the East Asian countries. An econometric analysis is undertaken in Section 5 using the standing gravity modeling framework to examine the determinants of inter-country differences in the degree of involvement in network trade. Section 6 summarizes the key findings, followed by a discussion on policy options for India to effectively link domestic manufacturing into global production networks. The analysis in Sections 4 and 5 is based on a systematic separation of trade in parts and components and final assembly ("network trade") from total manufacturing trade flows using data set extracted from the United Nations (UN) trade database. The procedure followed in data compilation is discussed in the Appendix.

2. Global Production Sharing

Global production sharing is not entirely a new phenomenon.[3] What is new about the contemporary process of global production sharing is its wider and ever increasing product coverage, and its rapid spread from mature industrial countries to developing countries.[4] With a modest start in the electronics industry in the late 1960s, international production networks have gradually evolved encompassing many developing countries and spreading to many industries such as sport footwear, automobile, televisions and radio receivers, sewing machines, office equipment, electrical machinery, machine tools, cameras, watches, light emitting diodes, solar panel, and surgical and medical devices. 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.

3. By the late 1950s, when the national trade data reporting systems of mature industrial countries had begun to produce disaggregated data to warrant some tentative estimation, components of machinery accounted for nearly 15% of manufacturing exports of these countries (calculation based on the data appendix in Maizels 1963).

4. Production sharing can occur both within a given country and across national border. The sole focus of this paper is on the latter, the international dimension of production sharing, which is directly relevant for understanding the patterns and determinants of India's comparative export performance. Of course, for a systematic analysis of the growth impact of the export performance it is important to probe both aspects of global production sharing, because activities of domestic firms that undertake subcontracting for exporting firms are not captured in the standard trade data.

The expansion of global production sharing has been driven by three mutually reinforcing developments (Helpman 2011; Jones 2000; Jones and Kierzkowski 2001, 2004; Yi 2003). First, rapid advancements in production technology have enabled the industry to slice up the value chain into finer, "portable" components. As an outcome of advances in modular production technology, some fragments of the production process in certain industries have become "standard fragments" which can be effectively used in a number of products.[5] Second, technological innovations in communication and transportation have shrunk the distance that once separated the world's nations, and improved speed, efficiency, and economy of coordinating geographically dispersed production process. This has facilitated, and reduced the cost of, establishing "service links" needed to combine various fragments of the production process across countries in a timely and cost efficient manner.[6] Third, liberalization policy reforms across the world over the past four decades have considerably removed barriers to trade and foreign direct investment (FDI).

At the early phase of development (in the 1960s and 1970s), production sharing was basically a two-way exchange between the home and host countries undertaken by multinational enterprise (MNEs); parts and components were exported to the low-cost, host country for assembly and the assembled components were re-imported to the home country to be incorporated in the final product (Brown and Linden 2005; Grunwald and Flamm 1985; Helleiner 1973). As production operations in the host countries became firmly established, MNE subsidiaries began to subcontract some activities to local (host country) firms, providing the latter with detailed specifications and even fragments of their own technology. Over time, many firms which were not part of original MNE networks have begun to undertake final assembly by procuring components globally through arm's-length trade, benefitting from the ongoing process of standardization of parts and components. These developments suggest that an increase in production-sharing based trade may or may not be accompanied by an increase in the

5. Examples include long-lasting cellular batteries originally developed by computer producers and now widely used in cellular phones and electronic organizers; transmitters which are now used not only in radios (as originally designed) but also in computers; and electronic chips which have spread beyond the computer industry into consumer electronics, motor vehicle production and many other product sectors.

6. There is an important two-way link between improvement in communication technology and the expansion of production sharing within global industries. The latter results in lowering the cost of production and rapid market penetration of the final products through enhanced price competitiveness. Scale economies resulting from market expansion in turn encourage new technological efforts, enabling further fragmentation of production processes (Jones and Kierzkowski 2004).

host country's FDI and focusing on MNEs as the sole agent of global production sharing leads to an underestimation of the importance of the phenomenon (Brown et al. 2004; Jones 2000). However, there is clear evidence that MNEs are still the leading vehicle for developing countries to enter global production networks. The presence of key players in a particular country is vital, both as an "investment-stalk" or signalling effect to other foreign firms less familiar with that country, and an agglomeration magnet by which firms benefit from being part of a geographical network or cluster-related activities and specialized support services (Dunning 2009; Lall 2002; Ruwane and Gorg 2001; Wells and Wint 2000).[7]

As supply networks of parts and components became firmly established, producers in advanced countries have begun to move final assembly of an increasing range of products (for example, computers, mobile phones, and other hand-held devices, TV sets and motor cars) to developing country locations (Krugman 2008). Many of the MNEs in electronics and related industries now undertake final assembly in developing country locations, retaining only design and coordination functions at home. A major development in the institutional setting for global production sharing which facilitated this process is the emergence of a new breed of MNCs, contract manufacturers, which undertake final assembly for original manufacturing MNEs using parts and components procured from various producers (Sturgeon 2002).[8] Many original manufacturing MNEs in electronics and related industries have begun to rely increasingly on contract manufacturers (CMs) as their "virtual assembly plant," while increasingly focusing on competencies such as product design and sales promotion.

There is evidence that trade in parts and components, and final assembly traded within global production networks (henceforth referred to as

7. However, the experiences of South Korea and Taiwan have some unique features. Firms in these two countries entered global production network from the early 1990s without direct involvement of MNEs through FDI. Korean companies relied on imports of capital equipment, plans and core components, mainly from Japan with the Japanese trading companies playing a vital intermediary role. In Taiwan, Taiwanese and Chinese–American entrepreneurs who had a strong presence among Silicon Valley firms started assembly firms drawing on their connections with US MNEs (Feenstra and Hamilton 2006). In both countries some of these firms have grown to become major MNEs in their own right within global production networks. In the early 1970s, at the initial stage of global production sharing, MNEs set up production bases in Southeast Asian countries bypassing Korea and Taiwan, because of the highly selective FDI approval policy that did not permit full foreign ownership (Grunwald and Flamm 1985), and also presumably because of political risk considerations, "the upheaval caused by the Cultural Revolution in the mid- and late 1960s" (Goh 1993: 253).

8. The best example is Foxconn, a Taiwanese contract manufacturer that assembles all products of Apple Corporation from its production bases located in China.

"network trade") has grown at a much faster rate than total world manufacturing trade over the past four decades. In a pioneering analysis of trade data for the OECD countries, Yeats (2001) found that parts and components accounted for 30% of total trade in machinery and transport equipment[9] of these countries in 1996, compared to around 15% in the middle of 1980s. According to estimates by Ng and Yeats (2003), exports of parts and components from Asian countries increased more than fivefold over the period 1984–96, compared to an approximately three-fold increase in total merchandise exports. Following Yeats's approach, but with broader commodity coverage, Athukorala (2011) estimated the share of parts and components in total world manufacturing trade in 2007 at 32.1%, up from 23.6% in 1992. According to his estimates, total network trade (parts and components, and final assembly) accounted for over a half of total manufacturing trade in 2007. A number of studies have used the input–output technique to measure the degree of dependence of manufacturing production and trade of selected countries on global production sharing (Dean et al. 2011; Hummels et al. 2001; Johnson and Noguera 2012; Koopman et al. 2008). Hanson et al. (2001 and 2005) have measured the extent of production sharing using trade flows between US multinational enterprises and their foreign affiliates. All these studies, regardless of the yardstick used, point to the growing importance of production sharing in world trade and increasing cross-border interdependencies in the world economy.[10]

In recent years the popular press has begun to pay attention to the phenomenon of "reshoring" (also termed "reverse offshoring" or "onshoring"), shifting by MNEs of manufacturing facilities from overseas locations to the home country (Gray et al. 2013). There have been a number of highly published cases of US MNEs reshoring (or planning to restore) assembly processes from China to plants in the United States. However, whether this is a new structural (lasting) phenomenon, or simply a case of some isolated instances of shifting production bases receiving media attention against the backdrop of the political rhetoric of "bringing manufacturing back home" and the erosion of the size of the United States–China wage differentials, is yet to be seen. As Gray et al. (2013: 31) argue: "….as emerging economies grow and thus demand increases in these locations while levelling in the

9. These are the products belonging to Section 7 of the Standard International Trade Classification (SITC 7). They roughly account for more than one-half of all trade in manufacturing.

10. In addition to these direct quantifications, there are a large number of case studies and media commentaries of the nature and growing importance of production sharing (Krugman 2008 provides a summary).

United States and other developed countries, firm might want to reconsider their location decisions….to be close in proximity to demand." Also, as we have already discussed, global production sharing has already expanded well beyond the domain of the MNEs headquartered in the United States and the other developed countries.

Global production sharing opens up opportunities for developing countries to participate in a finer international division of labor. The nature of factor intensity of the given segments and the relative prices of factor inputs in comparison with their productivity jointly determine which country produces what components. It may be that workers in a given country tend to have different skills from those in other countries, and the skills required in each production block differ so that a dispersion of activity could lower marginal production cost (as in the Ricardian model). Alternatively, it may be that the production blocks differ from each other in the proportion of different factors required, enabling firms to locate labor-intensive production blocks in countries where productivity adjusted labor cost is relatively low (as in the Heckscher–Ohlin model). However, several preconditions need to be satisfied for a country to effectively participate in international production networks.

First, assembly processes within production networks require much more middle-level supervisory manpower (in addition to the availability of trainable low-cost unskilled labor) than the traditional labor-intensive manufacturing.[11] Under global production sharing, developed countries normally shift low skill-intensive parts of the value chain to developing countries. But, the least skill-intensive activities in the developed country can be more skill-intensive than the most skill-intensive activities in the developing country (Feenstra and Hanson 2003). Second, successful participation in global production sharing will not occur if the extra costs of service links associated with production sharing—cost involved in arrangements for connecting/coordinating activities into a smooth sequence resulting in the production of the final good—outweigh the gain from the lower costs of the activity abroad. These extra costs relate to transportation, communication, and other related tasks involved in coordinating the activity in a given country with what is done in other countries within the production network. Third, the policy regime and the domestic investment climate need to be conducive for involvement in production sharing. The decision of a firm

11. See also Steve Jobs' discussion with President Obama on Apple's assembly operations in China in Isaacson (2011: 546). "At that time, Apple had 700,000 factory worker employed in China, and that was because it needed 30,000 engineers on-site to supervise those workers. If you could educate these engineers, he said, we could move more manufacturing plants here."

to outsource production processes to another country—either by setting up an affiliated company or establishing an arm's length relationship with a local firm—entails "country risks". This is because supply disruptions in a given overseas location could disrupt the entire production chain. Such disruptions could be the product of shipping delays, political disturbances, or labor disputes (in addition, of course, to natural disasters). In many instances it is impossible to fully offset these risks by writing "complete contracts" (Helpman 2006; Spencer 2005).

Finally, why should governments in developing countries pay specific attention to global production sharing as part of outward oriented development strategy? There is no hard empirical evidence to address this issue. But the available evidence on the emerging patterns of global production sharing, when combined with the standard literature on gains from export oriented development (e.g., Dornbusch 1992; Grossman and Helpman 1992; Srinivasan 1999), suggests that growth prospects would be greatly enhanced through engaging in this form of international exchange. As discussed, network trade accounts for a large and increasing share of world manufacturing trade compared to the traditional manufactured goods such as apparel and footwear. Thus there can be considerable gains from improved resource allocation in line with social marginal cost and benefits, and from economies of scale and scope that arise in wider markets. Participation in global production sharing also has the potential to yield growth externalities (spillover effects) through transfer of technology and managerial know-how, skill development, and "atmosphere creation" effect. Engaging in global production sharing is an effective way of linking domestic manufacturing to dynamic global industries of electronics, electrical goods, medical devices, and transport equipment, which are the incubators of new technology and managerial skills. Labor training in a given stage/segment of a production process not only helps in moving up the value ladder within the given industry but also helps attract new investors in related industries by creating a pool of skilled labor.[12] Finally, participation in global production sharing is likely to have a favorable atmospheric effect: the creation of a Schumpeterian environment conducive to growth. The very nature of the process of global production is the continuous shaking up of industry through the emergence of new products and production processes in place of old

12. For instance the trained labor pool created by semiconductor assembly was a key pull factor for the subsequent expansion of hard disk drive industry in Singapore and Malaysia. More recently Penang (Malaysia) has become a preferred location for the major MNEs in the medical devices industry because of the availability of a sizeable skilled labor pool created by the electronics industry over the past two decades (Athukorala 2014; Wong 2007).

ones. Engagement in a manufacturing process involving a variety of goods and inputs could contribute more to growth than perpetual specialization in a narrow range of products.

3. India's Export Performance: An Overview

During the first four decades of the postindependence era India continued to remain an underperformer in world export markets, relative to both her own potential and the performance of many other developing countries. The overriding aim of the Indian development policy from the inception was across-the-board import substitution in the context of a foreign trade regime, which relied extensively on quantitative restrictions (QRs). Until about the mid-1970s the overall policy trend was towards tightening controls on both foreign trade and domestic industry. The pull of resources into import substitution industries by the high level of protection, plus overvaluation of the real exchange rate resulting from upwards shift in demand for imports and a rate of domestic inflation above that of trading partners, discouraged production for export. Also, the inflexibilities created by the pervasive controls on domestic manufacturing handicapped the ability of firms to penetrate export markets (Panagariya 2004, 2008; Singh 1964; Srinivasan 1998).

