

Goldar, Bishwanath; Das, Deb Kusum; Sengupta, Sreerupa; Das, Pilu Chandra

**Working Paper**

## Domestic value addition and foreign content: An analysis of India's exports from 1995 to 2011

Working Paper, No. 332

**Provided in Cooperation with:**

Indian Council for Research on International Economic Relations (ICRIER)

*Suggested Citation:* Goldar, Bishwanath; Das, Deb Kusum; Sengupta, Sreerupa; Das, Pilu Chandra (2017) : Domestic value addition and foreign content: An analysis of India's exports from 1995 to 2011, Working Paper, No. 332, Indian Council for Research on International Economic Relations (ICRIER), New Delhi

This Version is available at:

<https://hdl.handle.net/10419/176359>

**Standard-Nutzungsbedingungen:**

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

**Terms of use:**

*Documents in EconStor may be saved and copied for your personal and scholarly purposes.*

*You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.*

*If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.*

# **Working Paper 332**

## **Domestic Value addition and Foreign Content: An Analysis of India's Exports from 1995 to 2011**

**Bishwanath Goldar  
Deb Kusum Das  
Sreerupa Sengupta  
Pilu Chandra Das**

**January 2017**



**INDIAN COUNCIL FOR RESEARCH ON INTERNATIONAL ECONOMIC RELATIONS**

## Table of Contents

<b>Abstract.....</b>	<b>i</b>
<b>1. Introduction.....</b>	<b>1</b>
<b>2. Literature Review .....</b>	<b>2</b>
2.1 <i>Literature survey on value added trade for network products: .....</i>	<i>3</i>
2.2 <i>Literature survey on measuring import content in export using input-output matrix framework:.....</i>	<i>4</i>
2.3 <i>Review of literature on Value Added trade covering India .....</i>	<i>5</i>
2.4 <i>Studies on measuring import intensity of exports with reference to India .....</i>	<i>7</i>
<b>3. Framework for measuring Domestic and Foreign content in Indian exports.....</b>	<b>10</b>
3.1 <i>Conceptual definition of value added trade.....</i>	<i>10</i>
3.2 <i>Data sources .....</i>	<i>12</i>
3.3 <i>Methodology .....</i>	<i>13</i>
<b>4. Trends in value added content in India’s Exports.....</b>	<b>14</b>
4.1 <i>Trends in domestic and foreign content in India’s exports at an aggregate level....</i>	<i>14</i>
4.2 <i>Trends in Domestic and foreign content in India’s export at a disaggregate level..</i>	<i>16</i>
4.3 <i>Analysis of trends in domestic production and trade for network products.....</i>	<i>21</i>
<b>5. Comparison of foreign content in India’s exports with important emerging economies .....</b>	<b>23</b>
5.1 <i>Foreign value added in industry by originating region.....</i>	<i>23</i>
5.2 <i>Trends in India’s value added exports over time relative to selected emerging economies.....</i>	<i>25</i>
5.3 <i>Comparison of foreign value added share with selected Asian emerging economies ...</i>	<i>27</i>
<b>6. Conclusion and Policy implications.....</b>	<b>28</b>
<b>References.....</b>	<b>31</b>
<b>Appendix.....</b>	<b>34</b>

## List of Tables

<b>Table 1:</b> Share of network products in manufacturing exports 2010-11 (%) – Selected Regions and Countries .....	6
<b>Table 2:</b> Review of past studies on import intensity of exports in India.....	9
<b>Table 3:</b> Domestic and foreign value added share in merchandize and service exports; India .	15
<b>Table 4:</b> Comparison of Estimates of Domestic and Foreign Value Added in Exports, from Alternate Data .....	15
<b>Table 5:</b> Domestic and foreign value added share in export by commodity (percent) (1998-99, 2003-04 and 2007-08).....	17
<b>Table 6:</b> Change in Foreign Value Added Share and Export: Cross Section Regression Analysis (1998-99 and 2007-08) .....	19
<b>Table 7:</b> Change in Exports at an aggregate level; 1998-99 to 2007-08 -Decomposition Analysis (Rs crore) .....	20
<b>Table 8:</b> Foreign value added share (FVS) by industry, India, by originating region, 2011 (%).....	24
<b>Table 9:</b> Percentage point change in foreign value added share in gross exports; 2011 over 1998 - India, Brazil, China and Indonesia .....	27
<b>Table 10:</b> Foreign Value-Added Shares in Output of Final Manufactures by Product Groups % 2008-India, China, Indonesia, Korea and Taiwan .....	28

## List of Figures

<b>Figure 1:</b> Domestic and foreign value added share in total exports; India.....	14
<b>Figure 2:</b> Trends in Import and Export intensity of network products 1998 to 2007-08. ....	22
<b>Figure 3:</b> Foreign Value Share in Select Network Product Categories, 2003 to 2011 .....	22
<b>Figure 4:</b> Total foreign value added in gross export (%), 2008, India compared with other countries.....	25
<b>Figure 5:</b> Trends in domestic and foreign value added in exports-Brazil, China, Indonesia, and India (%).....	26

## Abstract

India's merchandise trade has been growing in importance in recent years with increases in share in world exports and imports (Economic Survey, 2013-14). However with fragmentation of production process across countries, higher exports can no longer be linked to higher production as imports of intermediate products which are used in exports also increase. Against this background, it is very important to understand the contribution made to a product within the confines of the geographic boundaries of that economy. The present study estimates and analyzes the import content in Indian exports at a disaggregated industry level using the Hummel *et al.* (2001) approach used in this strand of empirical literature, as for instance applied by Koopmans, Wang and Wei (2008). The analysis highlights several interesting patterns. First, for India's exports, the import content in exports increased steadily from about 11 percent to about 22 percent in the time period 1995 to 2011. The rise in import content was relatively greater for merchandise exports from about 11 percent in 1995 to about 26 percent in 2011. In services exports, by contrast, the foreign value added content is relatively low and the increase has been rather modest. Second, at an individual commodity level (based on Input-output table classification), the decline in domestic value added content was associated with a simultaneous increase in foreign value added share for a majority of the commodities, indicating the pervasiveness of international fragmentation. Finally, a comparison of foreign value added share in aggregate exports with other emerging economies shows that in terms of degree of integration in global value chains, India lags behind most important emerging economies – Taiwan, Korea, Philippines, Vietnam, Malaysia, Thailand and China.

---

**Keywords:** *Value added trade, Import content and Exports*

**JEL classification:** *F6, F14 and O53*

**Authors' Email:** *bng@iegindia.org; dkdas@icrier.res.in; Sreeupa86@gmail.com; arpiludas@gmail.com*

This paper is based out of a research project - Estimating Domestic Value added and Foreign Content in India's Exports - undertaken at ICRIER, New Delhi and financially supported by a grant from the Ministry of finance, Government of India. The authors would like to thank Dr Arvind Subramanian and other participants at the project related seminar at MoF (held in January 2015) for comments and suggestions on the draft of the report. The authors are grateful to Dr H A C Prasad and Shri R Sathish for inputs in shaping the project proposals. The usual disclaimers apply. For any queries or comments, please address [dkdas@icrier.res.in](mailto:dkdas@icrier.res.in).

---

**Disclaimer:** *Opinions and recommendations in the report are exclusively of the author(s) and not of any other individual or institution including ICRIER. This report has been prepared in good faith on the basis of information available at the date of publication. All interactions and transactions with industry sponsors and their representatives have been transparent and conducted in an open, honest and independent manner as enshrined in ICRIER Memorandum of Association. ICRIER does not accept any corporate funding that comes with a mandated research area which is not in line with ICRIER's research agenda. The corporate funding of an ICRIER activity does not, in any way, imply ICRIER's endorsement of the views of the sponsoring organization or its products or policies. ICRIER does not conduct research that is focused on any specific product or service provided by the corporate sponsor.*

# Domestic Value addition and Foreign Content: An Analysis of India's Exports from 1995 to 2011

Bishwanath Goldar, Deb Kusum Das, Sreerupa Sengupta and Pilu Chandra Das

## 1. Introduction

It is now a common knowledge that global fragmentation of production is resulting in production processes that stretch across many countries both developed and developing. The emergence of global nature of production has implications especially for developing countries in the context of trade policy and exports in particular.<sup>1</sup> Further, it has grown into a global phenomenon involving countries at varying stages of development. In East Asia, for instance, it has played a major role in the region's economic growth and structural transformation (Athukorala and Menon, 2010). One of the main reasons for the international fragmentation of production lies in the open economy trade policies now pursued by many developing countries, which has led to significantly lower trade barriers as well as technology-led declines in costs of transportation and communications. This has led to the emergence of trade in value added.<sup>2</sup> As a result, the foreign content share in gross exports on average has increased manifold. The increase in these shares has been particularly pronounced in emerging market economies that rely heavily on developed world for intermediate inputs for producing their exports.<sup>3</sup>

India's merchandise trade has been growing in importance in recent years with increases in share in world exports and imports (Economic Survey, 2013-14). However, in the last six years, India's export growth has seen ups and downs, being in negative territory twice: in 2009-10 as an aftershock of the 2008 crisis and in 2012-13 as a result of the euro zone crisis (exports growth has been negative also last year). Further, given India's rapid integration with the world economy post the 1991-92 trade liberalization, it is imperative that global financial crisis and subsequent slowdown in the world economy has its impacts on the trade balance of the Indian economy. Therefore, from policy considerations it is important to assess the impact of domestic and foreign value addition in Indian exports. This would allow an assessment of the impact of a currency appreciation on a country's exports. In addition, given that significant import liberalization has already taken place in India. It would also help to assess the import intensity of India's exports. Against this background, the present study

---

<sup>1</sup> For a theoretical framework for studying the global fragmentation of production, see Jones 2000, Jones and Kierzkowski 2001, Helpman 2007 and Feenstra 2008.

<sup>2</sup> These developments led value or supply chains to become regional, as in the case of "Factory Asia" (Baldwin, 2008) or even global, as in the case of the iPod (Dedrick, Kraemer, and Linden, 2010).

<sup>3</sup> The international production networks gradually evolved and spread to industries such as sports footwear, automobiles, radio receivers, sewing machines, office equipment, electrical machinery, power and machine tools, cameras, and watches. Cost competitiveness and economies of scale achieved this way provided the setting for product innovation and a growth in world trade much faster than world production (Athukorala and Menon, 2006)

proposes to estimate and analyze the import content in Indian exports at a disaggregated industry level. This study mainly follows the Hummel *et al.* (2001) approach used in this strand of empirical literature, as for instance applied by Koopmans, Wang and Wei (2008).

The following analyses are undertaken: (1) the trends in value added trade in India's aggregate exports are examined over time<sup>4</sup>. (2) industry-level analysis is undertaken using detailed input-output transactions tables for India. The purpose is to estimate domestic and foreign value added content in India's exports at a disaggregated level. Then, using the WIOD (World Input-Output Database), a comparison of foreign content of India's exports is made with the global average and with the foreign content of exports of some important emerging economies. (3) Using the WIOD, an analysis is carried out of inter-temporal changes in value added in Indian exports relative to three other important emerging nations, namely China, Indonesia and Brazil and (4) an analysis is done on trends in domestic production and trade for selected network products which plays an important role in global value chains in East Asian economies.

An overview of earlier research on trade in value added exports is attempted in Section 2. In Section 3 the different data sources used and methodology adopted for estimating the domestic and foreign content in Indian exports are explained. The various subsections in Section 4 present the trend in value added content in India's exports at aggregate and industry level. In Section 5, a comparison of foreign content in India's exports with important emerging economies is examined. Finally, Section 6 highlights the conclusions of the study and outlines the policy suggestions that shall gainfully link India to global value chains.

## **2. Literature Review**

The literature on measurement of global value added trade is vast and is growing fast. While bulk of the past studies has estimated the extent of fragmentation for merchandise exports, there have been studies in recent times which attempted to estimate the value added trade for services exports. Again, many studies have decomposed value added exports by factor content employed and studied the consequence of fragmentation of production on employment, welfare and income distribution. This section provides a brief overview.