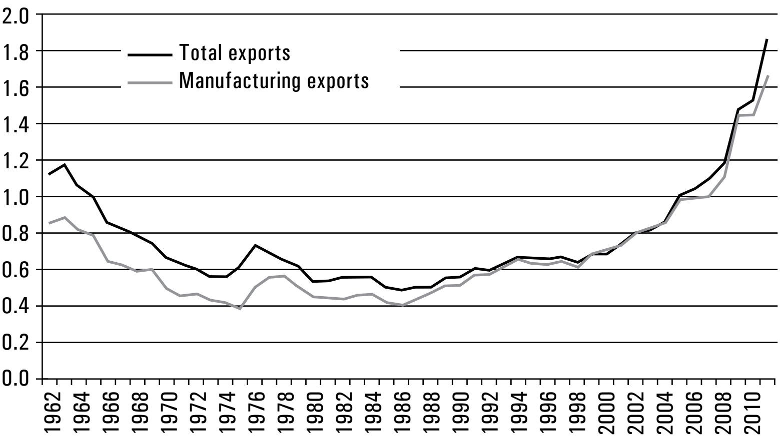
India's share of world non-oil exports fell continuously from 2.3% in the 1950s to 0.6% in the 1970s as shown in Figure 1. Notwithstanding some selective measures introduced to ameliorate the anti-export bias, India's world market share fell further to an average level of 0.5% by the middle of the 1980s. The degree of export orientation of the economy, measured by exports to GDP ratio, remained virtually unchanged around 6% throughout the 1970s and 1980s. The fall in India's share in total exports from developing countries during this period was much sharper, from 3.2% in the 1960s to 1.5% during the 1980s. Moreover, India's failure to keep up with overall export performance of other developing countries[13] was much more clearly visible in manufacturing trade: India accounted for 2.6% of manufacturing exports from developing countries in the late 1980s, compared to 10.2% in the early 1960s. In 1962 (the earliest year for which comparable country-level data are available), India was the second largest exporter of manufactured goods in the developing world (accounting for 14.2% of exports from

13. In this paper the standard United Nations country classification is used to identify developing countries. According to this classification "developing countries" encompasses developing Asia (the member countries of the Asian Development Bank), Latin America, Africa, and the Middle East.

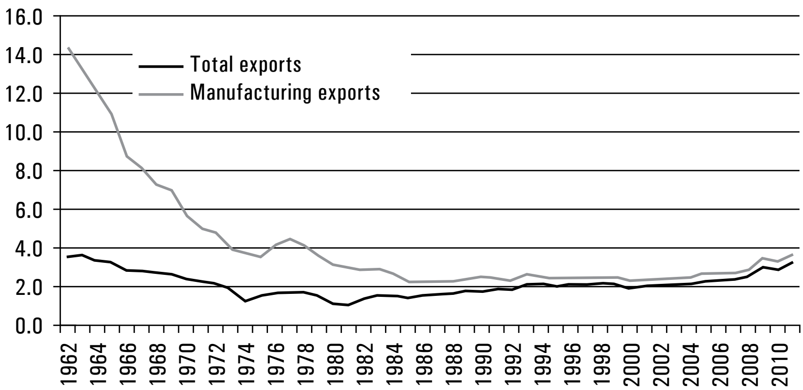
developing countries after Hong Kong (19.8%). By the time the liberalization reforms began in the early 1990, India was the 10th largest exporter (2.6%), after the Philippines (2.9%), and China's share (25.6%) was over 10 times larger than that of India.[14]

FIGURE 1. India's Share in Total World Exports and Exports from Developing Countries, 1962–2011[1]

(a) Total World Exports (%)



(b) Exports from developing countries (%)



Source: Based on data compiled from the UN Comtrade database.[15]
Notes: 1 Total merchandise exports net of oil and gas.
2 Developing countries are identified on the basis of the standard UN definition.

14. The data reported in this paper, unless otherwise stated, are based on the UN *Comtrade* database (http://comtrade.un.org/db/ accessed in January–March 2013).

15. http://comtrade.un.org/db/ (accessed in January–March 2013)

India's overall export performance has improved significantly following the liberalization reforms. Its share in total world non-oil exports recovered to the level of the early 1960s (about 1.2%) by 2002 and increased further to 1.8% in 2011. However, as yet there has not been any noticeable improvement in India's relative export performance among developing countries. Its share in total exports from developing countries has not yet surpassed the levels of the early 1960s (about 3.8%). India has so far failed to cash in on the "the great transformation of world trade" (Krugman 2008: 103), the dramatic shift in manufacturing exports from developed to developing countries that has occurred over the past four decades.

In Tables 1 and 2 India's export performance is compared with the East Asian developing countries by broad commodity categories.[16] India's share in world manufacturing exports increased from 0.6% in 1990–91 to 1.6% in 2010–11. Over the same period, China's share jumped from 2.5% to 15.3%. By 2010–11, China was accounting for 38.5% of total manufacturing exports from developing countries compared to India's share of 4.2%. The share of manufactured goods in total non-oil exports has continued to remain low (around 80%) in India compared to China and most other countries in East Asia.

India's world market shares in all commodity categories have increased over the past three decades, but no particular commodity category stands out for markedly rapid world market penetration in a comparison with the East Asian countries. During this period, Indian export expansion has been heavily concentrated in two product categories: resource-based products (products classified by material, Standard International Trade Classification, SITC 6),[17] and miscellaneous product (SITC 8, clothing, footwear, and other standard labor-intensive products).[18] A startling difference in India's export patterns compared to China and the other East Asian countries is the rather small share accounted for by the product group of machinery and transport

16. In order to minimize the effect of possible random shocks and measurement errors, henceforth two-year averages are used in inter-temporal comparison throughout this paper. All data are calendar-year based.

17. Gems and jewelry, which constitute over 15% of Indian exports, are included in this category.

18. It is important to note that even in miscellaneous manufactured goods, a product group in which India has considerable untapped potential, India's performance has been lacklustre in international comparisons. For instance, between 2005 and 2012, India's share in world apparel exports remained virtually unchanged around 5.3% whereas Bangladesh's share surged from 4.5% to 8.1% (data compiled from the UN Comrade database). India's export performance in apparel and other labor intensive manufactured goods has been extensively documented and analyzed by Panagariya (2008).

TABLE 1. Shares in World Manufacturing Exports: India and Developing East Asian (DEA) Countries, 1990–91, 2000–2001, and 2010–11 (%)[1]

				Manufacturing (SITC 5 to 8–68)				
		Total exports[2]	*Primary products (1 to 4 + 68)*	*Total*	*Chemicals and related products (5)*	*Products classified by material (6 – 68)*	*Machinery and transport equipment (7)*	*Miscellaneous manufacturing (8)*
India	1990–91			0.6	0.5	1.4	0.1	2.2
	2000–01	0.8	1.1	0.7	0.8	2.0	0.1	2.9
	2010–11	1.6	2.0	1.6	1.6	3.4	0.7	3.2
East Asia countries	1990–91	15.2	12.1	16.3	7.3	15.7	17.3	69.3
	2000–01	20.2	12.2	22.4	11.9	20.0	29.5	47.6
	2010–11	29.1	15.0	33.1	17.5	27.2	45.5	57.0
China	1990–91	2.5	2.7	2.5	1.4	3.6	1.3	13.0
	2000–01	4.6	3.4	5.0	2.2	5.3	4.5	18.6
	2010–11	12.8	3.4	15.3	5.9	13.9	19.5	37.9
Hong Kong	1990–91	3.6	1.3	4.1	2.1	4.6	3.5	15.6
	2000–01	3.6	0.9	4.1	1.7	3.4	4.3	12.2
	2010–11	3.2	0.5	3.7	1.1	2.2	6.4	6.5
Korea, Rp	1990–91	2.5	0.8	2.9	1.0	3.2	2.7	10.0
	2000–01	2.8	0.7	3.2	2.3	3.5	3.9	2.4
	2010–11	3.5	0.7	4.2	3.2	3.3	4.5	0.5
Taiwan	1990–91	2.2	0.7	2.8	0.8	2.8	2.8	18.6
	2000–01	2.6	0.5	3.3	1.9	3.8	4.7	6.0
	2010–11	2.5	0.5	3.2	1.9	3.1	5.0	3.9
Indonesia	1990–91	0.6	1.3	0.5	0.3	1.3	0.0	2.6
	2000–01	0.8	1.8	0.7	0.5	1.4	0.5	2.4
	2010–11	1.1	3.9	0.6	0.6	1.2	0.4	2.0

(Table 1 Contd)

(Table 1 Contd)

Malaysia	1990–91	1.0	1.9	0.8	0.2	0.5	1.5	1.9
	2000–01	1.5	1.3	1.6	0.7	0.8	3.2	1.1
	2010–11	1.3	1.8	1.3	0.8	0.9	2.2	1.1
Philippines	1990–91	0.2	0.3	0.1	0.1	0.1	0.2	1.2
	2000–01	0.6	0.4	0.7	0.1	0.2	1.5	1.3
	2010–11	0.4	0.3	0.3	0.1	0.2	0.7	0.4
Singapore	1990–91	1.7	1.1	1.8	1.3	0.8	3.6	2.2
	2000–01	2.2	0.6	2.4	1.7	0.6	4.7	0.9
	2010–11	2.3	0.5	2.5	2.6	0.7	4.5	0.3
Thailand	1990–91	0.9	2.1	0.7	0.2	0.7	0.8	4.2
	2000–01	1.2	2.0	1.1	0.7	1.0	1.5	1.9
	2010–11	1.5	2.2	1.4	1.2	1.3	1.7	1.2
Vietnam	1990–91	–	–	–	–	–	–	–
	2000–01	0.2	0.7	0.1	0.0	0.1	0.1	0.9
	2010–11	0.6	1.1	0.5	0.1	0.5	0.4	3.1
Developing countries	1990–91	19.0	21.2	19.2	9.8	21.5	18.6	81.7
	2000–01	26.7	23.7	28.4	15.6	28.4	34.4	63.6
	2010–11	36.9	30.7	39.7	22.1	37.2	50.4	68.0
World, $ billion	1990–91	2,708.6	407.5	2,241.9	274.7	472.4	749.1	76.4
	2000–01	5,469.8	615.2	4,602.5	567.0	820.2	1,764.7	195.2
	2010–11	13,400.4	1,914.8	10,756.6	1,724.1	2,051.3	3,808.1	373.9

Source: Compiled from UN Comtrade database.[19]

Notes: 1. Standard International Trade Classification (SITC) codes are given in brackets.
2. Excluding oil and gas.
– Data not available.

19. http://comtrade.un.org/db/ (accessed in January–March 2013).

TABLE 2. **Composition of Exports: India and Developing East Asian (DEA) Countries, 1990–91, 2000–2001, and 2010–11 (%)**

			Manufacturing (5 to 8–68)					
		Primary products (1 to 4 less 68)	*Total*	*Chemicals and related products (5)*	*Products classified by material (6–68)*	*Machinery and transport equipment*	*Miscellaneous manufacturing (8)*	*Total US$ billion*
India	1990–91	24.9	73.3	8.1	36.6	7.6	20.9	17.5
	2000–01	17.1	80.4	11.0	39.7	8.3	21.4	41.4
	2010–11	17.6	78.0	12.8	32.3	17.2	15.6	214.1
East Asia	1990–91	12.0	88.9	4.9	18.0	34.9	28.8	411.2
	2000–01	6.8	93.0	6.1	14.9	50.8	21.3	1,106.1
	2010–11	7.4	91.2	7.7	14.3	50.9	17.8	3,905.1
China	1990–91	16.4	83.6	5.5	25.1	16.8	36.2	67.5
	2000–01	8.2	91.6	5.0	17.1	35.2	34.3	252.5
	2010–11	3.8	96.1	5.9	16.6	49.2	24.4	1,712.5
Hong Kong	1990–91	5.3	94.3	5.8	22.2	28.5	37.8	98.6
	2000–01	2.9	96.5	5.0	14.4	39.2	37.9	196.4
	2010–11	2.3	93.3	4.5	10.6	57.5	20.7	427.3
Korea, Rp	1990–91	4.8	95.0	4.2	22.6	41.2	26.9	67.3
	2000–01	2.8	96.3	8.6	18.7	61.3	7.8	152.7
	2010–11	2.7	96.7	11.7	14.7	60.3	10.1	468.0
Taiwan	1990–91	4.6	95.4	3.7	22.0	48	30.9	71.7
	2000–01	2.0	98.0	7.5	21.5	65.3	11.5	139.1
	2010–11	3.1	96.9	9.9	18.6	59.5	7.7	291.5
Indonesia	1990–91	33.1	66.0	4.5	36.9	3.2	21.5	16.4
	2000–01	24.0	75.1	6.6	25.8	21.7	21	45.7
	2010–11	51.0	47.8	6.8	16.3	14.2	10.5	145.7

(Table 2 Contd)

(Table 2 Contd)

Malaysia	1990–91	28.9	70.5	2.0	9.5	46.4	12.6	26.5
	2000–01	9.2	89.8	4.5	7.8	68.2	9.3	84.1
	2010–11	19.6	79.6	7.8	11.0	49.6	11.3	177.1
Philippines	1990–91	25.5	74.5	3.6	8.9	29.1	33	4.3
	2000–01	6.5	93.2	1.0	3.8	76.1	12.3	34.7
	2010–11	12.6	76.1	3.5	8.1	57.4	7	48.7
Singapore	1990–91	9.8	88.4	7.8	8.6	61.1	10.9	46.0
	2000–01	3.2	92.7	8.1	4.1	71.3	9	120.1
	2010–11	3.3	86.7	14.6	4.7	58.9	8.5	311.8
Thailand	1990–91	33.3	65.5	2.4	13.0	23.3	26.8	25.5
	2000–01	19.3	77.5	6.0	12.0	44.2	15.3	64.9
	2010–11	21.2	75.7	9.9	13.1	41.9	10.8	200.8
Vietnam	1990–91	–	–	–	–	–	–	–
	2000–01	38.3	58.0	1.6	7.7	11.4	37.4	11.2
	2010–11	28.0	71.3	3.1	12.5	19.8	35.9	76.7
Developing countries	1990–91	16.8	83.8	5.2	19.7	31.2	25.8	514.8
	2000–01	10.0	89.5	6.0	15.9	47.6	20	1,462.4
	2010–11	11.9	86.3	7.7	15.4	46.6	16.1	4,945.1
						0	0	
World	1990–91	15.0	82.8	10.1	17.4	42.7	12.5	2,708.6
	2000–01	11.2	84.1	10.4	15.0	45.1	13.8	5,469.8
	2010–11	14.3	80.3	12.9	15.3	39.5	12.6	13,400.4

Source: Compiled from UN Comtrade database.[20]

Notes: 1 Standard International Trade Classification (SITC) codes are given in brackets.

– Data not available.

20. http://comtrade.un.org/db/ (accessed in January–March 2013).

equipment (SITC 7), which accounts for nearly a third of world merchandise trade and over 40% of total manufacturing trade. In 2010–11, machinery and transport equipment accounted for only 17.2% of total merchandise exports of India, compared to 59.2% in that of China and even larger shares in Korea, Taiwan, Malaysia, and Singapore. As we will see in the next section, the ongoing process of global production sharing is heavily concentrated within this product group.

An obvious caveat relating to the comparison of India's export performance in the Asian context using standard trade data (which records trade in "gross" terms), as we have done here, is that this could understate India's relative export performance. This is because export composition of China and the other East Asian countries, unlike that of India, is dominated by network trade which is characterized by a high degree of import intensity arising from two sources—multiple-border crossing of parts and components before they get finally embodied in final products, and the liberalization of each country in a given slice of the production process.[21] In order to understand this possible bias we compiled data on manufacturing exports both in gross (Customs-record based) and value-added terms from a new database put together by the Organization for Economic Cooperation and Development (OECD). The data are reported in Table 3 for those Asian countries for which both data series are available.

Per unit value added (that is value-added exports as a percentage of gross exports) is much bigger in India compared to China and the other East Asian countries except Indonesia (Table 3, last column). However, the use of the standard (gross) or the value-added export value series does not make a significant difference to India's relative export performance. In gross terms, India ranks sixth among the 11 countries, after China, Korea, Taiwan, Malaysia, Singapore, and Thailand. When value added data are used, India is evaluated to be at the fourth position, slightly above Thailand, Malaysia and Singapore. However, the big difference between China and India remains virtually unchanged: in gross terms Indian exports in 2009 amounted to only 10% of China's export and in value added terms this figure only increases marginally to 11%.

21. In recent years there has been a lively debate on the appropriateness of official trade statistics for the purpose of studying trends and patterns of manufacturing trade in the presence of global production sharing and how to modify and integrate the System of National Accounts (SNA) and Customs data reporting systems for the measurement of trade data in value-added terms. On this debate see various contributions in Mattoo et al. (2013).

TABLE 3. Comparison of Gross and Value-added Exports from Selected Asian Countries,[1] 2009

	Gross exports US$ billion	*Country rank*	*Value added exports[2] US$ billion*	*Country rank*	*Value added share of gross export (%)*
China	1042.0	1	666.0	1	63.9
Korea	328.7	2	178.8	2	54.4
Chinese Taipei	201.8	3	103.7	3	51.4
Singapore	116.6	4	53.4	7	45.8
Thailand	114.4	5	62.0	5	54.2
India	103.9	6	75.3	4	72.4
Malaysia	92.6	7	57.1	6	61.7
Indonesia	65.9	8	51.5	8	78.2
Philippines	37.8	9	19.8	9	52.3
Vietnam	20.6	10	8.3	10	40.3
Hong Kong, China	9.5	11	5.0	11	52.8

Source: Compiled from OECD StatExtracts.[22]
Notes: 1. Domestic value added in gross (Customs record based) exports calculated using national input–output tables.
2. Domestic value-added embodied in gross exports.

4. India in Network Trade

Between 1990–91 and 2010–11, world exports taking place within global production networks (network exports)[23] recorded an almost five-fold increase, from US$12803 billion to US$59070, with the share of developing countries in the total increasing from 11.9% to 45.1%, as given in Figure 2. This has contributed disproportionally to the shift in the geographic profile of manufacturing trade from developed to developing countries. The share of network products in exports from developing countries increased from 41.4% in 1990–91 to 60.1% in 2010–11. These exports accounted for over 60% of the total increment in manufacturing exports from developing countries over these two decades.[24]

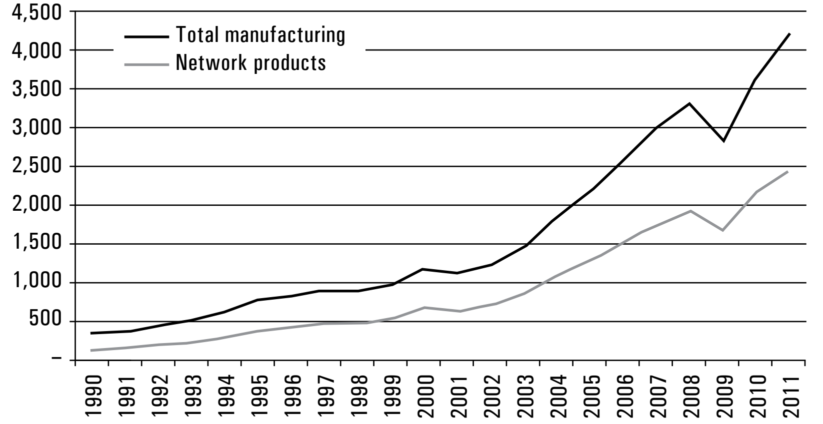
22. OECD-WTO Trade in Value Added (TiVA) database available at stats.oecd.org/index.aspx?queryid=47807 (accessed on November 23, 2013).

23. The procedure followed in delineating network exports (parts and components, and final assembly) from the standard trade data reported on the basis of the SITC is explained in Appendix (a).

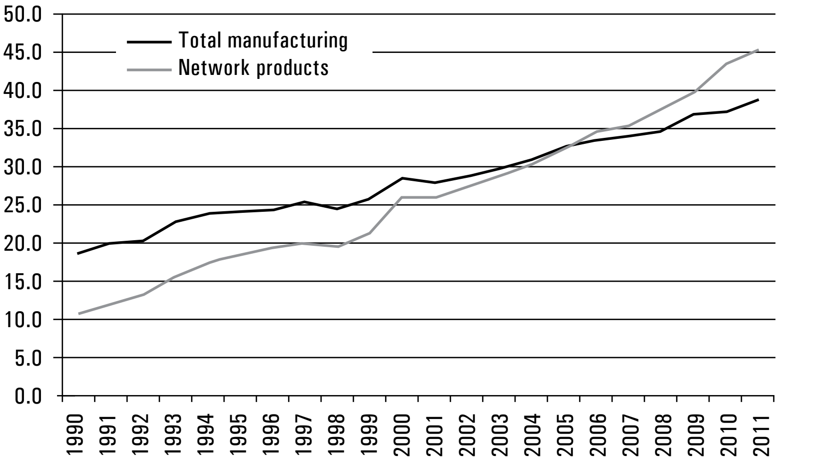
24. The data on the share of network products, in particular electronics and electrical goods, in total manufacturing reported here (which are based on nominal manufacturing value added) presumably understate the relative importance of this form of trade because during this period the prices of these products grew at a much slower rate compared to those of most other manufactured products (Krugman 2008).

FIGURE 2. Manufacturing Exports from Developing Countries, 1990–2011

(a) Export Value, US$ billion



(b) Developing Countries' Share in World Exports (%)



Source: Based on data compiled from the UN Comtrade database.[25]

Data on the contribution of global production sharing to the expansion of manufacturing exports from India and East Asian countries are summarized in Table 4. On average network products have accounted for over a half of total manufacturing exports from all East Asian countries (except Indonesia)[26] over the past two decades, with this share recording a notable

25. http://comtrade.un.org/db/ (accessed in January-March 2013).

26. The "outlier" status of Indonesia within East Asia in relation to its role in global production sharing is discussed too.

TABLE 4. Global Production Sharing and Manufacturing Exports: India and Developing East Asian Countries

Share in total manufacturing exports (%)

	Parts and component			*Final assembly*			*Network products*			*Contribution to export increment between 1990–91 and 2010–11*
	1990–91	*2000–01*	*2010–11*	*1990–91*	*2000–01*	*2010–11*	*1990–91*	*2000–01*	*2010–11*	
India	7.0	8.3	11.0	4.9	4.1	12.3	11.9	12.4	23.4	23.4
East Asia	23.9	42.0	39.3	20.0	18.1	23.2	43.9	60.0	62.5	68.9
China	11.4	25.0	30.7	12.7	17.2	25.1	24.1	42.3	55.8	63.5
Hong Kong	18.6	31.8	52.4	18.9	17.0	15.6	37.5	48.8	68.0	59.7
Korea, Rp	22.2	39.0	34.9	23.3	26.8	36.5	45.6	65.8	71.4	81.3
Taiwan	23.5	49.0	53.5	26.9	23.7	23.0	50.4	72.6	76.5	88.1
Indonesia	3.0	22.1	18.2	3.0	8.7	13.1	6.0	30.8	31.3	42.3
Malaysia	47.3	62.5	50.6	21.6	16.7	16.5	68.9	79.2	67.1	82.6
Philippines	37.3	77.8	66.8	8.5	5.8	11.3	45.7	83.6	78.1	87.7
Singapore	49.3	71.9	63.1	24.5	10.9	10.7	73.8	82.8	73.8	88.0
Thailand	26.6	42.3	35.9	12.3	17.5	23.1	38.9	59.8	59.0	70.2
Vietnam	–	16.8	20.1		4.6	10.3		21.4	30.5	21.4
Developing countries	22.3	38.6	36.4	19.1	19.6	23.6	41.4	58.3	60.1	66.6
World	27.4	33.1	29.7	29.7	26.2	25.2	57.1	59.3	54.9	61.4

Source: Compiled from UN Comtrade database.[27]
Note: – Data not available.

27. http://comtrade.un.org/db/ (accessed in January–March 2013).

increase in the past decade. Network product exports from India, too, have increased during this period, but these products accounted for only 23.4% of total Indian manufacturing exports in 2010–11. Network products accounted for nearly 70% of the total increment in manufacturing exports from East Asia between 1990–91 and 2010–11; the comparable figure for India was 22%.

As regards to the composition of network products, a striking common feature of East Asian countries' engagement in global production sharing is the heavy concentration of production within the broader commodity group of machinery and transport equipment (SITC 7). Within this product group telecommunication and sound recording equipment, semiconductors and other electrical machinery and equipment account for the lion's share of total network exports as seen in Tables 5 and 6. By contrast, these dynamic products still account for a much smaller share (26%) of network product exports from India.

A notable difference in the commodity composition of network exports from India compared to that of the East Asian countries is the relatively larger share accounted for by transport equipment. Table 5 shows road vehicles and other transport equipment accounted for 28% of total Indian network exports in 2010–11, compared to an East Asian regional average of 13.2%. Interestingly, the total volume of transport equipment exports from India is rapidly approaching the level of Thailand, which is the most successful second-tier automotive exporting country (after Japan and Korea) in Asia. India's total transport equipment exports increased from US$1.3 billion in the early 1990s to nearly US$19 billion in 2010–11. Thailand's transport equipment exports in 2010–11 were US$21.0 billion.

A number of leading automakers and auto part suppliers have established assembly plants in India and some of them have already begun to use India as an export platform within their global production networks (Humphrey 2003; Sen and Srivastava 2012). For example, Toyota Kirloskar Auto Parts, a joint venture between Toyota and a local manufacturer is exporting gearboxes from India to assembly plants in various countries including Thailand, South Africa and Argentina. Toyota Indonesia, which specializes in multipurpose vehicles has integrated its production system with its operations in India, importing engine components from Indonesia and exporting gearboxes and auto parts. Suzuki India has developed a two way sourcing network encompassing its plants in China, India and Indonesia. Almost all companies now export assembled cars (completely built units) to both regional and extra-regional markets. Until about the early 2000, parts and components accounted for the bulk of automotive exports from India.

TABLE 5. Composition of Networks Exports, 2010–11 (%)

	Office machines and automatic data processing machines (75)	*Telecom and sound recording equipment (76)*	*Electrical machinery excluding semi-conductors (77)*	*Semi-conductors[2]*	*Road vehicles (78)*	*Other transport equipment (79)*	*Professional and scientific equipment (87)*	*Photographic apparatus and optical goods, watches and clocks (88)*	*Other[2]*	*Total US$ billion*
India	1.9	10.9	14.1	1.9	26.3	22.0	3.0	1.0	18.8	34.6
East Asia	19.1	18.8	14.4	17.3	7.8	6.2	5.5	2.1	8.8	1,841.2
China	24.9	22.9	16.2	7.8	6.1	5.4	5.3	1.5	9.9	851.1
Hong Kong	17.7	25.8	17.4	25.1	0.6	0.2	3.4	5.0	4.9	264.2
Korea, Rp	4.5	12.9	9.9	14.9	20.1	17.5	10.8	1.5	7.8	297.9
Indonesia	11.3	22.7	24.3	4.7	15.2	6.6	1.2	1.0	13.0	20.5
Malaysia	23.0	14.6	11.9	36.2	1.8	1.5	5.3	1.2	4.5	90.4
Philippines	25.7	3.0	14.3	42.7	7.1	2.3	0.9	2.2	1.8	28.7
Singapore	15.1	6.2	8.7	44.6	2.3	4.7	4.3	1.6	12.5	190.6
Thailand	21.4	10.5	15.1	11.4	22.4	2.8	2.1	3.2	11.2	81.6
Vietnam	15.6	33.4	19.6	4.0	5.3	4.2	2.1	4.0	11.8	16.0
Developing countries	17.2	18.3	14.5	15.0	11.8	6.1	5.4	1.9	9.8	2,150.4
World	10.9	12.1	13.8	9.2	21.8	6.6	6.5	2.2	16.9	5,236.6

Source: Compiled from UN Comtrade database.[28]

Notes: 1. Standard International Trade Classification (SITC) codes are given in brackets.
2. These two categories contain parts and components only.