It is well acknowledged in the literature that with globalization and fragmentation of production process across different countries, the gross trade flow statistics have become less reliable to measure the value added and income generated by each country participating in the value chain. Case studies of global value chains in industries such as electronics, apparel, and motor vehicles have provided detailed examples of the discrepancy between gross and value-added trade. According to a commonly cited study of the Apple iPod (Dedrick, Kraemer, and Linden, 2008), while the Chinese factory gate price of an assembled iPod is \$144, only \$4 constitutes Chinese value added. Allocation of tasks of the NOKIA N95 shows that Hardware

---

<sup>4</sup> The period of study is 1995 to 2011. Estimates of value added trade are reported for two overlapping periods: 1995 to 2011 based on input-output transactions tables taken from the World Input-Output Database (WIOD), and 1998 to 2007 based on Indian input-output transactions tables published by the Central Statistical Office, Ministry of Statistics and Programme Implementation, Government of India.

and management tasks comprise 80% of total value added. More than half comes from the EU for management, hardware and software tasks while North America and Asia account respectively for 17% and 18% of total value. Case studies on production chains of Barbie doll (Tempest, 1996), computers (Kraemer and Dedrick, 2002) or more multipart products like car (Baldwin 2009) or airplanes (Grossman and Rossi-hansberg, 2008) have emphasized that global trade needs to be viewed not in terms of countries specializing in different final products but in terms of specialization in different components or processes in the production of products.

Apart from the case studies, there exists competing methods in literature which tries to quantify the magnitude of fragmentation in global value chains. There are two major approaches followed in literature. The first approach, pioneered by Yeats (2001), involves segregating parts and components from final assembled goods using country specific UN-SITC data. These studies are discussed under subsection 2.1. The second approach, originally proposed by Hummels, Ishii and Yi (2001) involves estimating the import content of exports (termed as vertical specialization) using input-output transactions matrix. This approach is also modified to decompose value added component by factors of production and study the consequence of global fragmentation on welfare and income distribution. The studies based on vertical specialization approach are discussed under subsection 2.2. The next two subsections 2.3 and 2.4 provide overviews of some selected studies which focus on India's participation in global value chains.

## **2.1 Literature survey on value added trade for network products:**

As pointed earlier, many authors (Yeats, 2001; Ng and Yeats, 2003; Athukorala and Yamashita, 2008; Kimaru, 2006; Athukorala, 2010, 2011; and Tiwari et al. 2013) have tried to quantify the magnitude of trade in parts and components and final assembly which is termed as 'network trade' by using individual country trade statistics from UN Comtrade database. Krugman (2008) points out that there is no definite rule that can be applied to differentiate between 'parts and components' and 'assembled products' in international trade data. One possible way is to focus on those product categories where network trade is heavily dominated. Once network product groups are identified, 'assembled products' are obtained as a difference between 'network products' and 'parts and components'.

Based on this approach, Athukorala and his associates find that network trade<sup>5</sup> has expanded faster than world trade in manufacturing, and degree of dependence of East Asia on network trade is relatively larger, with China playing the central role for final assembly. Kimura et al. (2007) using gravity model find that difference in location and service link costs are important drivers for trade in parts and components in East Asia. Tiwari et al. (2013) identify

---

<sup>5</sup> Athukorala (2011) defines network as trade based on global production sharing. Network trade comprises parts and component trade plus final assembly.



5 product categories<sup>6</sup> where India has high trade in network products with ASEAN. The study finds significant potential for deepening India's engagement in ASEAN by expanding network trade in road vehicle, transport equipment product categories telecommunications, machinery and chemical sector.

The analysis done for network trade in the above mentioned studies mainly concentrate in machinery and transport equipment sector. However, in recent times, there has been evidence that global production sharing is spreading beyond machinery and transport equipment product categories to pharmaceutical and chemical products, machine tools and various metal products. Apart from assessment of network product groups, there is a growing literature which attempts to decompose the gross trade flows into its value added components using input-output framework. The next subsection describes the set of studies which use input-output framework for its basis of analysis of global production sharing.

## **2.2 Literature survey on measuring import content in export using input-output matrix framework:**

### *a) Studies based on National Input output matrix:*

A large portion of studies based on input-output tables uses "Vertical specialization" indicator (VS for short), originally proposed by Hummels, Ishii and Yi (2001), for analysis of value added trade. Since VS indicator captures the imported intermediate goods and services embodied in exports, it has been considered a useful proxy indicator to illustrate a country's degree of participation in vertical specialization of trade. The VS indicator has been extended and applied in various other studies to estimate the domestic content in exports. These include studies undertaken by Chen, Cheng, Fung and Lau (2004), Koopman, Wang and Wei (2008), Dean, Fung and Wang (2007), among others. However, VS measure makes two key assumptions: (a) the imported inputs are used in the same intensity between production for exports and production for domestic sales. This assumption is violated in cases where processing trade is pervasive (Koopman, wang and Wei, 2008 and 2012) and (b) It assumes a country's exports (whether composed of final versus intermediate goods) are entirely absorbed in final demand abroad. Thus, it rules out scenarios in which a country exports intermediates that are used to produce final goods absorbed at home.

### *b) Studies based on inter country World Input Output matrix*

A more recent line of research focuses on estimating the value added content of trade by using World Input-Output table database (WIOD). Daudin, Rifflart and Schweisguth (2010), Johnson and Noguera (2010, 2012) and Koopman *et al.* (2010) use Inter-Country Input-Output (ICIO) tables, based on the Global Trade Analysis Project (GTAP) and World Input-Output database (WIOD), to calculate value added content in gross exports. In these studies input-output and bilateral trade data are combined to compute value added content in bilateral

---

<sup>6</sup> The categories include 1) Machinery, transport equipment and Scientific Instruments, 2) Basic metals and products, 3) Chemicals, 4) Plastic and Rubber, and 5) Others which includes a miscellaneous listing of HS grouping.

trade. The above mentioned studies use value added export to gross output ratio (termed as VAX ratio) to measure the intensity of production sharing. These studies highlight the fact that the changes in fragmentation are unevenly distributed across products, countries, and bilateral trade partners. The decline in value added trade is prominent within manufacturing and for countries undergoing structural transformation towards manufacturing. For instance, Johnson and Noguera (2011) finds a declining pattern in VAX ratios from 0.87 to 0.79 for European nations, 0.88 to 0.79 for East Asian nations, and 0.94 to 0.85 for North American nations during 1975 to 2005 indicating that the rise in production fragmentation over time is pervasive. But, apart from analyzing the trend and patterns of global production sharing, it is also important to examine the implication of fragmentation of production process across nations on employment and income distribution. There is a recent emerging line of research which attempts to study the issues of factor income distribution in global production framework. The next two subsections provide an overview of the India specific studies related to global production sharing.

### **2.3 Review of literature on Value Added trade covering India**

As already mentioned there are only a few studies which cover India in context of global production sharing. Banga (2013), for instance, using OECD WTO trade in value added (TIVA database) finds that the ratio of forward to backward linkages<sup>7</sup> in global value chain for India and other developing nations like Thailand, Vietnam, Malaysia and Philippines is less than one, indicating negative value added gains. Johnson and Norega (2012) using VAX ratios for 42 countries (including India) find evidence of increasing fragmentation of production process across countries. For India, in particular, the VAX ratio declined by 17 percent points at aggregate level, for the period 1970 to 2009. This study finds that nearly all countries experienced a decline by larger than 10 percentage points in VAX ratio during the abovementioned period. In a recent paper, Banga (2014) notes that domestic value added as a ratio to gross output of Indian industries has declined between 1995 and 2009 in most industries and at the aggregate manufacturing level. At the aggregate industry level, the ratio in question has declined from 90 percent in 1995 to 78 percent in 2009. She notes the even traditional export-oriented industries such as textiles and garments have experienced a decline in the domestic value added share in exports. Banga observes that India's share in global value added by exports is only about one percent. Based on her analysis, Banga concludes that Indian manufacturing is not gainfully linked to the global value chains, and that in many manufacturing industries in which India is 'locked out' of the global value chains, India is losing out in domestic value added growth. Indeed, Banga draws attention to a possible process of hollowing-out of the Indian manufacturing because the domestic manufacturing firms are not able to meet squarely competition from imports in the domestic markets, particularly competition from imports from China.

---

<sup>7</sup> Forward linkages are defined in terms of domestic value added exports of a country which goes into exports of other countries, whereas backward linkages are defined in terms of foreign value added in gross exports of a country.

Jiang and Milberg (2012) links vertical specialization with industrial upgrading<sup>8</sup> using an import content of export expansion ratio (ICEER). The study conducted on a panel of five countries China, India, USA, Brazil and South Africa finds that as the economy upgrades, vertical specialization follows a U-shaped pattern. Among the sample of countries selected, vertical upgrading is observed for China, India and Brazil whereas downgrading is observed for South Africa and USA for the period 1995 to 2005.

A number of studies based on network trade (Athukorala 2010, 2011; Athukurola and Menon, 2010; Sen and Srivastav, 2011; and Kimura and Obashi, 2010) have pointed out that among Asian countries India has significantly low participation in international production network. In the case of India, Athukorala (2011) estimates that in 2010-11 the share of network products in total manufacturing exports of India was about 14 percent and it was much lower than that of most of the developing East Asian and ASEAN countries (Refer table 2.1). This study further finds that for the year 2010-11 the share of P&C (parts and components) imports was 22.9 percent which was larger than P&C exports at 10.4 percent thereby suggesting that in contrast to rest of Asia, India is more involved in procuring P&C for manufacturing of final goods rather than becoming a global production base for production of such goods.

**Table 1 : Share of network products in manufacturing exports 2010-11 (%) – Selected Regions and Countries**

Country/Region	Parts and Components	Final Assembly	total network products
Developing East Asia	38.5	24.7	63.2
China	20.5	36.8	57.3
Taiwan	44.7	20.9	65.6
Republic of Korea	43.2	25.5	68.7
ASEAN	59.2	10.1	69.2
Indonesia	19.5	18	37.5
Malaysia	65.5	13.2	78.7
Philippines	71.2	16.3	87.5
Singapore	49.5	18	67.5
Thailand	44.5	21.4	65.9
Vietnam	12.03	7.5	19.5
South Asia	8.1	4.2	12.3
<b>India</b>	<b>10.4</b>	<b>3.7</b>	<b>14.1</b>
Developed Countries	25.2	23.6	48.8
Developing Countries	35.2	18.4	53.6
World	28.2	23	51.2

Source: Adopted from Athukorala (2011).

Some recent studies have tried to analyze the policy challenges that restrict India from a greater participation in global value chains. A case study by Nag (2011) for auto component

<sup>8</sup> Industrial upgrading as defined in Jiang and Milberg (2012) refers to capturing domestically a higher proportion of export value and relying less on imported inputs. This study interprets a decline in vertical specialization (import content of exports) as an indicator of industrial upgrading.

industry finds that India despite lowering tariff barriers and liberalizing the economy is mostly left out of Asian industrial production networks. He argues that high trade cost and the complexities with multiple rules of origin in PTAs as major challenges for India to link with Asian production chain. Sen and Srivastav (2011) contend that there are a number of policy challenges for India to successfully integrate with global and Asian production networks. They emphasize on need of reduction of transaction cost of trade, improve factor market rigidities, improvement of infrastructure and suggest steps to effectively utilize PTAs as a tool to plug in global production sharing. Hoda and Rai (2014) argue that India's low participation in production networks as compared to China, Malaysia and Thailand is due to limited stock of FDI in manufacturing sector. They suggest that India should improve logistics in terms of gateway infrastructure of ports, road and rail connectivity, ensure availability of uninterrupted power supply in industries, improve on labour laws, bring stability in tax regime and reduce corporate tax to stimulate investments and increase India's participation in global value chains.

Thus, most of the studies mentioned above are based on cross country analysis and compare India with other developed and developing countries in regard to participation in global production networks. But, there is a lack of comprehensive research on trends of import content in export at disaggregated level of manufacturing and services sectors. Also, no attempt has been made to decompose the domestic value added component of exports into contributions of capital and different categories of labour input. An attempt is made to analyze carefully all these aspects in this study.

#### **2.4 Studies on measuring import intensity of exports with reference to India**

Similar to the concept of import content in export, there have been a number of studies on import intensity of India's exports. For such analysis, most of the studies have used input-output transactions matrix to compute ratio of imported input requirement to output as a measure of import intensity of export. Broadly, there are three different data sources used in this strand of literature to calculate import intensity of Indian exports: a) Input-output tables [Bhattacharya (1989), Sathe (1995), Bhat et al. (2007), Bhat and Paul (2009) and Goldar (2013)], b) Annual Survey of Industry database, [(Burange (2001), among others], and c) Annual reports of companies [Siddharthan (1989), Pitre (1989), Sathe (1997), among others]. A majority of the studies on import intensity are based on input-output tables, and consider imported input to output ratio as an indicator of import intensity of that sector. We next provide a decade wise review of these studies below:

Bhattacharya (1989) and Sathe (1995) are two comprehensive studies which cover the decade of 1970s. Although both studies defined import intensity as the ratio of imported input to output, but the methodologies used by them are different. Bhattacharya (1989) first calculates sectoral import intensity using IO matrix as ratio of imported input to output. Based on his findings of increased import content in per unit of output at sector level for the period 1973-74 to 1979-80 Bhattacharya (1989) argued that the policy of export linked import liberalization followed in India led to a increase in sectoral import content, which facilitated the exporting sectors to increase its capacity to pay for its import. Although the study finds

increases in import intensity for most of the sectors but at an aggregate level the index of import intensity for total economy as per the study observed a declining trend during the period due to more than proportionate increase in total value of export (refer Table 2). Sathe (1995) follows the methodology by Bulmer Thomas (1984). Using input output tables, the study takes difference between column sum of Leontief inverse matrix that contains both domestic and imported inputs ; and column sum of Leontief inverse matrix that uses only domestically produced inputs. This difference is termed as import intensity. Sathe (1995) finds a rising trend in import intensity of exports between the period 1973-74 and 1978-79, from 7.8 percent to 11.9 percent. Pitre (1992) follows a similar method to that of Bhattacharaya (1989) and calculates import intensity of final consumption. This study finds increasing import intensity in late 1970s as compared to early 1970s.