28. http://comtrade.un.org/db/ (accessed in January–March 2013).

TABLE 6. Shares of Parts and Components in Total Networks Exports, 2010–11 (%)[1]

	Office machines and automatic data processing machines (75)	*Telecom-munication and sound recording equipment (76)*	*Electrical machinery excluding semiconductors (77)*	*Road vehicles (78)*	*Other transport equipment (79)*	*Professional and scientific equipment (87)*	*Photographic apparatus and optical goods, watches and clocks (88)*	*Total*
India	87.3	45.2	79.3	31.8	24.3	28.3	14.4	53.2
East Asia	75.9	60.1	64.7	40.1	9.0	12.1	25.3	66.1
China	64.4	55.4	55.8	45.4	3.8	10.3	22.6	59.3
Hong Kong	97.6	62.9	77.3	25.9	61.7	22.1	23.2	79.1
Korea, Rp	96.8	85.2	74.0	33.1	2.5	3.1	11.4	53.0
Indonesia	95.9	33.0	69.2	50.2	8.5	19.3	24.4	61.5
Malaysia	71.5	56.1	75.7	75.6	51.3	32.8	53.8	78.8
Philippines	86.4	79.9	66.2	93.6	20.8	22.7	8.9	86.1
Singapore	97.5	79.2	79.1	77.6	52.8	27.6	27.5	89.4
Thailand	99.6	39.0	57.9	27.8	54.3	40.7	48.1	66.8
Vietnam	99.6	35.8	89.0	78.6	3.1	19.5	84.5	68.9
Developing countries	76.3	57.5	65.4	34.2	10.4	12.6	24.6	63.8
World	82.1	60.7	68.5	30.1	18.1	14.5	17.6	61.0

Source: Compiled from UN Comtrade database.[29]

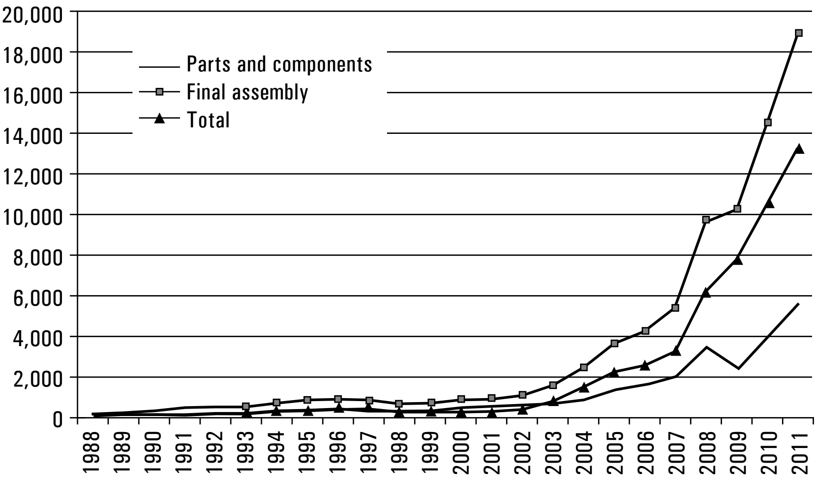
Note: 1. Standard International Trade Classification (SITC) codes are given in brackets.

29. http://comtrade.un.org/db/ (accessed in January–March 2013).

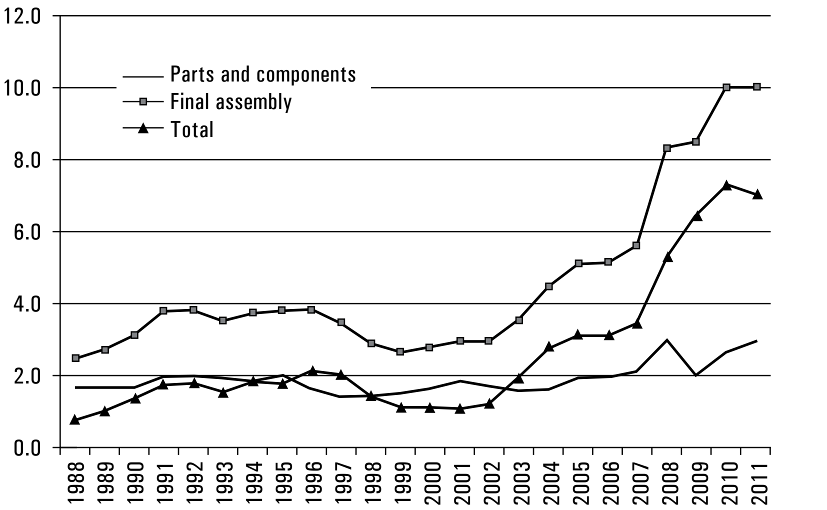
Since then exports of completely built units (CBUs) have increased at a much faster rate. Figure 3 shows that in 2010–11 CBUs accounted for nearly three quarters of total automotive exports of over US$19 billion.

FIGURE 3. Exports of Transport Equipment from India, 1988–2011

(a) Value (US$ million)



(b) Share in Total Manufacturing Export (%)



Source: Based on data compiled from the UN Comtrade database.[30]

30. http://comtrade.un.org/db/ (accessed in January–March 2013).

In a sharp contrast to automobile, as yet there are no signs of Indian manufacturing linking to production networks in electronics, electrical goods and other related products. A number of large electronics and electrical goods producing MNEs (e.g., Nokia, Samsung, LG) have set up production bases in India, but they are predominantly involved in production for the domestic market.

In most East Asian countries Special Economic Zones (SEZs) (until recently known as free trade zones or export processing zones have proved to be an effective vehicle for integrating domestic manufacturing into global production networks in these global industries (Sachs and Warner 1995). In these countries, SEZs provided an investment climate characterized by free trade conditions, a liberal regulatory framework and high-quality infrastructure. In India the first SEZ (in Kandla, Gujarat) was set up in 1965. A second SEZ was set up in Santacruz (Mumbai) in 1973, with a specific focus on attracting electronics firms. During the 1980s, five more zones were set up. By 2005 there were 17 SEZs in operation (Aggrawal 2012). But these SEZs never took off because of several reasons, such as their relatively limited scale; the government's general ambivalence about attracting FDI, and unclear and changing incentive packages attached to the zones (Bajpai and Sachs 2000; Kumar 1989). Moreover, unlike in the East Asian countries, where SEZs were an integral part of an overall export-led industrialization strategy, in India SEZs had to operate in the context of a highly restrictive trade and investment policy regime. It was difficult to insulate the zones from this unfavorable external investment climate (Aggarwal 2013).

Inspired by the notable success of SEZs in China, the Indian government announced a revamped approach to SEZs as part of the Foreign Trade Policy of 2000–01 (Panagariya 2008). This was followed by the enactment of the SEZ Act of 2005 to provide the overall legal framework within which the SEZs operate. The Act, which became operational in February 2010, provides for the setting up of SEZs by the private sector, in addition to state governments and the central government, and gives the Indian states some flexibility for the relaxation of labor laws and the offer of specific incentives to investors.

The past five years have seen a rapid proliferation of SEZs in India: by early 2011, 580 SEZs had been formally approved and, of them, 122 had begun operations (Aggarwal 2013). Table 7 illustrates the share of exports by SEZ enterprises in total exports from the country increasing from 9.1% in 2007–08 to 27.4% in 2009–10. However, so far there has not been a significant presence of foreign firms in electronics and other vertically integrated global industries. Electronics and electrical goods account for only a tiny share of exports (2.3% in 2009–10). It could be that despite significant recent reforms, in the eyes of foreign investors India's foreign investment regime still reflects the tension between the traditional aversion to foreign investment and the current recognition of its importance to economic development. The smooth functioning of SEZs has also been constrained by the controversial issue of land acquisition and unresolved issues relating to the relaxation of labor laws for the SEZ firms (Panagariya 2008: 271–73).

TABLE 7. India: Exports from Special Economic Zones, 2007–10[1] (%)

Product	*2007/08*	*2008/09*	*2009/10*
Biotech	0.3	0.9	0.2
Computer/electronic software	6.0	16.3	20.7
Computer hardware[2]	16.7	13.1	7.9
Electronics	0.8	0.4	0.4
Engineering	2.5	3.1	1.9
Gems and jewelry	34.5	33.5	19.9
Chemical and pharmaceuticals	2.2	6.4	33.5
Handicraft	0.1	0.0	0.0
Plastic and rubber	1.0	0.4	0.3
Leather, footwear, and sport goods	0.9	0.3	0.2
Food and agricultural products	0.9	0.3	0.2
Nonconventional energy	0.2	0.2	0.6
Textiles and garments	2.0	3.0	1.5
Trading and services	31.4	18.9	11.3
Miscellaneous	1.4	3.4	1.3
Total (%)	100	100	100
US$ billion	14.8	22.2	49.1
Memo item			
Percentage of India's total exports	9.1	12.0	27.4

Source: Compiled from WTO (2013), Table 111.19.
Notes: 1. Data are based on Indian financial year.
2. Assembly of computers and printers.

What explains the rapid growth of automotive exports compared to electronics and other machinery exports? The human capital base developed during over a half-a-century of import-substitution industrialization and the removal of restrictions on the entry of foreign automotive producers as part of the liberalization reforms provided the setting for the expansion of the Indian automobile industry (Humphrey 2003). But it is necessary to look into the peculiarities of automobile production in order to understand its unique export performance record.

Unlike electronics and electrical goods, automotives are bulky and "low-value-to weight" goods, and hence transport cost is a key determinant of market price. There is also a need to design the product to suit the taste and affordability of the consumer. Therefore, there is a natural tendency for final assembly plants to be located in countries with large domestic markets. Once auto makers choose to set up assembly plants in a given country, parts and component producers follow them because of two reasons. First, and perhaps more importantly, most auto parts also have low value-to-weight ratios, which makes its too costly to use air transport for the timely delivery required for just-in-time production schedules of the final assembler (Hummels 2007).[31]

Second, there is an asymmetrical market-power relationship between component makers and auto makers within the global automobile industry; the products of many auto part manufacturers are used in vehicles made by a handful of car makers. This is different from electronics parts, like integrated circuits and semiconductors, that are used in many industries. Thus, there is an incentive for the part makers to set up factories next to the assemblers in order to secure their position in the market (Klier and Rubenstein 2008: Chapter 3; Kohpaiboon and Jongwanich 2013).

Once a complete production base (involving both final assembly and component assembly/production) is established in a given (large) country, exporting to third countries becomes a viable option for automakers. Scale economies gained from domestic expansion makes exporting of both parts and components and assembled vehicles profitable as part of their global profit maximization strategy. Adaptation of products to suit domestic demand conditions and lower transportation cost compared to exporting from the home base also become important drivers of exporting to regional markets from the new production base.

An important aspect of the performance of Indian auto industry is the coexistence of high tariff protection (which implies an anti-export bias) and rapid export growth. In spite of some reductions in recent years, tariffs on completely built automotives continued to remain much higher (60% on average) than tariffs on other imports (average tariff of 8.5%) (WTO 2011). Moreover, given the cascading nature of the tariff structure (parts and components tariffs of about 21%), the rate of effective protection for domestic automotive assembly is presumably even higher than the average applied nominal rate. Viewed from the mainstream policy advocacy for designing export promotion policy, an interesting issue here is why continuing the

31. Air shipping is the mode of transport for over two-thirds of electronics exports from Singapore, the Philippines, Thailand, and Malaysia to the USA (estimate based on US Trade Commission data on trade by mode of transport between 2000 and 2005).

anti-export bias has not been a deterrent to rapid export growth. A possible explanation is that export expansion has been predominantly driven by MNEs, which have set up production plants in India to produce for the global market, not just for the Indian market. The conventional advocacy for removing anti-export bias as a precondition for export expansion is based on the implicit assumption that exporting is an act of domestically owned firms whose marketing decision is driven by the relative profitability of exporting compared to selling in the domestic market. Relative profitability in selling in the domestic market is probably not a binding consideration for the MNEs involved in sourcing and marketing within a global production network.

For the poor export performance record in electronics, the only major East Asian country whose experience resembles that of India is Indonesia. An understanding of why Indonesia, notwithstanding the obvious advantageous position in terms of its location and relative wages, has continued to remain a small player in regional production networks seems to hold lessons for India. Indonesia's engagement has so far been limited only to some low-end assembly activities undertaken mostly by Singaporean subcontracting companies in the Batam economic zone. In the early 1970s, two major electronic MNEs, which had already established production bases in Singapore, did set up assembly plants in Indonesia (Fairchild and National Semiconductor, established in 1973 and 1974 respectively), but both plants were closed down in 1986. At that time there was a worldwide slump in the semiconductor business. However, it is not clear whether external demand factors played an important role in their departure from Indonesia. Both these MNEs continued their operation in both Singapore and Malaysia with some restructuring and labor shedding in response to demand contraction. The unfavorable business environment in Indonesia, in particular labor market rigidities, that hindered restructuring operations in line with global changes in the semiconductor industry, appears to be the major reason. According to press accounts at the time, in 1985 Fairchild announced a plan to introduce a new technology that would have involved some reduction in their workforce, but the Ministry of Manpower opposed any retrenching that would have resulted from automation (Thee and Pangestu 1998).

Recently the issue of why Indonesia has been left behind in global production networks was brought into sharp relief when the Canadian firm, Research in Motion (RIM), the Blackberry producer, decided (in September 2011) to set up an assembly plant in Penang, Malaysia bypassing Indonesia (Manning and Purnagunawan 2011). Indonesia is the largest market for the Blackberry in Southeast Asia, accounting for some 75% of its total annual sales in the region, and almost ten times the annual sales of 400,000 in

Malaysia. Therefore, when RIM announced its plan to set up a production base in Southeast Asia, there were high hopes in Indonesian policy circles that Indonesia would be its preferred location. Indonesian authorities were, therefore, perplexed by RIM's decisions to go to Penang and the industry minister even announced the possible introduction of punitive import tariffs on luxury goods such as the BlackBerrys. However, it is not hard to understand the reason behind RIM's decisions in favor of Penang. For nearly three decades, Penang has been a world center for electronics (Athukorala 2011), whereas Indonesia has had a chequered record in attracting multinational enterprises involved in global production sharing. There has not been any notable improvement in the investment climate in the country compared to the situation in the 1980s when Fairchild and National Semiconductor closed down their operations (Wells and Ahmed 2007).

It is widely held in some policy circles that India (and Indonesia, for that matter) has "missed the boat" to join the electronics production network given the MNEs' long-standing attachment to the existing production bases and China's emergence as the premier assembly center in the world. This view is, however, not consistent with the ongoing developments in global production networks in East Asia. For instance, in recent years, the East Asia production networks have begun to spread to Vietnam and Cambodia.

Following the market-oriented policy reforms started in the late 1980s, a number of Korean, Taiwanese and Japanese firms set up assembly plants in Vietnam, but these ventures were predominantly of the conventional import-substitution variety with little links to the global production networks of the parent companies. From about the late 1990s part and component assemblies within regional production networks began to emerge, mostly with the involvement of small- and medium-scale investors from Taiwan and Korea, with only one major global player, Hitachi from Japan. A major breakthrough occurred with the decision made in February 2006 by Intel Corporation, the world's largest semiconductor producer, to set up a $300 million testing and assembly plant (subsequently revised to $1 billion) in Ho Chi Minh City. The Intel plant started commercial operation in early 2011 and is expected to eventually employ over 3,000 workers. The early experience in Singapore, Malaysia, Thailand and the Philippines indicates that there is something of a herd mentality in the site selection process of MNEs in the global electronics industry, particularly if the first entrant is a major player in the industry.

It seems that following Intel's entry, this process has already begun to replay in Vietnam (Athukorala and Tien 2012). A number of other major players in the electronics industry have already come to Vietnam following the footsteps of Intel. These include the Taiwanese-based Hon Hai Precision Industry and Compact Electronics (the world's largest and second-largest electronics contract manufacturers) and Nidec Corporation (a Japanese manufacturer of hard disk drive motors and electrical and optical components). In 2009, Samsung Electronics set up a large plant in Hanoi for assembling hand held products (HHPs) (smart phones and tablets). Over the past four years, Samsung has been gradually shifting HHP assembly from its plant in China to the Vietnam plant as part of a strategic production diversification strategy in response to increasing wages and rental cost in China. In 2009, 65% of Samsung's global HHP supply came from China, with Vietnam contributing to a mere 3%; by the end of 2012 these figures had changed to 45% and 33%, respectively. In 2012, Samsung Vietnam's production capacity reached 150 million units, and its total exports (about US$11 billion) amounted to 11% of Vietnam's total merchandise export earnings.[32]

There are also early signs of regional production networks expanding to Cambodia. In 2011, Minebea, a large Japanese MNE which produces a wide range of parts and components for the automotive and electronics industries, set up a plant (Minebea Cambodia) in the Phnom Penh Special Economic Zone to assemble parts for cellular phones using components imported from its factories in Thailand, Malaysia, and China. Minebea Cambodia currently employs 1,300 workers and it has plans to expand to a total workforce of 5,000 within two years. The other MNEs which have set up assembly plant in Cambodia include Sumitomo Corporation, Japan (wiring harnesses for cars); Denso, Japan (motorcycle ignition components); Pactics, Belgium (sleeves for sunglasses made by premier eyewear companies); and Tiffany & Company, USA (diamond polishing). There is anecdotal evidence that a number of other Japanese companies which have production bases in China and Thailand are planning to relocate some segments of their production process to Cambodia. Rising wages and rental costs in China and the neighboring Thailand, and production disruption caused by recent floods in Thailand are considered the drivers working to Cambodia's advantage (*Business Day* 2013).

When China began to emerge as a major trading nation in late 1980s, there was a growing concern in policy circles in Southeast Asia, and in other Asian countries, that competition from China could crowd out their export

32. The discussion here on Samsung's operation in Vietnam is based on a conference presentation made by Seokmin Park, Vice President and Head, Corporate Supply Chain Management of Samsung (Park 2013).

opportunities (Athukorala 2009). Initially, the "China fear" in the region was mainly related to export competition in the standard light manufactured good (clothing, footwear, sport goods, etc.), but soon it turned out to be pervasive as China begun to rapidly integrate into global production networks in electrical and electronics products through an unprecedented increase in foreign direct investment in these industries. The rapid increase in China's share in world exports markets in these product lines, coupled with some anecdotal evidence of MNEs operating in Southeast Asian countries relocating to China, led to serious concern about possible erosion of the role of Southeast Asian countries in global production networks. These concerns gained added impetus from China's subsequent accession to the WTO, which not only provided China with most-favored nation (MFN) status in major markets, but also enhanced China's attractiveness to export-oriented investment by reducing the country risk of investment.

As can been seen in the data reported in Table 4, there has been a significant contraction in final assembly of consumer electronics and electrical goods exported from some countries in Southeast Asia as an outcome of competitive pressure from China for final assembly.[33] However, this structural shift has not resulted in a "hollowing out" of production bases in Southeast Asia. On the contrary, the past two decades have seen a close complementarity between China and Southeast Asian countries within global production networks, for two reasons. First, expansion in final assembly in China has created new demand for parts and components assembled in Southeast Asia. Benefitting from this, electronics firms involved in component design, assembly and testing restructured their operations by moving into high-value tasks in the value chain. This process has been greatly aided by the deep-rooted nature of their production bases and the pool of skilled workers developed over the past three decades (Athukorala 2009). Second, a number of large electronics MNEs have shifted regional/global headquarter functions to Singapore and Penang. Manufacturing is only part of their operations. Their activities now encompass corporate and financial planning, R&D, product design and tooling, sales and marketing. Most MNEs which have shifted final assembly of consumer electronics and electrical goods to China perform global headquarter functions of their China operations from Singapore and Penang. Some of them now use their Penang affiliates as an integral part of their global training and skill enhancement programs (Athukorala 2014).

33. Final assembly is generally more labor intensive than component assembly, production and testing.

5. Determinants of Exports

This section reports the results of an econometric exercise undertaken to examine the determinants of inter-country differences in export performance, with emphasis on engagement in network trade. The analytical tool used here is the gravity model, which has become the workhorse for modelling bilateral trade flows.[34] After augmenting the basic gravity model by adding a number of explanatory variables which have been found in previous studies to improve explanatory power, the estimation equation is specified as,

$$\begin{aligned} Ln\ TRE_{ijt} = {} & \alpha + \beta_1 lnGDP_{it} + \beta_2 lnGDP_{jt} + \beta_3 lnPGDP_{it} + \beta_4 lnPGDP_{jt.} \\ & + \beta_5 lnDST_{ij} + \beta_6 lnRER_{ijt} + \beta_7 INS_{it} + \beta_8 lnLPI_{it} + \beta_9 FTA_{ijt} \\ & + \beta_{10} ADJ_{ijt} + \beta_{11} COML_{ijt} + \beta_{12} lnCLNK_{i,jt} + \beta_{13} AFC + \beta_{14} GFC \\ & + \beta_{15} DIND + \beta_{16} DODV + \gamma T + \varepsilon_{ij} \end{aligned}$$

where the subscripts *i* and *j* refer to the reporting (exporting) and the partner (importing) country, and *ln* denotes natural logarithms. The explanatory variables are listed and defined below, with the postulated sign of the regression coefficient in brackets.

TRE	Bilateral exports
GDP	Real gross domestic product (+)
PGDP	Real per capita gross domestic product (+)
DST	The distance between the economic centers of *i* and *j* (–)
RER	Real bilateral exchange rate (+)
INS	Institutional quality
LPI	Logistic performance index (+)
FTA	A binary dummy which is unity if both *i* and *j* belong to the same regional trade agreements (*RTA*) and 0 otherwise (+)
ADJ	A binary dummy variable which takes the value one if *i* and *j* share a common land border and zero otherwise (+)
COML	A dummy variable which takes the value one if *i* and *j* have a common language (a measure of cultural affinity) and zero otherwise (+)
CLNK	Colonial economic link dummy which takes the value one for country pairs with colonial links and zero otherwise (+)

34. The gravity model originated in Tinbergen (1962), purely as an attempt to capture empirical regularities in trade patterns. For recent attempt to provide a theoretical justification for its formulation and applications to trade flow modeling, see various contributions in Bergeijk and Brakman (2010).

AFC	A dummy (1 for 1997, 1998 and 1999 and zero otherwise) included to capture trade disruption caused by the Asian financial crisis (+).
GFC	A dummy (1 for 2008 and 2009 and zero otherwise) included to capture trade disruption caused by the global financial crisis (+).
DIND	A dummy variable for India (which takes the value one for India and zero for the other countries
DODV	A dummy variable for non-East Asian developing countries other than India (which takes the value one for non-East Asian developing countries other than India and zero for the other countries)
α	Constant term
T	A set of time dummy variables to capture year-specific "fixed" effects
ε	Stochastic error term, representing omitted influences on bilateral trade

The three variables, *GDP* of the reporting country and the partner countries and the distance *DST* between them, are the standard gravity model arguments. The common reasoning for the use of GDP as an explanatory variable is that larger countries have more variety to offer in international trade than smaller countries (Tinbergen 1962). The use of this variable in our trade equation is also consistent with the theory of international production fragmentation, which predicts that the optimal degree of fragmentation depends on the size of the market, because the scale of production would determine the extent to which such division of labor can proceed. In other words, the size of GDP can be treated as a proxy for market thickness (the economic depth of trading nations) which positively impacts on the location of outsourcing activity (Grossman and Helpman 2005; Jones and Kierzkowski 2001). There are also reasons to believe that GDP per capita has a positive effect on network trade over and above the effect of GDP. As countries grow richer, the scale and composition of industrial output could become more conducive to production sharing. In addition, more developed countries have better ports and communication systems that facilitate production sharing by reducing the cost of maintaining the services links involved in vertical liberalization (Golub et al. 2007).

It is important to note that per capita GDP is also widely used in the empirical trade and growth literature as a good surrogate for the capital–labor ratio. Thus, at first blush, one could interpret a statistically significant positive coefficient in our estimated equation to imply that capital-labor endowment is an important determinant of a country's successful integration within global production networks. However such an inference is not consistent with the theory of global production sharing; production sharing opens up opportunities for labor abundant and capital poor countries to specialize in labor-intensive slices of the value chain of high-tech (capital and skill-intensive) global industries (Jones 2000: Chapter 7; Jones and Kierzkowski 2001). Nor is it consistent with the experiences of the East Asian economies. For instance Singapore and Penang (Malaysia) specifically focused on electronics assembly at the very early stages of their development (Singapore in the mid-1960s and Malaysia in the early 1970s) particularly because of its suitability in creating a vent for their surplus labor pool, and capital almost entirely came from MNEs (Athukorala 2014; Goh 1993; Yew 2000). As discussed, production networks have begun to expand to Vietnam and Cambodia. Korea and Taiwan joined production networks in the early 1990s following almost two decades of rapid export growth based on liberalization in traditional labor-intensive products, but this sequence had much to do with the nature of the foreign investment regimes of the two countries and perhaps also international political conditions during the early post-war period (see Note 7).

Geographic distance is a proxy measure of transport (shipping) costs and other costs associated with time lags in transportation such as spoilage. Technological advances during the post-war era have contributed to the "death of distance" when it comes to international communication costs. However, there is evidence that geographical distance is still a key factor in determining international transport costs, in particular shipping costs (Evans and Harrigan 2005; Hummels 2007). Transport cost could be a much more important influence on vertical trade than on final trade, because of multiple border-crossings involved in the value-added chain.

The real exchange rate (*RER*) is included to capture the impact of the overall macroeconomic climate on international competitiveness of tradable goods production. *LPI* and *INS* are included to captures the cost of "service links" involved in connecting production blocks within global production networks: *LPI* measures the quality of trade-related logistic provisions, and *INS* captures various aspects of governance that directly affect property rights, political instability, policy continuity and other factors which have a bearing on the ability to carry out business transactions. Adjacency (*ADJ*) and common business language can facilitate trade by reducing transaction cost and through better understanding of each other's culture and legal systems.