For the decade of 1980s, Pitre (1992) using input output table finds a decreasing trend in import intensity of final consumption (from 5.17 in 1983-84 to 4.77 in 1987-88).

Many studies have used company annual report data to estimate the trends in import intensity of exports. Siddharthan (1989), with the help of regression analysis finds sharp rise in import intensity post liberalized period (1985-86 to 1987-88). This study uses data on large public limited companies from Reserve bank of India database for two alternate periods viz, 1982-83 to 1984-85 and 1985-86 to 1987-88. Mani (1991) analyses the import dependence of Indian Economy based on indicators like Net foreign exchange inflow rate (NFIR), Import intensity rate (IIR) and direct cost of Technology Import rate from RBI data of large public limited companies. This study suggests that import dependence has increased substantially between pre-liberalization and post-liberalization period. Singh (1994) using a similar approach to that of Siddharthan (1989) shows that there was a significant rise in import intensity of chemical, engineering, cotton textile, paper and paper products over the period 1975-76 to 1989-90.

Sathe (1997) and Burange (2001) using company balance sheet data published in Annual reports obtained from CMIE database calculated import intensity during the 1990s. The studies are not comparable as they used different set of companies for their analysis but the broad trend which is observed in both the studies is that compared to late 1980s, import intensity has declined in India in early 1990s and has again increased in late 1990s. Bhat et al (2007) using input output table framework finds that in the decade of 1990s for total economy and manufacturing sector there is a significant rise in import intensity. This study concludes that liberal import of raw material in India by large corporations to satisfy the demand of better quality in the international market has led to increased import intensity in the decade of 1990s.

The trends in import intensity in for the decade of 2000s period are not adequately covered in literature. Only two studies, Goldar (2013) and Bhat and Paul (2009) have estimated the import intensity for the decade of 2000s. They find that import intensity of exports has increased in the late 1990s as compared with early 1990s. It increased from 10.50 per cent in 1993-94 to about 24 percent in 2003-04 (Bhat and Paul, 2009) and to about 29 percent in 2006-07 (Goldar, 2013) manifesting a rising trend in fragmentation of production and

increasing integration of India into the global value chains. Apart from industry level analysis of import intensity in exports, a firm level analysis by Goldar (2013) finds that exporting firms are more import intensive than non exporting firms and import intensity of firms has a significant positive relationship with firm size, foreign equity participation, technology and capital goods imports

**Table 2: Review of past studies on import intensity of exports in India**

Sl no	Studies by	Database used	Measure selected	Time period	Import intensity ( % )	
1	Bhattacharya (1989)	Input output matrix	Import intensity of total economy	1973-74	7.85	
				1979-80	7.35	
			Import intensity of manufacturing	1973-74	10.04	
				1979-80	8.255	
2	Sathe (1995)	Input output matrix	Import intensity of total economy	1973-74	7.75	
				1979-80	11.9	
				1983-84	12.45	
3	Pitre (1992)	Input output matrix	Import intensity of final consumption for whole economy	1973-74	3.04	
				1979-80	4.75	
				1983-84	5.17	
				1987-88	4.77	
4	Burange (2001)	Balance sheet data of companies listed in CMIE database	Import intensity for registered manufacturing sector	1991-92	9.27	
				1997-98	12.27	
5	Bhat et al (2007)	Input output matrix	Import intensity of total economy	1993-94	10.5	
				1998-99	12.61	
				Import intensity for manufacturing sector	1993-94	12.88
					1998-99	16.77
7	Goldar (2013)	Input output matrix	Import intensity of total economy	2003-04	15.9	
				2006-07	17.2	
		Firm level analysis using data form capitaline	Import intensity of exporting firms	1999-00	9.16	
				2010-11	13.6	
				Import intensity of non exporting firms	1999-00	5.23
	2010-11	5.46				

*Source:* Authors' compilation based on past literature

Thus, there have been many studies in the past decades which attempt to measure the import intensity of exports for India. The findings of a few important studies related to import intensity of exports discussed so far are summarized in Table 2. The methodology and databases applied in these studies differ. Some studies find import intensity of exports has declined in 1970s (Bhattacharya, 1989) and others show an upward trend ( Sathe, 1995; Pitre, 1992). Some studies conclude that Import intensity of manufacturing have declined in early 1990s as compared to 1980s (Sathe, 1997 and Burange, 2001), and other studies indicate an increasing trend in import intensity in the post reform period ( Bhat et al., 2007; Goldar, 2013).

It is to be noted that most of the studies mentioned so far, undertaken in the Indian context, focus on assessing import intensity of exports or the overall magnitude of import content in exports for India rather than explaining the disaggregated sector/industry level trends in domestic and foreign value added in exports. There are in fact very few detailed industry level studies for India which present estimates value added content and factor content in exports,<sup>9</sup> especially for the decade of 2000s. Thus, the present study attempts to improve over the previous studies in the following ways:

First it aims to estimate the trends in domestic and foreign content in value added exports at a disaggregated sector level covering the time period 1998-99 to 2007-08. Second, using the WIOD (World Input-Output Database), a comparison of foreign content of India's exports is made with the global average and with the foreign content of exports of some important emerging economies, and finally drawing on the analysis undertaken the study makes some policy recommendations that shall gainfully link India to the global value chains.

### **3. Framework for measuring Domestic and Foreign content in Indian exports**

This section documents the conceptual definition of value added trade, the data sources used and methodology adopted for estimating domestic and foreign content of India's exports.

#### **3.1 Conceptual definition of value added trade**

Before we discuss the alternate data sources and the methodology used to estimate the import content in India's exports, it would be useful to illustrate the notion of value added trade used in the paper.

*Measuring value added trade: An illustrative example:*

The box below presents an illustrative example of vertical production chain with 3 countries. The production chain starts at Malaysia and United States where parts and components of a car are produced and they are exported to Thailand. In Thailand the imported inputs are combined with domestically produced accessories and the final assembly is done. This final product is then exported to United States. The value added column in the example shows the domestic value added in each country. It is assumed in this example that Malaysia and United States produce the parts and components of the car in their country without using any imported inputs. Column 3 shows the value of "vertical Specialization" or import content in exports or foreign value added content in exports. Since, in this hypothetical example, Malaysia and United States do not use any imports for their production of parts and components, therefore the value of vertical specialization for these two nations is set as Zero.

The valuation of exports is presented in columns 4 and 5. For Malaysia and United States, the value of exports remains the same for both the alternate measure (i.e. value added trade measure and traditional measure). But for Thailand the results vary based on alternate measurement techniques. When we evaluate Thailand's exports to USA using traditional

---

<sup>9</sup> See Goldar (2013) for a review.

measure we get a value of 100. This leads to a problem of double counting, as the intermediate inputs produced in Malaysia and United States enters twice: once when the input is exported to Thailand, and again when Thailand exports the finished product to USA. Measuring trade in value added terms overcomes this problem. In this approach the import content in exports is separated while measuring value added in exports. Thus, the value added exports equals 75 which includes the domestically produced intermediate inputs, and domestic factors of production like capital and labour which is required in the production process.

**Box 1: AN ILLUSTRATIVE EXAMPLE OF VERTICAL SPECIALIZATION**

Production Chain (column 1)	Value added (column 2 )	Import content in exports (column 3)	Value added measure (column 4)	Exports Traditional measure ( column 5)
<b>Malaysia</b>				
Parts and Componets (P&C)	10			
		0	10	10
<b>Thailand</b>				
Foreign intermediate input (P&C- imported from Malaysia)				
+				
Foreign intermediate input (P&C- imported from US)				
+				
Domestically produced intermediate input	35			
+				
Capital input	25			
+				
Labour input	15			
= Final good (say Car )				
		25 (10+15=25)	75 ( 25+35+15=75)	100 (10+15+35+25+15)
<b>United States</b>				
Final Consumption =Automobile ( imported from Thailand)				
Parts and components ( P&C)	15	0	15	15

The above example highlights three issues concerning the traditional measure of trade statistics. First, when world trade is calculated as a sum of bilateral trade flows, there is multiple counting of value of intermediate inputs each time it crosses the border for further processing. Second, with global production sharing, exports of a country now increasingly embody intermediate inputs produced abroad, thus making it difficult to assess the real contribution of gross exports towards domestic value addition and income distribution. Conventional trade statistics cannot distinguish those sectors of the economy where domestic



value addition is high. Thirdly, as per national accounting principles, value added reflects compensation of employee and operating surplus. With growth of multinational enterprises, it would be again difficult to estimate the true value of domestic labour income and capital compensation using gross trade data. These issues bring out that the focus should be on value added trade and not on gross trade to measure the contribution of exports to economic growth. In other words, with rise in global production sharing, exports of a nation should be decomposed into value added contributions from domestic sources and foreign sources.

The domestic content in exports depicts the contribution of domestic sectors to the supply chain and value added of a country, whereas foreign content in exports (or the import content in exports) provides an estimate of the trade between countries participating in global production chains. This can be measured through application of Vertical Specialization measure as proposed by Hummels et al (2001). The vertical specialization method relies on input-output transactions tables or preferably their international counterparts –the World Input Output tables to estimate vertical trade in value added. There are several extensions of the Hummels et al (2001) model. For example, in a measure proposed by Daudin et al (2011), one estimates the value of a country's exported goods that is absorbed as intermediate inputs to produce final goods in rest of the world which are then shipped back home. Again, Johnson and Noguera (2012) suggest a measure that involves using value added exports to gross exports or VAX ratio, to determine value added content of trade. This study primarily uses the most widely accepted Hummels et al (2001) approach in detangling the domestic content in exports from foreign content. In doing so, the data sources and the methodology that have been adopted are discussed in next two sections.

### **3.2 Data sources**

The primary source of data used are the input-output (IO) transactions tables (Commodity X commodity flow matrix) published by Central Statistics Office at an interval of 4 or 5 years. Three benchmark IO tables are used for the study: 1998-99 (contains 115 commodities), 2003-04 and 2007-08 (contain 130 commodities). The “commodity X commodity flow matrix” has been split to construct two matrices, one giving the flows of domestic production and the other giving the flows of imports.<sup>10</sup> Once imported and domestically produced intermediate inputs are accounted separately, domestic content and foreign content in exports is estimated using Hummel *et al.* (2001) approach.

The study also employs input-output tables for India and several other emerging economies, particularly China, Brazil, and Indonesia, taken from the World Input-Output Database (WIOD)<sup>11</sup>. The matrices are available for 40 countries for different years between 1995 and 2011. The IO tables for the years 1995, 1998, 2000, 2003, 2007, 2008 and 2011 have been used for the analysis. The major advantage of this dataset is that it provides a consistent set of tables of domestic and import flows to facilitate comparison across countries over time. The

---

<sup>10</sup> These matrices of domestic and import flows have been provided by Mr. Devender Pratap, which is gratefully acknowledged.

<sup>11</sup> [http://www.wiod.org/new\\_site/data.htm](http://www.wiod.org/new_site/data.htm)

IO tables divide the economy into 35 sectors, including 24 goods-producing sectors, of which 22 are manufacturing.

### 3.3 Methodology

Following Hummel *et al* (2001), a value-based input-output table can be specified as follows:

$$A^D X + Y^D = X \dots\dots\dots(1)$$

$$A^M X + Y^M = M \dots\dots\dots(2)$$

$$uA^D X + uA^M + A_V = u \dots\dots\dots (3)$$

where  $A^D$  is a  $nxn$  flow matrix of input coefficients of domestic products;  $A^M$  is a  $nxn$  matrix of inputs of imported products;  $Y^D$  is an  $1xn$  vector of final demands of domestically produced products. This includes usage of gross capital formation, private and public final consumption, and gross exports;  $Y^M$  is a  $n \times 1$  vector of final demands for imported products. This vector again includes usages of gross capital formation, private and public final consumption;  $X$  is a  $n \times 1$  vector of gross output;  $M$  is a  $n \times 1$  vector of imports;  $A_V$  is an  $1 \times n$  vector of each sector  $j$ 's ratio of value added to gross output, and  $u$  is an  $1 \times n$  unity vector.

Define a vector of share of domestic content,  $DVS = \{dvs_j\}$ . This is  $1 \times n$  vector, as the additional domestic value added generated by one additional unit of final demand of domestic products.

$$DVS = \widehat{A}_V (I - A^D)^{-1} \dots\dots\dots (4)$$

Where  $\widehat{A}_V$  is a diagonal matrix with  $a_j^V$  as its diagonal elements and  $(I - A^D)^{-1}$  is the well-known Leontief inverse, a matrix of coefficients for total domestic intermediate product requirement. Equation (4) is the standard formula which is used to compute the share of domestic content in total exports for each industry.

Next we define a vector of share of foreign content by  $FVS = u - DVS$ .

Using Equation (3), it can be shown that

$$FVS = u - \widehat{A}_V (I - A^D)^{-1} = uA^M (I - A^D)^{-1} \dots\dots\dots (5)$$

For each industry, this is the column sum of the coefficient matrix for total intermediate import requirement. This formula gives the vertical specialization of trade as mentioned by Hummel *et al* (2001). Again, Domestic value added of total exports is calculated as:

$$DVS \text{ of total exports} = \widehat{A}_V (I - A^D)^{-1} E / Ex \dots\dots\dots (6)$$

$$\text{And, FVS of total exports} = uA^M (I - A^D)^{-1} E / Ex \dots\dots\dots (7)$$

Where  $E$  is  $nx1$  vector of exports,  $Ex$  is sum of exports across the  $n$  sectors.

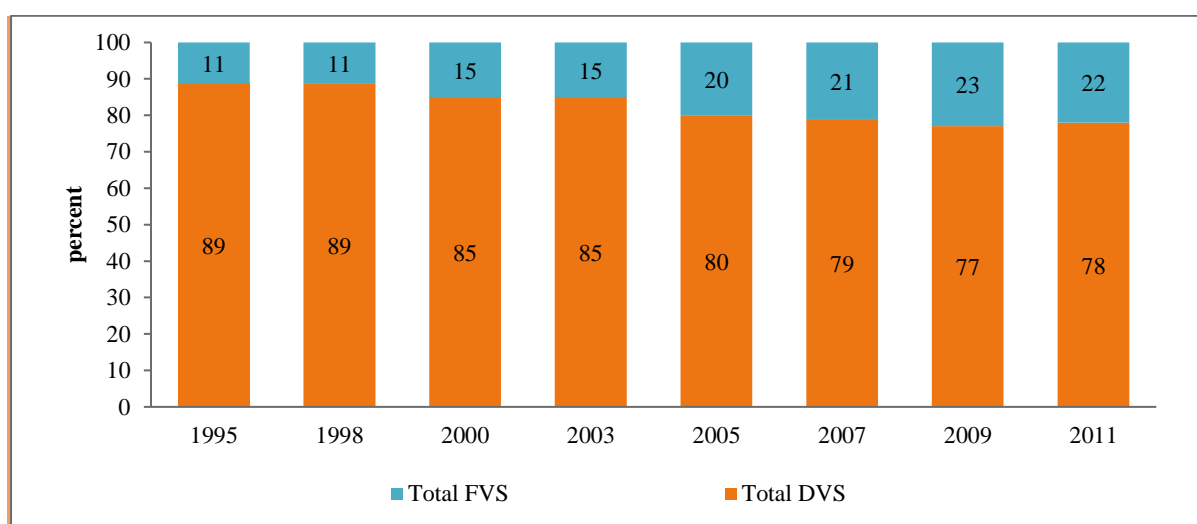
#### 4. Trends in value added content in India's Exports

Based on the methodology described in Section 3, this section presents the empirical results of the value added content in India's exports. In this section, the following are examined: (a) trends in domestic and foreign value added in India's exports, at the aggregate level and industry-level, and (b) trends in domestic production and trade for network products.

##### 4.1 Trends in domestic and foreign content in India's exports at an aggregate level

Trends in shares of domestic and foreign value added in aggregate gross exports and merchandise export for India is presented in Figure 1. It is observed from Figure 1 that the domestic value added in total exports has experienced a steady decline from 89 percent in 1995 to about 78 percent in 2011. On the other hand, the foreign content in exports increased by about 11 percentage points during the above mentioned period, manifesting a rising trend in fragmentation of production and increasing integration of India into the global value chains.

Figure 1: Domestic and foreign value added share in total exports; India



Source: authors' computation based on India's input output tables taken from the WIOD.

The same pattern is observed for merchandise exports. In this case, the increase in foreign value added share is relatively greater; the increase is by about 15 percentage points between 1995 and 2011 (refer Table 3). For service exports, the FVS increased from 6.4 percent in 1995 to 10.3 percent in 2007. The share declined to 8.6 percent in 2009 and further to 8.5 percent in 2011. It appears that global value chains were affected by the economic crisis and collapse of international trade. The fall in foreign content is associated with a simultaneous rise in domestic content in service exports (by 2 percentage point between 2007 and 2011).

**Table 3: Domestic and foreign value added share in merchandize and service exports; India**

Sector		1995	1998	2000	2003	2005	2007	2009	2011
Merchandize exports	DVS	88.83	87.78	84.34	82.94	75.96	74.62	72.74	74.28
	FVS	11.17	12.22	15.66	17.06	24.04	25.38	27.26	25.72
Services Exports	DVS	93.65	93.56	91.68	93.76	90.75	89.70	91.43	91.53
	FVS	6.35	6.44	8.32	6.24	9.25	10.30	8.57	8.47

Source: Authors' computation based on India's input output tables taken from the WIOD.

Table 4 shows the estimates of foreign and domestic value added in India's exports in three select years, 1998, 2003 and 2007, obtained by using alternate data sources. One set of estimates is based on the WIOD. Another set makes use of detailed input-output tables for India published by the Central Statistical Office (CSO). In the case of the latter, two alternate sets of estimates have been made. One of them (under the head A1) uses the CSO input-output tables without trying to match them with the tables available in the WIOD. In the other, an alternate estimate for 2007 (shown under the head A2) has been made in which the import flow matrix derived from the input-output tables of the CSO for 2007-08 has been adjusted to some extent to match the import flow matrix for India for 2007 in the WIOD (in terms of the overall breakup of the imports of a particular commodity into intermediate consumption and final consumption).

**Table 4: Comparison of Estimates of Domestic and Foreign Value Added in Exports, from Alternate Data**

Sector/Period		estimates based on CSO IO tables				estimates based on WIOD		
		1998	A1 2003	2007	A2 2007	1998	2003	2007
Merchandize exports	DVS	84.95	79.38	70.78	69.91	87.78	82.94	74.62
	FVS	15.05	20.62	29.22	30.09	12.22	17.06	25.38
Services exports	DVS	90.76	92.79	86.73	85.83	93.56	93.76	89.70
	FVS	9.24	7.21	13.27	14.17	6.44	6.24	10.30
Total exports	DVS	86.93	84.13	78.53	77.65	88.4	85.50	78.57
	FVS	13.07	15.87	21.47	22.35	11.6	14.50	21.43

Note: A1: CSO based import flow matrix without making any adjustment to match the WIOD import flow matrix for India; A2: CSO based import flow matrix proportionately adjusted to match the WIOD import flow matrix.

Source: Authors' computation based on India's input-output tables taken from the CSO website and such tables taken from the WIOD.

Whichever set of estimates one chooses from Table 4, it is evident that there was a downward trend in the domestic value added content in India's exports, and an increase in import

content or foreign value added share. At level form, it is observed that for all select years, the import content in exports for merchandise exports is much higher than the import content in service exports. Also, the rise in foreign value added share between 1998-99 and 2007-08 was relatively greater in the merchandise exports (increase in FVS by almost 14 percentage point) than in service exports (increase is by 4 percentage point).

Alternate to the above mentioned databases, OECD-WTO in May 2013 released its dataset on Trade in value-added (TIVA) for 58 countries for the years 1995, 2000, 2005, 2008 and 2009 using harmonized input-output tables of these countries. In the TIVA database, the share of foreign value added in total exports for India is reported as 10 percent in 1995, 13 percent in 2000, 20 percent in 2005, 24 percent in 2008 and 22 percent in 2009. According to the more recent (2015) release of TIVA base, the share of foreign value added in India's exports in 2011 was 24 percent.<sup>12</sup> These estimates are by and large in agreement with the estimates shown in Table 3.

#### **4.2 Trends in Domestic and foreign content in India's export at a disaggregate level**

A disaggregate level analysis reveals that the extent of fragmentation varies greatly across commodities. It is observed from Table 5 that in the year 2007-08, Petroleum products, Ships and boat building and repair, and Aircraft and spacecraft had very high foreign value added share in exports. The import share is well above the average foreign value added share across commodities. Other products with relatively high foreign value added share include Fertilizers, Coal tar products, Inorganic and organic heavy chemicals, Non-ferrous basic metals, Electric wires and cables, and Communication equipment. By contrast, sectors like Trade, Insurance, Computer and related services, Fruits, Vegetables, Milk and milk products, and Poultry products have relatively low import content in exports (below five percent).

It is important to note that, although there was a rise in exports in gross terms during the period 1998 to 2007, among disaggregated commodities, a downward trend is observed in domestic value added share in gross exports in almost all cases. In general it is expected for some commodities for example petroleum products to have low domestic and high foreign value added shares as India like most of the other countries have a deficit in domestic oil production. In contrast it is expected that manufacturing of food products will have relatively low foreign content in its exports as most of the intermediate inputs in production process is supplied from local sources. For both type of products, the foreign value added shares have been increasing over time, indicating increasing fragmentation in the production process of the product. Traditional export oriented sectors like Textiles, Leather and leather products, Drugs and medicines, Food processing, and Automobile and ancillaries have witnessed a fall in domestic value share over the years.

A decline in domestic value added content by five percentage points or more between 1998-99 and 2007-08 and an associated increase in foreign value added share is seen for a majority of commodities, indicating the pervasiveness of international fragmentation. Increase in import content in exports was more predominant across merchandise exports as compared to

---

<sup>12</sup> [http://www.oecd.org/sti/ind/tiva/CN\\_2015\\_India.pdf](http://www.oecd.org/sti/ind/tiva/CN_2015_India.pdf)

agriculture and services exports. Between the years 1998-99 and 2007-08, the largest increase in import content in exports occurred in Ships and boat building and repair, followed by Petroleum products and Fertilizers (more than 20 percentage point increase).