The free trade agreement dummy variable (*FTA*) is included in the model to capture the impact of tariff concessions offered under these agreements. All countries covered in our data set are members of one or more FTAs. In theory, network trade is considered to be relatively more sensitive to tariff changes (under an FTA or otherwise) compared to conventional horizontal trade (Yi 2003). Normally a tariff is incurred each time a good in process crosses a border. Consequently, with a one percentage point reduction in tariff, the cost of production of vertically-integrated goods declines by a multiple of this initial reduction. Moreover, a tariff reduction may make it more profitable for goods previously produced in their entirety in one country to now become vertically fragmented. Consequently, the trade-stimulating effect of an FTA would be higher for network trade than for normal trade, other things remaining unchanged. However, in reality, the trade effect of any FTA would depend very much on the nature of the rules of origin (ROOs) built into it. The trade-distorting effects of ROOs are presumably more detrimental to network trade than to conventional final goods trade, because of the inherent difficulties involved in delineating the product for duty exemption and because of the transaction costs associated with the bureaucratic supervision of the amount of value-added in production coming from various sources (Krishna 2006). Formulating ROOs for network related trade is a rather complicated business. The conventional value-added criterion is virtually not applicable to this trade because the products involved are low-value-added by their very nature. The only viable option is to pursue the so called change-in-tariff-lines-based ROOs, but this leads to insurmountable administrative problems because trade in electrical and electronics goods, and their related components, belong to the same tariff codes at the HS-6 digit level, which is the normal base for designing these type of ROOs. Moreover, the process of global production sharing is characterized by the continuous emergence of new products. Given the obvious administrative problems involved in revising ROOs in tandem, the emergence of new products naturally opens up room for unnecessary administrative delays and the tweaking of rules as a means of disguised protection.

Among the other variables, the two country dummy variables, *DIND* and *DODV*, are included (by treating the East Asian countries as the base dummy) to capture the impact of various other factors not captured by the other explanatory variables on export performance of India and the other developing countries, respectively. Finally, *DAFC* and *DGFC* are included to control for trade disruptions during the East Asian financial crisis and the recent global financial crisis.

The export equation is estimated using annual data compiled from exporter records in the UN trade data system[35] during the period 1996–2009. Even though the prime focus of our analysis is on network trade, disaggregated into parts and components and final assembly, we estimate the model for total manufacturing trade as well for the purpose of comparison. Our data set covers the export trade of 20 developing countries with 45 partner countries (including the 20 countries). All countries that accounted for 0.01% or more of total world manufacturing exports in 2004–05 are included in the country list. The trade data in nominal US$ are converted into real terms using US trade price indices extracted from the US Bureau of Labor Statistics database. Data on real *GDP* and per capita *GDP* are extracted from the World Bank *World Development Indicators* database. Data on *LPI* is taken from the *Logistics Performance Index* database of the World Bank (Arvis et al. 2007). This index is based on a worldwide survey of global freight forwarders and express carriers complemented by a number of qualitative and quantitative indicators of the domestic logistics environment, institutions, and performance of supply chains. Logistic quality of the individual countries covered are assessed on a "1-to-5 scale" (1 for the worst performance and 5 for the best) focusing on seven areas of performance: (a) efficiency of the clearance process by customs and other border agencies; (b) quality of transport and information technology infrastructure; (c) ease and affordability of arranging international shipments; (d) competence of the local logistics industry; (e) ability to track and trace international their shipments; (f) domestic logistic costs; and (g) timeliness of shipments in reaching their destination.

Institutional quality (*INS*) is measured by the International Country Risk Guide (ICRG) index compiled by the Political Risk Services Group, which is the most widely used variable to measure the quality of governance in the empirical growth and trade literature. It measures the ability of governments to carry out their declared programs and legislative strength.[36] The indicator runs on a seven point scale from 0–6, with higher values representing less corruption (or a higher control over corruption). The data on bilateral distance comes from the trade patterns database of the French Institute for Research on the International Economy (CEPII). The CEPII distance measure is a composite measure of the bilateral great-circle distance between

35. United Nations Statistical Office, Commodity Trade Statistics (Comtrade) Database. http://comtrade.un.org/db/ (accessed in January–March 2013).

36. In experimental runs we used three other alternative indicators of institutional quality (governance), (rule of law, government effectiveness, control of corruption) from the World Bank's World Governance Indicators database. The results were comparable in the standard OLS estimation. However, we were not able to use these indicators in FE and HT estimations because of data gaps.

major cities of each economy compiled by taking into account the trading significance of each city in each economy. For a complete listing of variables and data sources see Appendix B.

Of the three standard panel data estimation methods (pooled OLS, random-effects, and fixed-effects estimators), the fixed effect estimator is not appropriate in this case because the model contains a number of time-invariant explanatory variables which are central to our analysis. In experimental runs, we used both pooled OLS and random-effects (RE) estimators. The Breusch Pagan Lagrange multiplier test favored the use of the random effects estimator (REE) over the OLS counterpart. However the simple RE estimators can yield biased and inconsistent coefficient estimates if one or more explanatory variables are endogenous (that is, if they are jointly determined with the dependent variable). In our case, there are reasons to suspect that FTA and reporting country GDP are potentially endogenous for a number of reasons (Baier and Bergstrand 2007; Brun et al. 2005). The endogeneity problem is particularly important in estimating the impact of FTA on bilateral trade flows because the trade agreements are normally signed between countries that already have achieved certain levels of bilateral trade. Unobserved characteristics of some country pairs that may facilitate FTAs, such as political links and security concerns, can also result in the correlation of FTA dummies with the error term. There can also be reverse causation running from trade to GDP, even though the potential endogeneity problem may not be as important as in the case of the FTA variable in the context of a cross-country gravity model. Given these concerns, we reestimated the model by the instrumental variable estimator proposed by Hausman and Tayler (1981) (henceforth HTE estimator). The HTE addresses the endogeneity problem in cross-section gravity models by using instruments derived exclusively from inside the model to capture various dimensions of the data. Its superiority over REE in generating consistent coefficient estimates of the gravity model has been demonstrated by a number of recent studies.[37]

The preferred HTE estimates for exports of network products and total manufacturing are reported in Table 8. Note that we have deleted the dummy variables for common language (COML), common land border (ADJ) and colonial links (CLK) for the final estimates because these three variables turned out to be statistically insignificant in experimental runs in all cases. In order to examine whether there are differences between parts and components (P&C) and final assembly in relation to the postulated impact of the

37. See Egger (2005) and Serlenga and Shin (2007), and the works cited therein.

explanatory variables, we estimated the equation for total network products with an intercept dummy variable for P&C and its interaction with all other determinants (slope dummies). This approach is equivalent to estimating two separate regressions for the two categories but has the added advantage of providing a direct test of the statistical significance of the differences between the estimated coefficients. In all regression runs, the logistic performance index (LPI) variable turned out to be statistically insignificant in the full models, for both network products and total manufacturing, because of its high correlation with the exporter's per capita GDP (PGDP-exporter). We have therefore reported two equations, with and without PGDP-exporter, given the importance of LPI for our analysis.

In the final equation for network products we have retained only the statistically significant dummy interaction terms of P&C.[38] Only three interaction variables (*P&C*logPGDPimporter*, *P&C*logRER* and *P&C*FTA*) turned out to be statistically significant, and the magnitude of the regression coefficients are very small. The results therefore suggest that there is no notable difference between exports of P&C and final assembly in terms of the relevant determinants.

The coefficients of the two standard gravity variables (GDP and DST) in all equations, and those of most of the other variables statistically significant with the expected signs. The magnitude of the coefficient of the distance variables (about 1.5) is consistent with results of previous gravity model applications to modeling trade flows (Bergeijk and Brakman 2010).

To comment specifically on the evidence directly relevant for this paper, the hypothesis that the level of development, measured by per capita GDP relevant for explaining network trade is strongly supported by the results. The elasticity of network exports to per capita GDP of the exporter and the partner is 0.39 and 0.36, respectively (Equation 1.1). The comparable figures for total manufacturing exports (0.21 and 0.17) are much smaller in magnitude and the differences are statistically significant.[39] Interestingly, the coefficient of LPI is statistically insignificant (albeit with the expected positive sign) in both cases, supporting our hypothesis that the stage of development (measured by per capita GDP) is a good surrogate variable for the quality of trade related logistics. The coefficient of LPI becomes highly significant for network products when the equation is estimated after

38. The deletion of the other dummy variables was supported by the standard F test for joint significance.

39. In this section we simply infer statistical significance of the difference between two coefficients by testing whether the difference is within ("insignificant") or beyond ("significant") two standard-error bands from each coefficient.

TABLE 8. Determinants of Bilateral Trade Flows (1996–2009)

	Network products		*Total manufacturing*	
Variable	*Equation 1.1*	*Equation 1.2*	*Equation 2.1*	*Equation 2.2*
	(3)	*(4)*	*(1)*	*(2)*
Log GDP exporter	1.25***	1.56***	1.31***	1.41***
	(7.80)	(19.87)	(13.08)	(22.05)
Log GDP importer	1.14***	1.72***	1.50***	1.70***
	(5.70)	(16.96)	(13.49)	(24.29)
Log PGDP exporter	0.39***		0.21***	
	(4.21)		(2.78)	
Log PGDP importer	0.36*	0.33***	0.17*	0.14*
	(5.71)	(5.32)	(1.95)	(1.87)
Log DST	−1.55***	−1.42***	−1.57***	−1.54***
	(−6.02)	(−10.68)	(−11.90)	(−15.67)
Log RER	0.40***	0.38***	0.28***	0.27***
	(10.29)	(9.66)	(10.21)	(9.83)
Log INS	0.36***	0.40***	0.33***	0.35***
	(5.71)	(6.27)	(7.88)	(8.38)
FTA	0.16***	0.18***	0.11***	0.11***
	(2.88)	(2.84)	(2.80)	(2.84)
LPI	0.11	0.40***	0.03	0.19*
	(0.36)	(2.89)	(0.26)	(1.86)
AFC	−0.06	−0.27**	0.18**	0.10*
	(0.68)	(3.74)	(3.23)	(21.98)
GFC	−0.26***	−0.34***	−0.23***	−0.25***
	(−5.93)	(−7.59)	(−7.13)	(−7.58)
IND	−1.76***	−3.34***	−1.37***	−1.87***
	(−2.82)	(−8.11)	(−2.82)	(−5.83)
ODV	−1.54***	−2.96***	−1.34***	−1.65***
	(−3.78)	(−7.42)	(−3.78)	(−7.42)
P&C* log PGDP-importer		0.02***		
		(7.85)		
P&C* log RER	−0.05***	−0.05***		
	(−4.97)	(−4.56)		
P&C *FTA	−0.06***	−0.06***		
	(3.86)	(3.66)		
Constant	−23.05***	−23.05***	−43.93***	−30.65***
	(−7.45)	(−7.45)	(−13.00)	(−16.45)
F statistic	38.62	38.62	73.24	49.31
Observations	10417	10417	11862	11881
Number of pairs	911	911	922	911

Source: Own estimations based on data sources detailed in the text.

Notes: T-ratios are given in brackets with statistical significance of regression coefficients denoted as *** 1%, ** 5%, and *10%. The t-ratios are based on standard errors computed from the robust covariance matrix that allows for clustering as well as heteroskedasticity. Time dummies are included in all regressions but are not reported here.

deleting the exporting country per capita GDP variable (Equation 1.2). The result suggests that a one notch upward movement in the LPI quality ladder is associated with 0.4% increase in total network exports. The coefficient of LPI in the equation for total manufacturing exports is much smaller (0.19) and is significant only at the 10% level. Thus the results point to the importance of the quality of service link cost in determining a country's attraction as a location within global production network.

The results for the real exchange rate RER variable suggest that network trade is relatively more sensitive to the international competitiveness of traded goods production in a given country: RER elasticity of network exports is 0.40 compared to 0.28 for total manufacturing and the difference is statistically significant. The coefficient of the FTA variable is statistically significant in all four equations but larger in magnitude for network products (0.16 compared to 0.12 for total manufacturing). This result is consistent with the fact that tariffs on final electrical and transport equipment still remain high in most countries (WTO 2011). The coefficient of the FTA variable for parts and components is smaller (0.12) compared to that for final assembly (0.18). This is consistent with the fact that almost all Asian countries permit duty-free entry of parts and components as part of their export promotion policy package. Also most countries covered in our dataset have significantly liberalized trade in information technology products as part of their commitments under the WTO Information Technology Agreement which came into effect in 1996 (Menon 2013).

Finally, the coefficient of the India dummy variable (DIND) is highly significant with a negative sign in all equations. The estimated coefficient for network exports suggests that after controlling for the other explanatory variables, the level of network exports from India is only one-fifth of the average level of the East Asian countries. There is, however, no notable difference between India and the other developing countries relative to the East Asian countries.

There can be many country-specific idiosyncratic effects that lie behind the India–East Asia difference. But one particularly important difference is that as first comers in this area of international specialization, East Asian countries offer considerable agglomeration advantages for companies that are already located there. The site selection decisions of MNEs operating in assembly activities are strongly influenced by the presence of other key market players in a given country or neighboring countries. Against the backdrop of a long period of successful operation in the region, many MNEs, particularly the US-based ones, have significantly upgraded the technical activities of their regional production networks in Southeast Asia and assigned global production responsibilities to affiliates located in Singapore and more recently also to those located in Malaysia and Thailand. All in all, the results seems to support the view that MNE affiliates have a tendency 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 (Rangan and Lawrence 1999).