**Table 5: Domestic and foreign value added share in export by commodity (percent) (1998-99, 2003-04 and 2007-08)**

Code/ Sector		FVS			DVS		
	Commodity	1998-99	2003-04	2007-08	1998-99	2003-04	2007-08
1	Paddy	4.36	8.48	9.70	95.64	91.52	90.30
2	Wheat	5.59	9.88	8.71	94.41	90.12	91.29
3	Jowar	4.55	9.34	11.09	95.45	90.66	88.91
4	Bajra	5.07	6.13	8.02	94.93	93.87	91.98
5	Maize	5.51	5.64	10.14	94.48	94.36	89.86
7	Pulses	5.34	6.31	7.06	94.66	93.69	92.94
11	Other oilseeds	*	4.75	7.29	*	95.25	92.71
16	Rubber	2.09	5.56	5.41	97.91	94.44	94.59
17	Tobacco	2.04	2.79	9.48	97.96	97.21	90.52
18	Fruits	*	0.83	1.93	*	99.17	98.07
19	Vegetables	*	0.99	2.09	*	99.01	97.91
20	Other crops	2.61	5.82	7.82	97.39	94.18	92.18
21	Milk and milk products	1.12	1.62	2.14	98.88	98.38	97.86
23	Poultry & Eggs	*	1.03	3.47	*	98.97	96.53
24	Other liv.st. produ.	1.94	3.64	4.84	98.06	96.36	95.16
25	Forestry and logging	1.89	2.14	4.66	98.11	97.86	95.34
26	Fishing	2.94	5.70	5.91	97.06	94.30	94.09
27	Coal and lignite	7.27	5.78	8.98	92.73	94.22	91.02
28	Natural gas	*	4.24	6.61	*	95.76	93.39
29	Crude petroleum	3.81	7.39	11.21	96.19	92.61	88.79
30	Iron ore	5.42	5.67	6.54	94.59	94.33	93.46
31	Manganese ore	3.01	2.38	3.89	96.99	97.62	96.11
32	Bauxite	4.84	23.78	8.45	95.17	76.22	91.55
33	Copper ore	6.78	4.51	8.43	93.21	95.49	91.57
34	Other metallic minerals	4.23	8.24	7.26	95.77	91.76	92.74
35	Lime stone	4.23	5.41	10.09	95.77	94.59	89.91
36	Mica	6.39	10.85	6.24	93.22	89.15	93.76
37	Other non metallic minerals	2.15	2.04	4.55	97.85	97.96	95.45
38	Sugar	3.38	6.97	8.05	96.62	93.03	91.95
41	Edible oils other than vanaspati	6.10	7.65	9.62	93.90	92.35	90.38
42	Tea and coffee processing	5.18	10.38	12.79	94.82	89.62	87.21
43	Miscellaneous food products	7.54	8.78	10.32	92.46	91.22	89.68
44	Beverages	10.61	9.75	11.51	89.39	90.25	88.49
45	Tobacco products	9.59	5.19	8.07	90.41	94.81	91.93
46	Khadi, cotton textiles(handlooms)	6.86	9.10	10.59	93.14	90.90	89.41
47	Cotton textiles	8.03	10.80	14.60	91.97	89.20	85.40
48	Woolen textiles	10.53	14.27	14.42	89.47	85.73	85.58
49	Silk textiles	9.23	15.64	25.49	90.77	84.36	74.51
50	Art silk, synthetic fiber textiles	14.63	18.92	26.15	85.37	81.08	73.85
51	Jute, hemp, mesta textiles	7.49	8.59	14.09	92.51	91.41	85.91
52	Carpet weaving	9.00	12.78	16.33	91.00	87.22	83.67
53	Readymade garments	9.01	13.25	16.44	90.99	86.75	83.56
54	Miscellaneous textile products	10.48	13.13	19.16	89.52	86.87	80.84
55	Furniture and fixtures-wooden	7.05	10.88	12.38	92.95	89.12	87.62
56	Wood and wood products	6.71	8.88	10.12	93.29	91.12	89.88
57	Paper, paper prods. &	17.58	16.86	19.17	82.41	83.14	80.83

Code/ Sector		FVS			DVS		
		1998-99	2003-04	2007-08	1998-99	2003-04	2007-08
	Commodity newsprint						
58	Printing and publishing	16.43	15.57	20.08	83.57	84.43	79.92
59	Leather footwear	10.76	9.84	11.83	89.24	90.16	88.17
60	Leather and leather products	13.95	10.86	11.90	86.05	89.14	88.10
61	Rubber products	14.85	19.01	21.51	85.15	80.99	78.49
62	Plastic products	20.29	20.83	29.93	79.71	79.17	70.07
63	Petroleum products	40.54	52.22	65.83	59.46	47.78	34.17
64	Coal tar products	15.36	30.96	33.66	84.64	69.04	66.34
65	Inorganic heavy chemicals	18.82	23.20	34.45	81.18	76.80	65.55
66	Organic heavy chemicals	19.64	21.73	36.24	80.36	78.27	63.76
67	Fertilizers	25.52	29.54	50.30	74.48	70.46	49.70
68	Pesticides	16.70	18.98	27.39	83.30	81.02	72.61
69	Paints, varnishes and lacquers	21.24	20.72	24.61	78.76	79.28	75.39
70	Drugs and medicines	15.32	16.88	26.12	84.68	83.12	73.88
71	Soaps, cosmetics & glycerin	17.59	17.96	26.40	82.41	82.04	73.60
72	Synthetic fibers, resin	19.01	23.86	33.17	80.99	76.14	66.83
73	Other chemicals	12.60	16.08	23.94	87.40	83.92	76.06
74	Structural clay products	24.77	23.69	18.64	75.23	76.31	81.36
75	Cement	16.19	18.23	21.63	83.81	81.77	78.37
	Other non-metallic mineral prods.						
76		22.71	21.09	26.16	77.29	78.91	73.84
77	Iron, steel and ferro alloys	11.85	17.84	24.41	88.15	82.16	75.59
	Iron and steel casting & forging						
78		14.82	20.40	26.92	85.18	79.60	73.08
79	Iron and steel foundries	13.78	24.89	31.28	86.22	75.11	68.72
80	Non-ferrous basic metals	23.63	27.72	37.95	76.37	72.28	62.05
81	Hand tools, hardware	13.89	20.58	27.63	86.11	79.42	72.37
82	Miscellaneous metal products	16.95	22.91	31.56	83.05	77.09	68.44
83	Tractors and agri. implements	14.41	20.27	30.20	85.59	79.73	69.80
84	Industrial machinery(F & T)	20.56	21.06	33.75	79.44	78.94	66.25
85	Industrial machinery(others)	15.97	19.69	29.42	84.03	80.31	70.58
86	Machine tools	13.13	19.88	28.40	86.87	80.12	71.60
87	Other non-electrical machinery	16.94	20.41	31.71	83.06	79.59	68.29
88	Electrical industrial Machinery	20.69	22.00	31.53	79.31	78.00	68.47
89	Electrical wires & cables	30.25	32.22	38.82	69.75	67.78	61.18
90	Batteries	25.75	28.25	34.74	74.25	71.75	65.26
91	Electrical appliances	21.86	20.88	29.38	78.14	79.12	70.62
92	Communication equipments	18.11	23.42	35.03	81.89	76.58	64.97
93	Other electrical Machinery	20.85	23.82	32.60	79.15	76.18	67.40
	Electronic equipments(incl.TV)						
94		23.65	24.75	35.56	76.35	75.25	64.44
	Ships and boat building & repair						
95		16.75	42.29	82.00	83.25	57.71	18.00
96	Rail equipments	12.50	17.48	24.84	87.50	82.52	75.16
97	Motor vehicles	14.17	15.91	28.13	85.83	84.09	71.87
98	Motor cycles and scooters	14.83	15.47	22.01	85.17	84.53	77.99
99	Bicycles, cycle-rickshaw	17.53	16.03	22.52	82.47	83.97	77.48
100	Other transport equipments	10.97	15.31	23.42	89.03	84.69	76.58
101	Watches and clocks	17.02	12.65	11.79	82.98	87.35	88.21
	Medical, precision & optical instruments						
102		*	15.72	25.05	*	84.28	74.95
103	Jems & jewelry	*	47.60	36.61	*	52.40	63.39
104	Aircraft & spacecraft	*	15.18	78.29	*	84.82	21.71
105	Miscellaneous manufacturing	28.51	23.26	25.40	71.49	76.74	74.60
106	Construction	13.45	17.51	16.98	86.55	82.49	83.02
109	Railway transport services	6.93	12.96	9.39	93.07	87.04	90.61

Code/ Sector		FVS			DVS		
	Commodity	1998-99	2003-04	2007-08	1998-99	2003-04	2007-08
110	Land transport including via pipeline	*	19.29	23.24	*	80.71	76.76
111	Water transport	*	12.07	20.72	*	87.93	79.28
112	Air transport	*	17.92	18.86	*	82.08	81.14
113	Supporting and aux. tpt activities	*	7.38	10.28	*	92.62	89.72
115	Communication	3.50	6.51	12.95	96.50	93.49	87.05
116	Trade	4.02	3.29	5.08	95.98	96.71	94.92
119	Insurance	4.84	4.93	5.04	95.16	95.07	94.96
123	Business services	*	10.00	21.89	*	90.00	78.11
124	Computer & related activities	*	4.32	7.87	*	95.68	92.13
125	Legal services	*	0.95	5.27	*	99.05	94.73
129	Other services	12.47	6.31	21.37	87.53	93.69	78.63
	Merchandise exports	15.05	20.62	29.22	84.95	79.38	70.78
	Service exports	09.24	07.21	13.27	90.76	92.79	86.73
	Total export	13.07	15.87	21.47	86.93	84.13	78.53

Note: \*commodities not classified in 1998-99 IO matrix

^25 IO sectors are removed from the analysis as there are no reported exports for these sectors.

Source: Authors' calculations based on Input output transaction tables published by Central Statistics Office, Ministry of Statistics and Programme Implementation, Government of India.

The analysis presented above has confirmed that FVA share in India's exports has increased over the period 1998-99 to 2007-08. However, we need to discern if there is an accompanied increase in exports. To this end we have carried out a regression analysis. We regress changes in exports on changes in FVA. The change in logarithm of exports and change in FVA share in exports between 1998-99 and 2007-08 are considered for the analysis. The results are reported in Table 6.

**Table 6: Change in Foreign Value Added Share and Export: Cross Section Regression Analysis (1998-99 and 2007-08)**

All IO sectors				Sectors with greater than 1% export share (2007-08)			
Dependent Variable: Change in ln(export)							
	Coeff.	t	P> t		Coeff.	T	P> t
<b>Diff FVA Share</b>	3.653055	1.81	0.073**	<b>Diff FVA Share</b>	9.581175	2.12	0.049*
<b>Cons</b>	1.4091	5.98	0	<b>Cons</b>	1.166923	2.24	0.038
Number of obs	91	R-square	0.0357	Number of obs	19	R-square	0.2097

Note: Diff FVA Share – Changes in FVA share in Export. \* Statistically significant at 5% level, \*\* statistically significant at 10% level.

Source: Authors' calculation based on IOTT 1998-99 and 2007-08.

Using a cross sectional regression for all IO sectors, we find a significant positive effect of FVA on exports (Table 6). To check the robustness of our estimates, we have estimated another regression equation in which we consider only those IO sectors which had a share of one percent or more in aggregate exports of India in 2007-08. In this case, we observe a



stronger positive relation between change in exports and change in FVA – the regression coefficient is statistically significant at five percent (Table 6). Comparing the coefficient of change in FVA share across the two regressions, we find that in the case of the first regression which covers all sectors a one percentage point increase in FVA share would lead to an increase in exports by over 3 percentage points. This impact is even stronger for sectors with greater than one percent export share as in this case a one percentage point increase in FVA share brings about more than 9 percentage point increase in exports growth. It is needless to say that the analysis presented in Table 6 is not rigorous enough because other determinants of export growth need to be included in the regression equation. However, the results provide some basis to argue that greater integration into global economy as reflected in FVA shares has helped India to increase in her exports.

While the regression analysis indicates a positive impact of increase in FVA on export performance, an interesting question that arises here is whether the addition to exports associated with an increase in FVA exceeds the increase in imports that a hike in FVA implies. If this is not so, then a hike in FVA may have an adverse effect on domestic value addition even though prima facie it is beneficial to exports. To investigate this issue, a decomposition analysis has been undertaken. In this analysis, the aggregate exports of those sectors which accounted for one percent or more of India's total exports in 2007-08 are considered. The estimated regression coefficient for these sectors shown in Table 6 is utilized for this decomposition analysis.

**Table 7: Change in Exports at an aggregate level; 1998-99 to 2007-08 -Decomposition Analysis (Rs crore)**

Group	Increase in exports(Rs crore)	Increase in exports caused by a hike in FVA(Rs crore)	% of export increase due to greater use of imported inputs	Contribution of other factors (%)	Increase in imports associated with increased exports (Rs Crore )	Increase in imports associated with increased exports caused by higher FVA	Net gain
Aggregate exports of sectors having more than 1 percent share in India's Total exports	427649.12	137472.75	32.15	67.85	122429.54	41871.86	95600.89

*Note:* Export data for the year 1998-99 and 2007-08 is taken from Input output tables published by CSO

*Source:* Authors' calculations

It is observed from the table that between 1998-99 and 2007-08 aggregate exports (for sectors contributing one percent or more to the total Indian exports) increased by Rs. 4276.5 billion. The hikes in foreign value added content had a strong favorable effect on the increase of exports. In absence of other factors, the greater use of imported inputs would lead to an increase in exports by Rs. 1375.8 billion (this estimate is based on the regression coefficient in Table 6). This accounts for about 32 percent of the total increase in exports that took place between 1998-99 and 2007-08. The rise in exports over the periods also leads to a rise in imported input by Rs. 1224.3 billion, of which Rs. 418.71 billion increase took place in respect of the additional exports traceable to the hikes in foreign value added share in export. This rise in imports due to FVA hike was much less as compared to the increase in exports caused by FVA hike which resulted into a net gain of about Rs. 956 billion. These net gains are attributable to greater integration into global economy.

Thus from the decomposition analysis we find that increase in FVA had a favorable effect on both total imports and total exports, but the positive effect on export expansion was much stronger than the effect on import increase leading to substantial net gains for the economy.

### **4.3 Analysis of trends in domestic production and trade for network products**

In the earlier sub sections, we have drawn attention to the domestic and foreign content in exports at disaggregate level. In this section, we will analyze the trends of selected product categories which have a relatively greater scope for production networks. Literature on global production networks emphasizes that trade for network products is proportionately larger in East Asia, in particular in ASEAN, than in North America and Europe. Following Arthukola (2011) we identify 14 product categories<sup>13</sup> (which we refer as network product goods) in which global production sharing is spreading rapidly in East Asian region. These items are mainly concentrated in machinery and transport equipment sectors.

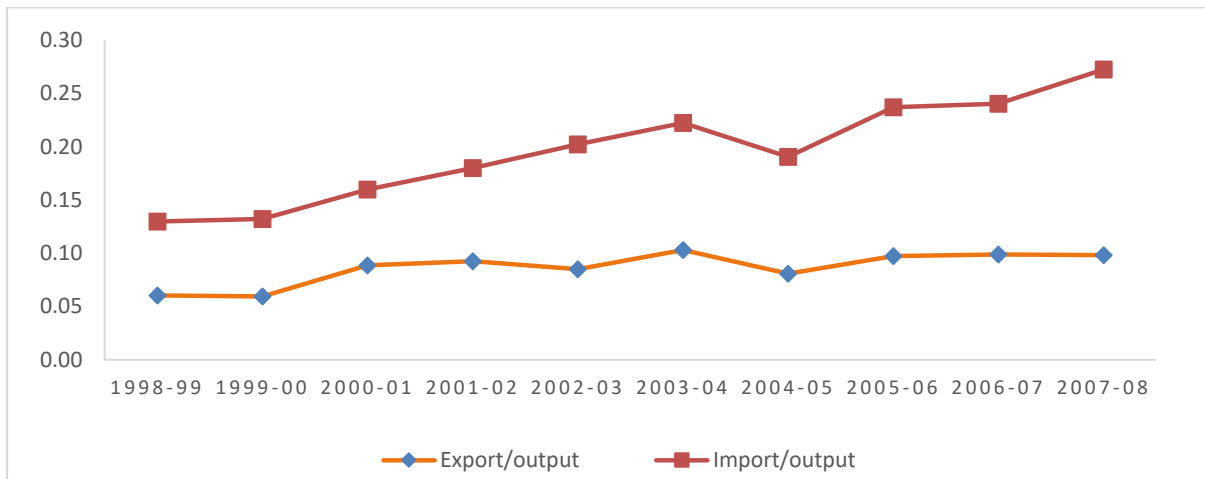
The trends in import intensity and export intensity of aggregate network product group are presented in Figure 2. A sharp rise in import intensity of network products from 0.13 to 0.27 is observed during the period 1998 to 2007. At item level network products<sup>14</sup> it is observed that import to domestic production ratio is considerably high for communication equipment, other electrical machinery, and electronic equipment.

---

<sup>13</sup> Arthukola (2011) 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) (Athukorala 2011). We mapped SITC codes with IOTT codes and HS codes to identify 14 corresponding IO sectors/commodities where network trade is predominant.

<sup>14</sup> Refer appendix tables A1 and A2 for trends in domestic production and trade of selected network product categories.

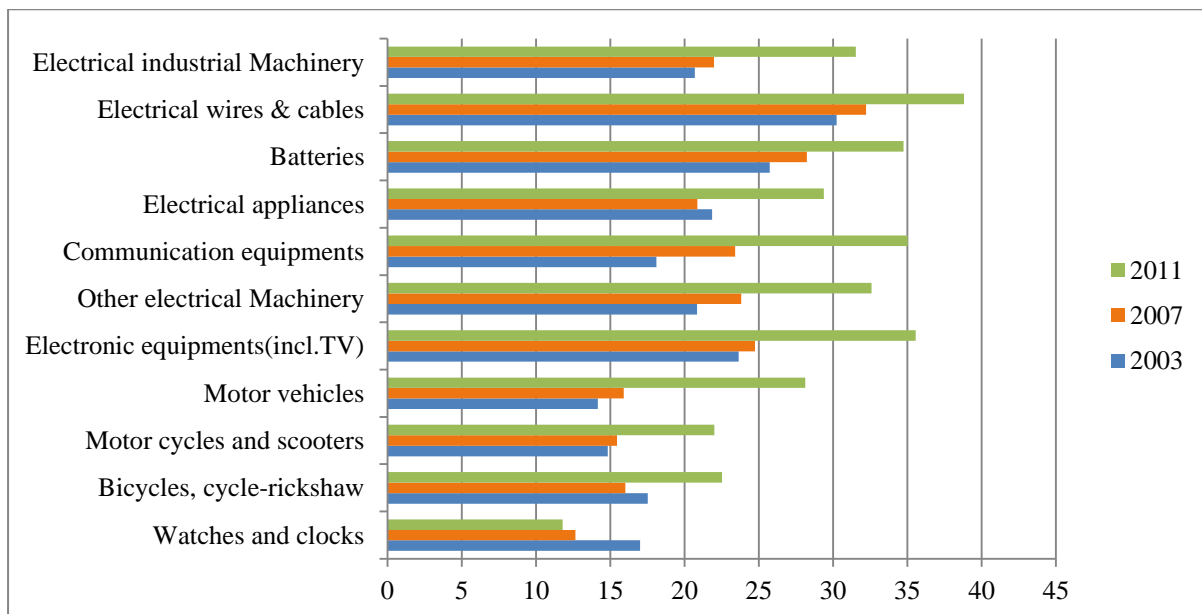
**Figure 2: Trends in Import and Export intensity of network products 1998 to 2007-08.**



*Source:* Authors' computation based on ASI database and trade data drawn from the export –import databank of the department of commerce, Ministry of commerce and Industry

From Table 3, it is observed that within the network product group the top 3 items which recorded the highest foreign value added content in 2007 are electrical wires and cables, communication equipment and electronic equipment (foreign value added share over 35 percent). In terms of growth, the largest increase in foreign content between the period 1998 to 2007 is observed for communication equipment (17 percentage point change in FVS) followed by motor vehicles and other transport equipment (more than 12 percent change in FVS). A graphic presentation of changes in foreign value added share in select network product categories (IO sectors) is made in Figure 3.

**Figure 3: Foreign Value Share in Select Network Product Categories, 2003 to 2011**



*Source:* Prepared from Table 5

To sum up the above discussion, in this section we have studied the extent of international fragmentation in Indian exports. It is observed that the foreign value added in India's export increased steadily from 11 percent to 22 percent during 1995 to 2011. The rise in import content was relatively greater for merchandize exports, from 11 percent to 26 percent during the same period. Among disaggregated commodities, an upward trend is observed in foreign value added share in gross exports in almost all cases implying greater integration with global production chains. Traditional export oriented sectors like Textiles, Leather and leather products, Drugs and medicines, Food processing, and Automobile and ancillaries have witnessed a rise in foreign value added share over the years. To note a few commodities, the foreign value added share increased by 6 percentage point for cotton textile, 7 percent or readymade garment, 16 percentage for silk textile, over the period 1998 to 2007. At an individual commodity level between the years 1998 and 2007, the largest increase in import content in export took place in Ships & Boats (almost 60 percentage points increase) followed by Petroleum products and Fertilizer (25 percentage point increase). To study whether the rise in foreign value added led to expansion of total exports and significant net gains for the economy a regression analysis along with a decomposition exercise was carried out. The Regression analysis established a positive impact of increase in FVA on export performance and the decomposition analysis brought out that positive effect of increase in FVA, on export expansion was much stronger than the effect on import increase leading to substantial net gains for the economy. Next turning to network product group, the top 3 items which recorded the highest foreign value added content in 2007 are electrical wires and cables, communication equipment and electronic equipment (foreign value added share over 35 percent). Thus, the rise in foreign content in exports for majority of disaggregated commodities over time implies that the participation of India in global value chain is increasing over time, with services export playing an import role in climbing up the global value chains. However, the distribution of gain from linking to global value chain is an important issue for a developing country like India. Some studies in past have highlighted that gains are unevenly distributed in value chains (Kaplinsky and Filter 2004, Milberg 2009) however, very few studies have empirically estimated the distribution of value added gains under global production chains across countries. This area needs further research in future.

## **5. Comparison of foreign content in India's exports with important emerging economies**

Having analyzed the domestic and foreign value added contents in India's exports for individual industries and at the aggregate level in previous section, this section presents a comparison of India's participation in global value chain with other emerging economies. Subsection 5.1 presents a decomposition of India's foreign value added by originating region. Subsection 5.2 compares the emerging trends and patterns of India's value added trade over time with selected emerging nations and finally subsection 5.3 analyses the comparative position of India with selected Asian economies in global value chains.

### **5.1 Foreign value added in industry by originating region**

Foreign value added (FVA) share shows the total value added share that is created in other countries and enters the export of a country. For example, foreign value added in India's

export will be sum of value added created in China, and also the value added created in other nations from where China has imported its inputs for producing the intermediate good. Thus FVA of a country can be decomposed to analyze the contribution of each nation to imports of intermediate goods. Such decomposition can have important implications for bilateral trade balance.

Table 8 shows a decomposition of the contribution of developed and developing regions to foreign value added share in India's exports. The decomposition is shown by industry for the year 2011. It is observed, that developing economies including china embodies much higher value added share than developed and developing countries excluding china. China in an average contributes about 18 percent of foreign value added share across all industries. At a disaggregate level, China's contribution to foreign value added share of India's export is highest for post and telecommunication (about 29 percent of FVS). For Textiles and textile products, manufacturing n.e.c., recycling; electrical and optical equipment, transport equipment, other community, social and personal services more than one fourth of the total FVS of India originates from China. This shows China's emergence as a significant exporter of manufacturing products, driven by its integration into Asian value chains.

**Table 8: Foreign value added share (FVS) by industry, India, by originating region, 2011 (%)**

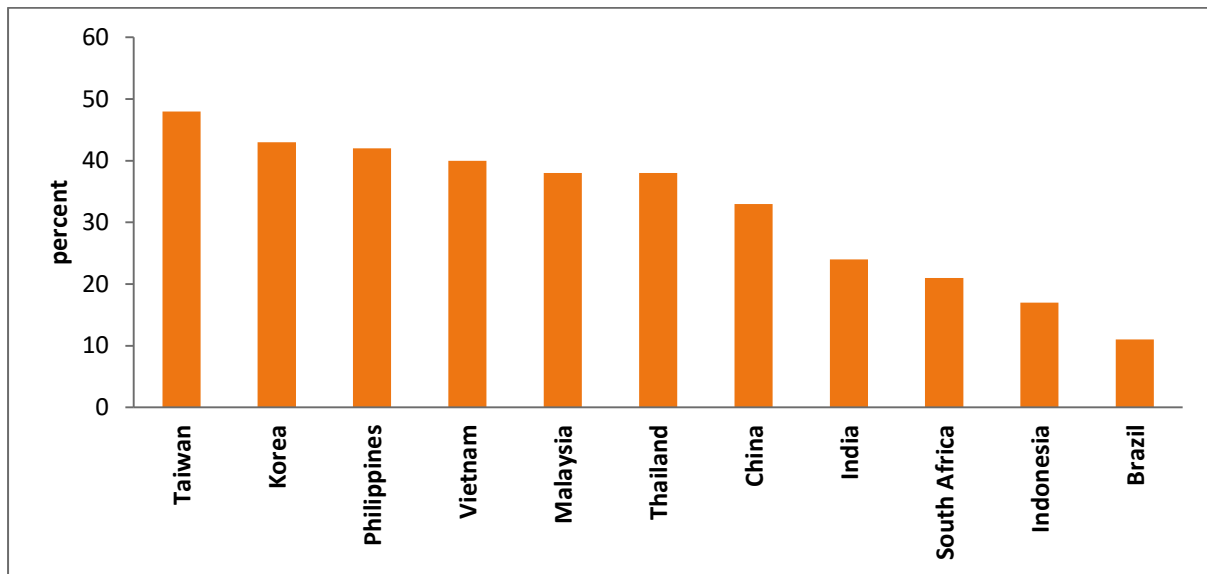
Industry classification	FVS	Developed	Developing	Developing Except China
Agriculture, Hunting, Forestry and Fishing	2.88	0.66	2.22	1.78
Mining and Quarrying	4.88	1.45	3.43	2.62
Food, Beverages and Tobacco	11.33	2.15	9.18	7.96
Textiles and Textile Products	15.96	4.01	11.94	7.82
Leather, Leather and Footwear	10.86	3.13	7.73	5.73
Wood and Products of Wood and Cork	12.43	1.92	10.51	9.44
Pulp, Paper, Paper , Printing and Publishing	16.11	5.27	10.84	8.55
Coke, Refined Petroleum and Nuclear Fuel	33.79	2.54	31.26	30.16
Chemicals and Chemical Products	19.60	4.89	14.71	11.32
Rubber and Plastics	19.46	5.28	14.18	10.40
Other Non-Metallic Mineral	16.54	6.13	10.41	8.31
Basic Metals and Fabricated Metal	20.81	6.16	14.65	12.57
Machinery, Nec	19.48	6.17	13.31	10.41
Electrical and Optical Equipment	19.51	6.12	13.39	9.47
Transport Equipment	19.87	6.72	13.15	9.57
Manufacturing, Nec; Recycling	53.55	12.85	40.70	25.74
Wholesale Trade and Commission Trade, Except of Motor Vehicles and Motorcycles	2.07	0.59	1.48	1.07
Retail Trade, Except of Motor Vehicles and Motorcycles; Repair of Household Goods	2.07	0.59	1.48	1.07
Hotels and Restaurants	10.77	1.89	8.88	7.48
Inland Transport	17.49	3.81	13.69	11.05
Post and Telecommunications	8.77	2.34	6.43	3.89
Financial Intermediation	3.75	1.28	2.47	1.69
Renting of M&Eq and Other Business Activities	6.89	2.56	4.33	2.81
Other Community, Social and Personal Services	9.34	2.24	7.10	4.51