6. Conclusions and Policy Implications

Global production sharing has become an integral part of the global economic landscape. Trade within global production networks has been expanding more rapidly than conventional final-goods trade. The degree of dependence on this new form of international specialization is proportionately larger in the high-performing East Asian countries compared to the other developing countries. India still remains a minor player in global production sharing, notwithstanding its geographical proximity to the dynamic East Asian economies. India's export performance during the reform era has been dominated by resource-intensive products (SITC 6) and the standard labor-intensive products (SITC 8). So far there are no clear signs of India entering into global and regional production networks in electronics and electrical goods, which have been the prime mover of export dynamism in the successful export-oriented economies in East Asia. Of course, India still has a vast untapped potential for expanding traditional labor-intensive manufactured goods, but these goods account for a much smaller and diminishing share in world manufacturing trade compared to trade in parts and components and final assembly within global production networks.

The findings of this study give credence to the case made in a number of influential studies for further reforms to improve India's export performance (e.g., Bhagwati and Panagariya 2013; Joshi 2008; Krueger 2010; Panagariya 2004, 2008, 2013; Srinivasan 2012). Relative to the first four decades following independence, India's policy reforms since 1991 have certainly achieved a great deal in unshackling the economy and integrated it into the world economy. However, as extensively discussed in this literature there are still many unresolved problems relating to the overall investment climate, in general and the anti-export bias in the policy regime, in particular. There is also a significant unfinished agenda of behind-the-border reforms. Regulations impacting on private sector activities have become less onerous since the start of the reforms, but there are various sector-specific regulations in abundance. While the the License Raj (the infamous industrial licensing policy) has been largely eliminated at the center, it still survives at the state level along with a pervasive Inspector Raj. Despite recent reforms, India's foreign investment regime still reflects the tension between the traditional aversion to foreign investment and the current recognition of its importance to economic development. Private investors, both foreign and local, require a large number of permissions (for example, electricity and water supply connections, water supply clearance and so on) from state governments to start business and they also have to interact with the state bureaucracy in the course of day-to-day business. Stringent labor laws and restrictive labor market practices are among other prominent issues. These issues are reflected in India's poor ranking among the countries in the region, in particular the dynamic export-oriented economies in East Asia, in terms of various indicators of ease of doing business.[40] Moreover, so far India has not been successful in using SEZs as an effective vehicle for providing foreign investors with a suitable investment climate that is insulated from the remaining distortions in the rest of the economy. Smooth functioning of the India SEZs has also been constrained by the controversial issue of land acquisition and unresolved issues relating to the relaxation of labor laws for the SEZ firms.

As discussed in Section 2 and supported by the findings of the empirical analysis in the rest of the paper, completing this unfinished reform agenda is even more important for linking India into global production networks than for the expansion of the standard labor-intensive products and other conventional exports. The relative importance attached by firms to service-link costs compared to labor cost is much more important in this new form of international exchange. This means that the economic base of the host country is the ultimate draw for investors in this area: just offering incentives for investors cannot compensate for the lack of such a base. International vertical integration of manufacturing naturally increases the risks associated with supply delays and disruptions in a given location within the production network, because it can bring the operation of the entire production network to a halt. In the current business climate in India such disruptions could take many forms, including shipping delays, strikes, power outage or political disturbances.

40. India's global ranking on various indicators has been extensively documented. For a recent comparison, including comprehensive coverage of the relevant studies, see Hoda and Rai (2013).

Is there a case for proactive policies to attract FDI, in addition to improving the economic base through further reforms in order to effectively link Indian manufacturing to global production networks? As discussed (Section 2), over time global production sharing has expanded well beyond the confines of intra-firm activities of MNEs, but there is compelling evidence that MNEs are still the leading vehicle for developing countries to enter global production networks. There are also compelling economic reasons which support the argument that countries may not be able to attract the volume of FDI that their economic base merits without active investment promotion (Wells and Wint 2000). Despite their size and global reach, MNEs do not always have perfect information on potential sites: "Most companies consider only a small range of potential investment locations [and] many other countries are not even on their map" (Wells and Wint 2000). Given this "market failure in information," the decision making process relating to site selection can be subjective and biased. Moreover, as an increased number of countries embrace liberalization reforms, there is tense competition in the market for investment sites: many potential host countries compete for attracting big players in global industries to their countries. Therefore, it may be worthwhile for a country to invest in altering the perceptions of potential investors by improving its image, and not taking economic fundamentals as given.

It is important to emphasize that investment promotion is not the same as giving subsidies or financial incentives, although incentives can play a role at the margin when investors choose among alternative locations with similar economic fundamentals required for the long term viability of their operations. The focus of the investment promotion campaign can be general (aimed at home countries with potential investors), industry specific (investors in industries in which the host country has an actual or potential competitive edge), or investor specific. Effective investment promotion should go beyond simply marketing the country and also focus on facilitating and coordinating the perquisites for setting up operations and effective functioning when the MNEs decide to set up production plants. This involves addressing potential failures in markets and institutions for skills, technical services or infrastructure in relation to the specific needs of targeted investors.

The experiences of Ireland (Ruwane and Gorg 2001), Singapore (Wong 2007), Costa Rica (MIGA 2006; Rodriguez-Clare 2001), Penang (Athukorala 2014), and more recently of Vietnam (Altman 2007; Athukorala and Tien 2012) suggest that well-focused investment promotion can be very effective in attracting FDI in line with the country's development priorities. Investment promotion in Ireland, Singapore, and Penang was primarily industry specific, targeting electronics and the related supporting industries. Costa Rica provides an example of targeting a specific MNE (Intel). Vietnam's approach is much more broad-based, but in recent years it has been successful in attracting two large players in the electronics industry (Intel and Samsung) through targeted promotion. In all these countries, investment promotion has gone well beyond the initial marketing stage, to facilitating the operation of the newly established foreign ventures. For instance, in Costa Rica and Vietnam the governments' commitment to invest in training to meet the future skill needs of its local operations was a major factor considered by Intel in its site selection decision. In Singapore, the government went even further and involved MNE managers in designing training and infrastructure programs. The state government of Penang joined hands with MNEs in setting up the Penang Skill Development Centre to train middle-level technicians, which is now hailed the world over as a successful case of public-sector-MNE collaboration in human capital development. The state government of Penang also adopted an innovative approach of involving managers of MNE affiliates, operating in the state, in its investment promotion campaigns in the respective home countries. The experiences of these countries also show that, in global industries like electronics and electrical goods, initial success in attracting a big player/players to set up operations in a country breeds success because in these industries there is something akin to herd mentality in the site selection process of MNEs.

The remarkable success of the Indian software industry, a highly visible symbol of India's emergence in the world economy, is perhaps illustrative of India's growth potential through production sharing spurred by reforms (Desai 2002; Krueger 2010). The software industry is unique in India in that restrictions on MNE entry have been virtually abolished. Now virtually every major global company in the software industry has a base in India and the entry of MNEs has opened up opportunities for Indian companies to thrive through functional specialization, and to develop niche products and services for large clients abroad. Liberalization of FDI has also been accompanied by the removal of quantitative restrictions on imports of computers and peripherals, and drastic cuts in import tariffs on these products and significant telecommunication reforms. In addition to these reforms, which laid the foundations that made the domestic software industry internationally competitive, there are other product-specific features which make the software industry immune to the trade-retarding effects of the investment climate. For instance, the fact that IT was not heavily dependent on Indian infrastructure (being able to transmit services via satellites) certainly gave

IT firms an advantage over manufacturers who might otherwise have had to depend on roads and ports to export their goods. Regulations surrounding the employment of labor were largely not binding because the labor needs of the IT sector consisted largely of skilled workers. As it was a start-up industry, most of the behind-the-border controls and regulations affecting firms in other industries were not a binding constraint for IT firms (Krueger 2010). Finally, the powerful Indian diaspora in the global software Industry (the so-called IIT mafia) played a vital role in "selling the country… [by]… leveraging its own strength with India's comparative advantage" (Kapur 2010: 262).[41]

Appendix

(A) Trade Data Compilation

The data used in this section for all countries other than Taiwan are compiled from the United Nation's Comtrade Database[42], based on Revision 3 of the Standard International Trade Classification (SITC Rev. 3). Data for Taiwan are obtained from the trade database (based on the same classification system) of the Council for Economic Planning and Development, Taipei. (the UN trade data reporting system, Comtrade database).

Parts and components are delineated from the reported trade data using a list compiled by mapping parts and components in the UN Broad Economic Classification (BEC) with the Harmonized System (HS) of trade classification at the 6-digit level. The product list of the WTO Information Technology Agreement Information, gathered from firm-level surveys conducted in Thailand and Malaysia were used to fill gaps in the BEC list of parts and components. Data compiled at the HS 6-digit level were converted to the SITC (based on the SITC Revision 3) for the final analysis using the UN HS-SITC concordance.[43] It is important to note that parts and components, as defined here, are only a subset of the "intermediate goods", even though the two terms have been widely used interchangeably in the recent literature on global production sharing. Parts and components, are

41. The "diaspora effect" has not materialized in other industries perhaps because of the absence of favorable domestic policies: "The well-known infrastructural and policy weaknesses in manufacturing have steered the diaspora's role in IT more towards the software side, rather than developing the hardware sector" (Kapur 2010: 262).

42. http://comtrade.un.org/db/ (accessed in January–March 2013).

43. For details on the method of classification and the list of parts and components see Athukorala (2010).

inputs further along the production chain. Parts and components, unlike the standard intermediate inputs, such as iron and steel, industrial chemicals and coal, are "relationship-specific" intermediate inputs; in most cases they do not have reference prices, and are not sold on exchanges, and are more demanding on the contractual environment (Nunn 2007). Most (if not all) parts and components do not have a "commercial life" their own, unless they get embodied in a final product.

There is no hard and fast rule applicable to distinguishing between parts/components and assembled products in international trade data. The only practical way of doing this is to focus on the specific product categories in which network trade is heavily concentrated (Krugman 2008). Once these product categories have been identified, assembly trade can be approximately estimated as the difference between parts and components—directly identified based on our list—and recorded trade in these product categories.

Guided by the available literature on production sharing, we identified seven product categories: office machines and automatic data processing machines (SITC 75), telecommunication and sound recording equipment (SITC 76), electrical machinery (SITC 77), road vehicles (SITC 78), professional and scientific equipment (SITC 87), and photographic apparatus (SITC 88). It is quite reasonable to assume that these product categories contain virtually no products produced from start to finish in a given country. However, admittedly the estimates based on this list do not provide full coverage of final assembly in world trade. For instance, the outsourcing of final assembly does take place in various miscellaneous product categories such as clothing, furniture, sporting goods, and leather products. It is not possible to meaningfully delineate parts and components and assembled goods in reported trade in these product categories because they contain a significant (yet unknown) share of horizontal trade. Likewise, assembly activities in software trade have recorded impressive expansion in recent years, but these are lumped together in the UN data system with "special transactions" under SITC 9. However, the magnitude of the bias resulting from the failure to cover these items is unlikely to be substantial because network trade in final assembly is heavily concentrated in the product categories covered in our decomposition (Yeats 2001; Krugman 2008).

Although SITC Rev 3 was introduced in the mid-1980s, a closer examination of country-level data shows that data recording systems in many countries have considerable gaps in the coverage of parts and component trade until about 1990. Therefore, we use 1992 as the starting year of data disaggregation for the inter-country comparison of trade based on global production sharing.

(B) Variables Used in Estimating the Export Equation: Definitions and Data Sources

Label	*Definition*	*Data Source/variable construction*
TRD	Value of bilateral trade (imports and exports) in US$ measured at constant (2000) price.	Exports (at CIF price, US$): compiled from importer records of UN-COMTRADE, online database (http://comtrade.un.org/db/ (accessed in January-March 2013) Exports and import values are deflated by US import and export price indices extracted from the US Bureau of labor Statistics database (http://www.bls.gov/ppi/home.htm).
GDP	Real GDP (at 2000 price)	World Development Indicator, The World Bank
DST	Weighted distance measure of the French Institute for Research on the International Economy (CEPII), which measures the bilateral great-circle distance between major cities of each country	French Institute for Research on the International Economy (CEPII) database
RER	Real exchange rate: $RER_{ij} = NER_{ij} * \frac{P_j^D}{P_i^W}$ where, NER is the nominal bilateral exchange rate index (value of country *j*'s currency in terms of country *i*'s currency) currency), PW in price level of country *j* measured by the producer price index and PD is the domestic price index of country *i* measured by the GDP deflator. An increase (decrease) in RER_{ij} indicates improvement (a deterioration) in country's international competitiveness relative to country *j*.	Constructed using data from World Bank, World development Indicators database. The mean-adjusted RER is used in the model. This variable specification assumes that countries are in exchange rate equilibrium at the mean.
LPI	World Bank logistic performance index The original index (1: worst to 6: best scale) converted "1 to 100".	LPI database, World Bank (Arvis et al. 2007)
INS	Institutional (governance) quality ("1:worst to 100: best" scale)	International country risk index RPS Group (http://www.prsgroup.com)
RTA	A binary dummy variable which is unity if both country *i* and country *j* are signatories to a given regional trading agreement (RTA)	CEPII database
COML	A dummy variable which is unity if country *i* and country *j* have a common language and zero otherwise.	CEPII database
ADJ	A binary dummy variable which is unity if country *i* and country *j* share a common land border and zero otherwise	CEPII database

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Comments and Discussion

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Professor Prema-chandra's paper offers a mix of analytical approaches including historical, anecdotal, and descriptive accounts, along with regression based evidence to examine India's experience with global production networks.

The foundation of his argument is that India's export performance has been fairly disappointing, particularly in "network industries" where "global production sharing" is important. While road vehicles have been an exception to India's disappointing export performance, this likely reflects the large domestic market rather than particular strength in this industry. The paper concludes that logistics and institutions appear to matter particularly for network productions. Second, India's poor performance is not fully explained by the variables examined in the paper. Finally, the idea that managerial talent and a middle class workforce are particularly important in these network industries is also suggested. Because India has a reputation for being rich in talent, specifically in engineering and middle level managerial talent, this is a somewhat incongruous result.