Source: Authors' calculations based on WIOD database

## 5.2 Trends in India's value added exports over time relative to selected emerging economies

Figure 4 presents' comparative statistics on foreign value added share in aggregate exports in respect of selected emerging economies. It is evident from the figure that, in terms of vertical specialization or degree of integration in global value chains, India lags behind most other important emerging economies, although there are economies which are performing worse.<sup>15</sup>

**Figure 4: Total foreign value added in gross export (%), 2008, India compared with other countries**

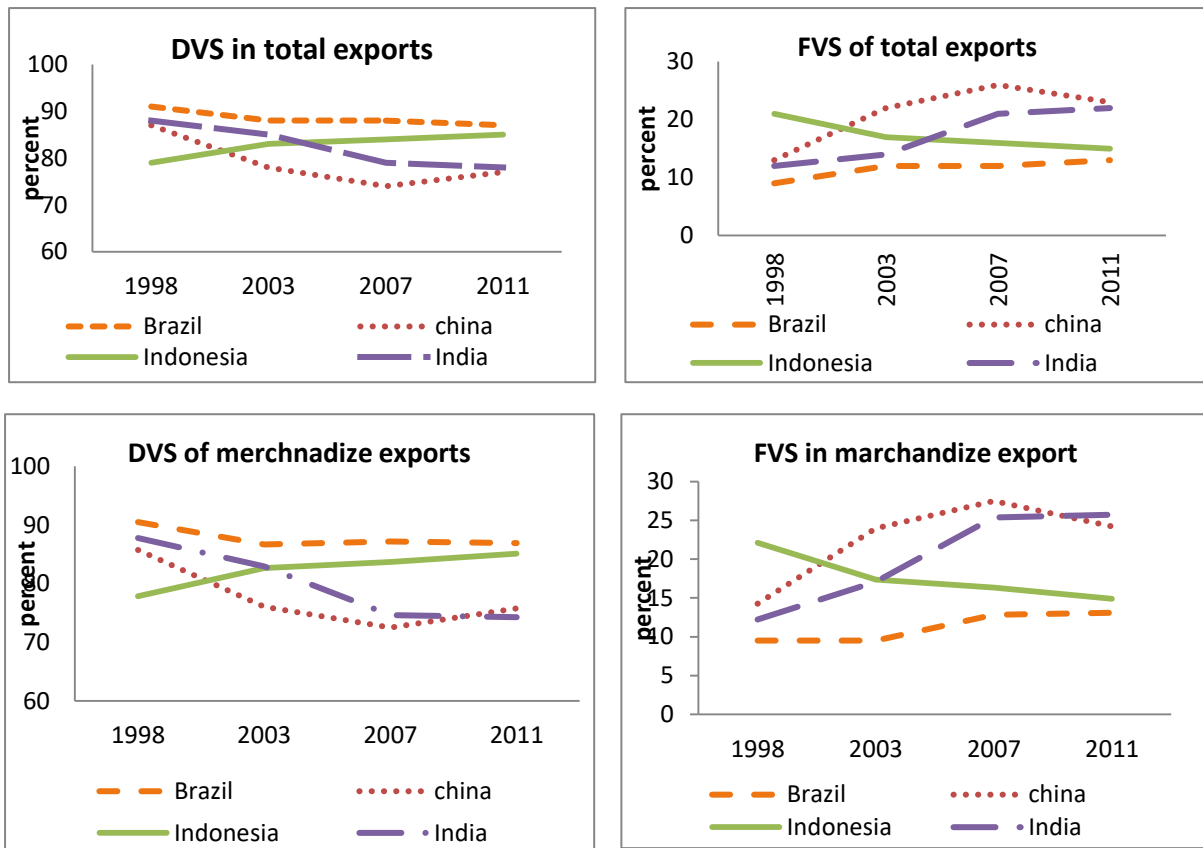


*Source:* Authors' computations based on OECD-WTO TIVA data, May 2013.

To study how value added in Indian exports have moved over time relative to other emerging economies a cross-country analysis over the period 1998 to 2011 is presented in Figure 5. It is observed from Figure 5 that domestic value added in total exports has declined substantially for China and India (10 percentage points) and marginally for Brazil (4 percentage points) indicating a rise in foreign content in Exports. However, for Indonesia, a reverse trend is observed. Domestic value added in total exports has increased by 6 percentage points during the period 1998 to 2011.

<sup>15</sup> According to the estimates of Banga (2014), foreign value added formed 22 percent of India's gross exports in 2009. Domestic value added exports feeding into exports of other countries formed 20 percent and domestic value added getting used for other countries domestic demand formed the remaining 58 percent. The corresponding figures for Korea are 41, 24 and 35 percent, and those for Malaysia are 38, 28, and 34 percent, respectively.

**Figure 5: Trends in domestic and foreign value added in exports-Brazil, China, Indonesia, and India (%)**



*Source:* Authors' computation based on input-output tables for 1998, 2003, 2007 and 2011 taken from the WIOD.

At a disaggregated level, for China (refer Table 9), a remarkable rise in foreign content in total exports is observed for Coke, refined petroleum and nuclear fuel; Basic metals and fabricated metal products; Machinery n.e.c.; Electrical and optical equipment; and Chemicals and chemical products (more than 10 percentage point increase between 1998 and 2011). For India, the largest increase in foreign content in exports is observed in Manufacturing n.e.c. and recycling (almost 35 percentage points). A high rise in foreign value added is observed also for Textiles and textile products and Electrical and optical equipment (more than 7 percentage points). For Brazil, more than five percentage point rise in foreign value added share over the period is observed in Electrical and optical equipment; Transport equipment; Coke refined petroleum and nuclear fuel; and Chemicals and chemical products. For Indonesia however, for a majority of the industries, there was a fall in foreign content and a subsequent rise in domestic value added in exports. The most remarkable rise in domestic value added content is observed in Basic metals and fabricated metal products; and Transport equipment (more than 10 percentage point rise).

**Table 9: Percentage point change in foreign value added share in gross exports; 2011 over 1998 - India, Brazil, China and Indonesia**

Industry No	Industry description	% point change in FVS			
		India	Brazil	China	Indonesia
1	Agriculture, Hunting, Forestry and Fishing	0.41	3.89	2.70	-0.62
2	Mining and Quarrying	0.12	3.72	7.78	-0.46
3	Food, Beverages and Tobacco	2.29	2.49	5.11	-2.84
4	Textiles and Textile Products	7.22	3.99	0.08	1.09
5	Leather, Leather and Footwear	0.46	0.44	0.23	-2.24
6	Wood and Products of Wood and Cork	3.31	2.53	6.46	-3.86
7	Pulp, Paper, Paper , Printing and Publishing	-1.02	1.53	7.02	-4.77
8	Coke, Refined Petroleum and Nuclear Fuel	4.37	6.25	28.98	-5.20
9	Chemicals and Chemical Products	3.63	6.11	10.75	-9.86
10	Rubber and Plastics	4.24	4.81	7.77	-7.06
11	Other Non-Metallic Mineral	-0.62	3.73	7.81	-4.79
12	Basic Metals and Fabricated Metal products	4.98	4.09	14.21	-16.90
13	Machinery, NEC	1.6	4.50	11.11	-9.73
14	Electrical and Optical Equipment	7.89	7.58	11.23	-5.90
15	Transport Equipment	4.48	5.71	9.84	-13.82
16	Manufacturing, NEC; Recycling	34.69	2.93	3.88	-3.71
20	Wholesale Trade and Commission Trade	-0.67	1.74	1.18	-4.67
21	Retail Trade, Repair of Household Goods	-0.67	1.74	1.18	-4.67
22	Hotels and Restaurants	2.69	1.31	3.86	-2.73
23	Inland Transport	6.4	2.90	5.98	1.89
27	Post and Telecommunications	5.77	3.29	1.34	-3.86
28	Financial Intermediation	0.82	1.20	0.85	-4.92
30	Renting of Mech & Equip, Other Business Activities	-0.09	2.02	4.21	-9.80
34	Other Community, Social and Personal Services	1.90	3.53	-1.38	1.85

*Note:* Eleven sectors are excluded from the analysis as exports reported for these sectors for India are nil or small.

*Source:* Authors' computation based on input-output tables taken from the WIOD.

### 5.3 Comparison of foreign value added share with selected Asian emerging economies

While fragmentation of production network has now become a global phenomenon, the degree of dependence to production network is significantly high in Asian economies. Table 10 presents the global average of foreign value added share and compares it for selected south Asian economies. For traditional export oriented sectors like textiles and leather, the foreign content in exports in India is lower than that of global average, as also that of Indonesia, Korea and Taiwan, but it higher than that of China.

The foreign value added share in India's exports is not markedly lower than that for China. For many product categories like coke refined petroleum and nuclear fuel, chemical and chemical products, Transport equipment, manufacturing n.e.c. and recycling, Textiles and leather, India has greater integration into the global value chains than China. However, in terms of integration in global value chains, India lags far behind Korea and Taiwan for most of the industries except manufacturing n.e.c. and recycling. This may be attributed to low FDI



stock in India's manufacturing as compared to other southeast Asian economies. Thus there is urgent need to bring in reforms that will reduce trade barriers, improve logistic and infrastructure situation and promote investment that will in turn contribute to improving India's participation in global production network. The policy suggestions that will gainfully link India to global value chains are discussed in section 6.

**Table 10: Foreign Value-Added Shares in Output of Final Manufactures by Product Groups % 2008-India, China, Indonesia, Korea and Taiwan**

No.	Industry	ISIC rev. 3 Code	Global					
			average	India	China	Indonesia	Korea	Taiwan
1	Coke, Refined Petroleum and Nuclear Fuel	23	53.7	43.3	42.5	11.6	81.8	81.8
2	Basic Metals and Fabricated Metal	27,28	30.2	23.5	25.9	21.0	48.9	49.9
3	Electrical and Optical Equipment	30-33	29.1	20.9	32.7	31.6	41.3	49.4
4	Chemicals and Chemical Products	24	28.0	26.6	24.5	22.2	48.3	57.8
5	Transport Equipment	34,35	30.3	22.9	22.2	21.3	34.5	37.2
6	Machinery, n.e.c.	29	24.0	21.6	22.2	44.6	37.0	42.4
7	Rubber and Plastics	25	26.4	24.5	23.7	28.8	37.5	45.7
8	Manufacturing, n.e.c.;							
	Recycling	36	23.6	47.7	14.7	17.9	32.4	38.1
9	Wood and Products of Wood and Cork	20	20.7	15.5	16.2	12.6	39.4	39
10	Other Non-Metallic Mineral	26	20.2	19.7	16.4	12.6	32.7	43.1
11	Food, Beverages and Tobacco	15,16	16.9	12.2	11.5	11.2	29.2	34.4
12	Textiles and Textile Products	17,18	20.4	18.2	15.6	32.7	30.6	35.1
13	Pulp, Paper, Paper , Printing and Publishing	21,22	18.3	19.8	18.5	24.5	28.3	37.4
14	Leather, Leather and Footwear	19	18.5	13.2	16.2	21.1	29.3	34.1

Source: Authors' computation using WIOD. The column for global average is taken from Los et al. (2014)

## 6. Conclusion and Policy implications

With fragmentation of production process across countries and continents, higher exports can no longer be linked to higher production as imports of intermediate products which are used in exports also increase. The increased use of imported inputs has caused a generalized decline in domestic value added share for merchandize and total exports. This phenomenon has been studied for India in this paper (using both National and WIOD databases), along with such assessment done for other three important emerging nations, Brazil, China and Indonesia. The analysis highlights several interesting patterns.