For the regression based evidence, I would have liked to pool the samples and constrain some coefficients to be equal providing for a simpler comparison of coefficients. Similarly, I would have liked a much greater discussion on the standard errors given the panel nature of the data with no significant time variation. Finally, I'm not entirely sure that the politics variable from International Country Risk Guide (ICRG) is well suited to this purpose. It is a well-known variable, but it is not clear why it is used here. Variables for intra-firm trade and issues in intellectual property protection would be interesting to use given the emphasis on contractibility.

The paper places a great deal of emphasis on certain manufacturing sectors. In fact, this is really a paper about a few Standard International Trade Classification (SITC) codes, but it remains unclear why these specific codes were chosen over others. Similarly, the distinction between parts and assembly was ambiguous. Assemblies appear to be residuals, meaning they are the sum of parts and components subtracted from the total, however the way in which assemblies are calculated was not clear. At the heart of the paper lies the issue of what "global production sharing" actually refers to. There are several possibilities. The narrowest way to read this paper is that it is about a subset of manufacturing trade. It is about what is going on with these four SITC codes. If this is the correct reading, the reason for choosing these codes should be elaborated further. Alternatively, this paper could be about trade in intermediate goods, in which case a different data source would be more convincing. Finally, this paper may also be about off-shoring and intra-firm trade. Multinationals, in the language of this argument, are the sine qua non for network trade. In this case the paper is really about multinationals, and more attention needs to be paid to intra-firm trade. In particular, there are databases on intra-firm trade for the United States, for Germany, that are very good for this type of issue, and might be more interesting than bilateral trade data.

Another possible focus could be foreign direct investment. Exploring the distinction between horizontal and vertical arrangements and between offshoring and outsourcing would be critical. As one example, Apple's manufacturing is happening at arm's length, or quasi arm's length, through Foxconn. The paper should be clear about the differences between these types of FDI arrangements, and which one it is really focused on. The paper's policy discussion might also expand toward, for example, ownership restrictions. If one is considering FDI decisions and breaking up the production process, then being forced to share ownership is quite important.

Finally, the process of global fragmentation has taken on new levels of sophistication which creates new imperatives for India's policy-makers. Specifically, firms have become adept at splintering their headquarters, which used to be immutable and stationary in one country. Corporations are dividing their financial home, legal home and home for managerial talent across jurisdictions. As one example, one might think of Samsonite as an American company. But, it is listed in Hong Kong. Its legal home is in the Caribbean, and its managerial talent sits in Massachusetts. This shift has taken place in a number of different companies. This is the new domain of competition for jurisdictions. Additionally, these production and headquarter decisions cannot be understood without paying attention to tax incentives. The policy debate in developed countries is largely about tax incentives for mobile income associated with R&D and patents. The location of intellectual property gives rise to significant production locational decisions as well. In Apple's case, a large part of Apple's IP is located in Ireland for tax reasons and this complicates the possibility of locating production facilities in America. In short, tax incentives are altering intellectual property decisions that in turn dictate production decisions.

Rajesh Chadha
NCAER

The paper makes an important contribution to the understanding of India's participation in global production sharing in the manufacturing sectors. While India has played a significant role in sharing global software services, its performance has been unimpressive with regards to manufactured products.

Many input–output technique-based studies measure the degree of dependence of manufacturing production and trade of selected countries on global production sharing using trade flows between MNEs and their foreign affiliates. These studies point to the growing importance of production sharing in world trade and the increasing cross-border interdependencies in the world economy.

The paper provides rich information on network trade. It points out that India lags significantly behind as far as processing and assembly activities are concerned. India's composition of network exports is biased heavily in favor of road vehicles and other transport equipment, accounting for more than 48 % of its total network exports. The corresponding number is 14 % for East Asia and only 11.5 % for China. In contrast, the shares of India's network exports are extremely low for office machines and automatic data processing machines, telecommunication and sound recording equipment and semiconductors. The corresponding values are much higher for China and East Asia on the whole.

The author has argued that the concentration of India's network exports in favor of road vehicles and auto components may be due to very high customs duty on passenger cars as compared with auto parts, thus giving exceedingly high effective protection to road vehicles. This phenomenon has possibly driven automotive MNEs to set up production plants in India to produce for the global market, not just for the Indian market.

On the contrary, India's global production networking is abysmally insignificant in electronics, electrical goods and related products. While a number of large MNEs, including Nokia, Samsung and LG, have set up production bases in India, these are predominantly involved in production for the domestic market and not for exports. The Special Economic Zones, which had played an important role in East Asia's network exports, have not been helpful for India despite the enactment of the SEZ Act of 2005. The only East Asian country which compares with India's failure of developing its network trade in electronics is Indonesia. The labor market rigidities in Indonesia have been cited to be the major cause of the presence of failing MNEs there.

One of my major comments relates to the author's observation on the rapidly growing intermediate or parts and components trade versus the overall manufacturing trade of the finished goods. This is somewhat puzzling because when we talk of parts and components, I do understand that they switch between countries multiple number of times. So when we say that the trade in parts and components has grown by say, 30 % versus the final goods trade growing by 10 %, I do not know how to discount the multiple crisscrossing through countries' borders. So the growth pattern of final assembly or final goods versus the multiple entry of intermediates raises question of data classification of intermediate versus final goods. A good may be "final" for a manufacturing firm in an "exporting country" but the same may be "intermediate" for a manufacturing firm in the "importing country".

Further, comparing export data of, say Hong Kong, with that of, say Malaysia or India, is likely to have some oddity. The distinction between the shares of entrepot trade of a country vis-à-vis its network trade may not be easy.

The issue of network trade is not something new. It has always been there, albeit in smaller proportion. This phenomenon is based mainly on shifting/dynamic forces of Ricardian comparative advantage. A Japanese economist Akamatsu had written about this issue way back in the 1930s and had named it as the "flying geese investment". It is inverted, "V" shaped formation. When a particular sector becomes "sunset" in one country it may be "sunrise" in another country. The relative wage rate advantage in a developing country attracts assembly operations to it from a developed economy. The developed economy may continue to provide the specialized parts and components from its own production facilities or set up such production facilities in some other developing countries.

The share of network trade in India's exports has been low because of the absence of enthusiastic MNEs and FDI which have shied away because of the issues of labor law rigidities, land acquisition, inspector-raj, availability of infrastructure, governance, etc. In fact, these factors have not only discouraged FDI and investment by MNEs but have had equally debilitating effect on domestic investment in manufacturing sectors particularly the unskilled/semi-skilled labor-intensive sectors. The share of manufacturing has been stagnant around 17 % ever since economic reforms were initiated in 1991.

Finally, I would like to draw the author's attention to the new *Made in the World* initiative taken by WTO (http://www.wto.org/english/res_e/statis_e/miwi_e/miwi_e.htm).

> Today, companies divide their operations across the world, from the design of the product and manufacturing of components to assembly and marketing, creating international production chains. More and more products are "Made in the World" rather than "Made in the UK" or "Made in France". The statistical bias created by attributing the full commercial value to the last country of origin can pervert the political debate on the origin of the imbalances and lead to misguided, and hence counter-productive, decisions. The challenge is to find the right statistical bridges between the different statistical frameworks and national accounting systems to ensure that international interactions resulting from globalization are properly reflected and to facilitate cross border dialogue between national decision makers.

New databases are required to undertake more sophisticated studies on global production sharing, network and processing trade. One such initiative has been taken by the European Commission by preparing the *World Input–Output Database* (http://www.wiod.org/new_site/home.htm).

> Production processes increasingly fragment across borders. This fundamentally alters the nature of international trade with deep consequences for the location of production. The World Input–Output Database (WIOD) is the first public database that contains new information on these trends and provides the opportunity to analyse the consequences of fragmentation, for example for shifting patterns in demand for skills in labour markets, or for local emissions of air pollutants. WIOD provides time-series of world input–output tables for forty countries worldwide and a model for the rest-of-the-world, covering the period from 1995 to 2011. These tables have been constructed in a clear conceptual framework on the basis of officially published input–output tables in conjunction with national accounts and international trade statistics. In addition, WIOD provides data on labour and capital inputs and pollution indicators at the industry level that can be used in conjunction enlarging the scope of possible applications.

A very useful paper that may also be referred to is: http://www.wiod.org/publications/papers/wiod10.pdf.

General Discussion

Rohini Somanathan expressed surprise at India being more successful in high value-added products such as automobiles. She enquired about the importance of the price of land as well as the domestic market. It is said that there is a big domestic market for automobiles and that also helps exports. But it seems that when Ford initially set up its plant in Chennai, it exported more than it sold in the Indian market.

Following up on the comments by Mihir Desai, T.N. Srinivasan said that it was not clear why there is focus on a particular component of trade—in this case what is being termed network trade—unless it is associated with some externalities that otherwise would not be realized. If we view the policy problem as creating an environment in which the decisions taken by all who are participating in the production, consumption and trade enable their transactions costs to be minimized that is one thing. There you do not focus on any one set of products but on creating a broad favorable environment for trade.

Srinivasan further said that if the intra-firm trade is at the heart of this trade, the aggregate country level data which the paper is using for the analysis is not the right one and firm level data is what would be required.

Rajnish Mehra said that taxation may be crucial to this trade, especially the intra-firm component. So if you look at R&D, which is expensed rather than depreciated, you find these being concentrated where you have the highest marginal tax rates. So a lot of these decisions are tax-based decisions. Luxembourg has almost zero manufacturing but has the headquarters of so many firms, and that is just a tax arbitrage within the EU. Supposing you brought goods into Germany you would pay the VAT, export the goods, and collect the VAT back. In contrast, Luxembourg has tax free zones near the airport where essentially you park your goods, you pay no VAT and you ship them out. These are things of first order importance, especially for US firms, which want to make sure that tax liability is kept as low as possible.

In his response, Prema-chandra Athukorala opened by stating that he would pick up points that are more interesting and relevant. The flying geese phenomenon to which Rajesh Chadha pointed is entirely different from production sharing. In the former, you start with labor-intensive products and, when the wages increase, you move on to more capital-intensive production. Here we are talking about specialization within a product. Perhaps the paper needs to provide a little bit historical material.

Turning to Mihir's comments, Athukorala said that he would address them when revising the paper. Regarding Srinivasan's comment on intra-firm trade, he opined that it was only part of the full story as most of the fragmentation trade initially occurred within multinationals. Then, there are these new firms called contract manufacturers like Foxconn, which emerged because most of the components eventually become modular products. They can be used in many products. Also, companies like Foxconn assemble for many other firms. Therefore, if you simply focus on intra-firm trade you are going to miss a huge chunk of the story.

Athukorala agreed that firm level data is ideal but said that their access is largely limited. There are a number of papers on intra-firm trade within production networks, including one by Slot and others in the *Review of Economics and Statistics*.

Athukorala also said that the distinction between standard intermediate goods and parts and components is very important. Parts and components trade is relation-specific, unlike other intermediate goods. Therefore, even though people use both terms interchangeably, the former are a particular type of intermediate goods. Ronald Jones terms this intra-process trade which is different from trade in standard intermediate goods.

Regarding the externality point raised by Srinivasan , Athukorala argued that there are lot of sources of externalities from trade in network products. This has been the most rapidly growing segment of manufacturing trade and once you are there, you have many more opportunities. Ten years ago, we did not know a product called iPod. They have been the outcome of global production sharing. Therefore, this area is much more different from standard specialization. New products are emerging. If you are in this area you benefit more out of it. Penang (Malaysia) offers the case of the best known electronic hub. Firms in this region began with simple electronic assembly with Intel, AMD and others coming in the intial phase. That base has allowed the country to move on to many new product areas. Now Penang has got the hub for medical devices.

Finally, responding to the point by Somanathan, Athukorala said that he did not have data on land prices but that rental cost is a very important determinant of production locations. One of the reasons why Motorola started shifting from Singapore to other countries was the high rental cost. In India, it is not the cost but the bureaucratic hurdles involved in accessing land that remain a matter of concern. This needs to be studied as part of the special economic zone idea. The Chennai story is interesting, but the advent of these companies was facilitated through the large size of the market. Therefore, the component base developed and companies started exporting. Perhaps a few companies export more than what they sell domestically. This is exactly what happened in Thailand. Initially, as you know, the Hilux was basically designed by these companies in Thailand, in order to meet the requirements of farmers (due to the latter's requirement of a multiple-use vehicle that could be used for transporting, traveling and other uses). Then, these companies started developing products for exports due to a good investment environment. Now Thailand is the biggest Hilux vehicle exporter in the world, bigger than the United States. Unlike in electronics, there is a very important relationship between the domestic production base, the size of the market and exporting. Again, if you look at Brazil and Mexico the unfolding story here is exactly similar to what is happening in these countries.

Srinivasan rejoined pointing out that Athukorala had distinguished the particular products on which he was focusing from the general intermediate products category by appeal to the relationships between firms or within firm. But then without firm level information it is difficult to pursue the relation specific component. Regarding externalities, Srinivasan said that Athukorala seemed to say that they flowed from participation in this type of trade. Now, the exact nature of this is not very clear. Think of innovation. For innovating new products using some of the components and others that are being produced elsewhere, do you have to have a manufacturing location in your country? You can be anywhere, the products might be produced anywhere. You can think of a new product which could combine the components and parts from everywhere and locate yourself through a tax advantage to some other place and so on. None of this is crucially dependent on being a participant in this particular trade. So, the nature of externalities is not clear at all.