First, for India's exports, the import content in exports increased steadily from about 11 percent to about 22 percent in the time period 1995 to 2011. The rise in import content was relatively greater for merchandize exports from about 11 percent in 1995 to about 26 percent in 2011. In services exports, by contrast, the foreign value added content is relatively low and the increase has been rather modest. In the abovementioned time period, 1995 to 2011, the

foreign value added content in services exports increased from about 6.4 percent to about 8.5 percent.

Second, at an individual commodity level (based on Input-output table classification), the decline in domestic value added content was associated with a simultaneous increase in foreign value added share for a majority of the commodities, indicating the pervasiveness of international fragmentation. Between the time points 1998 and 2007, the largest increase in import content in export is observed in Ships and boat building (65 percentage point increase) followed by Petroleum products and Fertilizer (25 percentage points increase). By contrast, for commodities/ industries like trade and insurance, milk and milk products, pulses, metallic minerals like iron ore, magnesium ore, copper ore etc there has been only a small increase in the import content in exports (below five percent).

Thus a rise in foreign value added in exports was witnessed across majority of products. But did this hike in foreign content in exports result in growth of export volumes and led to significant gains for the economy? This was analyzed through a regression analysis followed by a decomposition exercise which brought out that increase in foreign value added share had significant positive effects on both imports and exports. But the favorable effect on export expansion was much stronger as compared to import growth leading to substantial net gains for the economy.

Third, a comparison of foreign value added share in aggregate exports with other emerging economies for the year 2008 shows that in terms of degree of integration in global value chains, India lags behind most important emerging economies – Taiwan, Korea, Philippines, Vietnam, Malaysia, Thailand, China; although there are countries which are performing worse – South Africa, Indonesia, and Brazil. However the domestic value added in exports has moved at different pace in different countries over the period 1998 to 2011, with a stronger reduction taking place in China and India as compared to Brazil. A reverse trend is observed for Indonesia, where domestic value added in exports has shown an upward trend in the period 1998 to 2011. Fourth, a decomposition analysis of the foreign value added components of India's exports reveals that a major part is traceable to developing countries, of which the contribution of China is significant.

Fifth, an analysis of trends in exports, imports and domestic production of network products (which includes electrical machinery, communication equipment and motor vehicles) brings out that the ratio of imports to domestic production has risen substantially while the increase in the ratio of exports to domestic production has been modest. In network products, the scope for getting involved into global value chains is relatively much greater. The observed divergence in the trend in imports-production ratio and exports-production ratio probably means that imports are primarily being used for meeting the domestic demand for the final network products in India rather than being used to exports.<sup>16</sup>

---

<sup>16</sup> See the paper of Tiwari et al. (2014)

Based on the analysis undertaken and the available literature on globalization and fragmentation of production process across different countries, particularly the studies dealing with India, the following suggestions may be made for increasing India's involvement in the global value chains.

First, the supply-side problems that are coming in the way of manufacturing sector growth in India are also hindering India's involvement in global value chains. For the value added trade, assured supply is critical. Given the serious problems of infrastructure availability being faced by Indian manufacturing, massive efforts, through public-private partnership or otherwise, are required for infrastructure development in the country – power, transport, port facilities, etc – for creating a situation conducive to India's increasing involvement in global value chains.

Secondly, enterprises involved in global value added trade need to be of some minimum threshold size. A study undertaken by Wigneraja (2014) reveals that firm size is an important factor determining the probability of small and medium scale firms joining global value chains. He argues that economies of scale and fixed costs are significant factors in joining production networks in the early stages, but become less important later. He also points out the advantage of SME clusters in facilitating the units in the cluster joining the production network. Considering the size of Indian manufacturing firms, it would be realized that most firms are too small to be in position to have sufficient scale economies or have sufficient resources to bear the initial fixed costs associated with joining production networks. There are several reasons for the preponderance of very small size manufacturing units in India (which is known as the problem of missing middle), of which a very important one has to do with regulations including those related to labour. It appears that easing of regulations of small and medium scale enterprises will encourage them to grow bigger in size and bring them to a sufficient size threshold to join global production networks. Formation of SME clusters is another major policy initiative that can help Indian manufacturing growth and facilitate Indian manufacturing firms get increasingly involved in global value chains.

Finally, there is need for improving business environment for attracting foreign direct investment. As noted above, India's low integration into global value chains is attributable, at least in part, to low FDI stock in India's manufacturing as compared to other southeast Asian economies. Thus, there is urgent need to undertake policy reforms that will reduce trade barriers, improve logistic and infrastructure situation and promote investment that will in turn contribute to improving India's participation in global production network.

## References

- Athukorala, P. (2011).** ‘Production Networks and Trade Patterns in East Asia: Regionalization or Globalization?’ *Asian Economic Papers*, MIT Press, 10(1), 65-95.
- Athukorala, P. and Jayant, M. (2010).** ‘Global Production Sharing, Trade Patterns, and Determinants of Trade Flows in East Asia’, *Working Papers on Regional Economic Integration 41*, Asian Development Bank.
- Athukorala, P and Yamashita, N (2008)**, Patterns and Determinants of Production Fragmentation in World Manufacturing Trade, in F. di Mauro, S. Dees, and W. McKibbin, eds. *Globalization, Regionalism and Economic interdependence*. Cambridge; Cambridge University Press. pp. 45-72
- Baldwin, R. (2009).** Integration of the North American economy and the new paradigm globalisation. CEPR Discussion Paper Series 7523.
- Banga, R. (2014)**, “Trade Facilitation and ‘Hollowing-out of Indian Manufacturing’”, *Economic and Political Weekly*, 49 (4): 57-63.
- Banga, R. (2013)**, ”*Measuring Value in Global Value Chains*” Background Paper No : RVC-8 UNCTAD
- Bhat, T. P., Atulan Guha, Mahua Paul and Partha Pratim Sahu (2007)**, “Estimates of Import Intensity in India’s Manufacturing Sector: Recent Trends and Dimensions” Working Paper no. 2007/08, Institute for Studies in Industrial Development, New Delhi.
- Bhat, T.P. and Mahua Paul (2009)**, “Measurement of Import Intensity of exports in India,” *Journal of income and wealth*, 31(1):81-92.
- Bhattacharya, M (1989)**, “Import-Intensity of Exports: A Case Study of Indian Economy,” *Indian Economic Journal*, 36 (3): 94-98.
- Burange, L.G. (2001)**, “Import-Intensity in the Registered Manufacturing Sector of India,” *Indian Economic Journal*, October–December, 49 (2): 42–52.
- Chen, X., L. Cheng, K.C. Fung and L.J. Lau (2004).** The estimation of Domestic Value-added and Employment Induced by exports: An application to Chinese Exports to United States, Stanford University.
- Daudin, G., C. Rifflart and D. Schweisguth (2010).** Who produces for Whom in the World Economy?, *OFCE Working Paper*, Sciences Po Paris, June.
- Dean, J. M., K.C. Fung, and Zhi Wang (2007).** Measuring the Vertical Specialisation in Chinese Trade, *Office of Economics Working Paper* No. 2007-01-A, U.S.

International Trade Commission. Economic Survey (2013-14), Ministry of Finance, Government of India

**Foreign Trade Policy (2009 to 2014)** published by Government of India; Ministry of Commerce and Industry.

<http://dgftcom.nic.in/exim/2000/policy/ftplcontentE1213.pdf>.

**Grossman, G. M. and E. Rossi-Hansberg (2008)**. Task trade between similar countries. NBER Working Paper 14554.

**Goldar, B. (2013)** “Determinants of Import Intensity of India's Manufactured Exports Under the New Policy Regime.” *Indian Economic Review*, Vol. 48 (1), Special Issue

**Goldar, B. et al (2014)** “Estimates of Productivity Growth for the Indian Economy” published by Reserve bank of India. <http://www.rbi.org.in/scripts/PublicationReportDetails.aspx?UrlPage=&ID=785>

**Hoda A. and Rai D.K. (2014)** “Trade and Investment Barriers affecting International Production Networks in India”; Working Paper No 281; Indian Council for Research on International Economic Relations.

**Hummels, D., J. Ishii, and K. Yi. (2001)**, “The Nature and Growth of Vertical Specialization in World Trade.” *Journal of International Economics* 54:75–96.

**Johnson, R. C. and Guillermo Noguera. (2012)**. “Accounting for Intermediates: Production Sharing and Trade in Value Added.” *Journal of International Economics* 86(2): 224-236.

**Jiang, X, and Milberg W. (2012)**. “Vertical Specialization and industrial upgrading: a preliminary note,” SCEPA Working paper 10.

**Kaplinsky, R. and Fitter, R.(2004)** ‘Technology and Globalization: Who Gains When Commodities are De-commoditized?’, *International Journal of Technology and Globalization, Vol.1, No.1*.

**Kimura, F., Takahashi, Y, and Hayakawa, K (2007)**, ‘Fragmentation and Parts and Components Trade: Comparison between East Asia and Europe’ *North American Journal of Economics and Finance*’ 18(1), 23-40.

**Koopman, R, Z. Wang and S. Wei (2008)**. How much of Chinese exports is really made in China? Assessing domestic value-added when processing trade is pervasive, *NBER Working Paper series* n. 14109.

**Koopman, R., W. Powers, Z. Wang and S. Wei (2010)**. Give credit where credit is due: tracing value added in global production chains, *NBER Working Paper series* n.16426.

- Koopman, R, Zhi Wang and Shang-Jin Wei. (2012).** “Estimating domestic content in exports when processing trade is pervasive.” 99(2012):178-189, *Journal of Development Economics*
- Kraemer, K. and J. Dedrick (2002).** Dell computer: Organization of a global production network. Unpublished manuscript, Personal Computing Industry Center, UC Irvine.
- Los,Bart,Marcel P. Timmer, and Gaaitzen J. de Vries.(2015)**”How Global are Global Value Chains?A New Approach to Measure International Fragmentation” *Journal of Regional Science*, Vol. 55, No. , pp. 66–92
- Milberg, W. (2009)** “Shifting Sources and Uses of Profits: Sustaining US Financialization with Global Value Chains”, Schwartz Center for Economic Policy Analysis. The New School. SCEP
- Ng, F and Yeats. A (2001).** Production Sharing in East Asia ; Who Does What for Whom , and Why? In L. K. Cheng and H. Kierzkowski , eds. *Global Production and Trade in East Asia*. Boston; K.Kluwer Academic Publisher. pp. 63-109.
- Sathe, D. (1995),** “Impact of Diversification of Composition of Exports: An Analysis of the Linkages of Indian Exports,” *Journal of Indian School of Political Economy*, Jan-March. 7(1):94-103.
- Sathe, D. (1997),** “Import Intensity of India's Exports: Some Fresh Evidence,” *Economic and Political Weekly*, 32(8): M31-M44.
- Siddharthan, N. S. (1989):** “Impact of Import Liberalisation on Export Intensities - A Study of the Indian Private Corporate Sector.” *Indian Economic Journal*, 37(2): 103-111.
- Tempest, R. (1996).** Barbie and the world economy. *Los Angeles Times* September 22.
- Tiwari M, Veeramani C and Singh M. (2014)** “*The potential for involving India in regional production networks: Analyzing networked production and vertically specialized trade patterns between India and ASEAN*”

## Appendix

**Table A1: Commodity wise Export to domestic production ratio for network product groups; 1998 to 2007**

<b>IOTT commodity code</b>	<b>commodity description</b>	<b>1998-99</b>	<b>1999-00</b>	<b>2000-01</b>	<b>2001-02</b>	<b>2002-03</b>	<b>2003-04</b>	<b>2004-05</b>	<b>2005-06</b>	<b>2006-07</b>	<b>2007-08</b>
<b>88</b>	Electrical industrial Machinery	0.03	0.03	0.05	0.05	0.04	0.05	0.05	0.04	0.05	0.06
<b>89</b>	Electrical wires & cables	0.01	0.01	0.03	0.03	0.05	0.06	0.07	0.06	0.08	0.09
<b>90</b>	Batteries	0.04	0.04	0.10	0.09	0.09	0.10	0.06	0.07	0.06	0.05
<b>91</b>	Electrical appliances	0.05	0.06	0.10	0.10	0.09	0.13	0.11	0.12	0.14	0.10
<b>92</b>	Communication equipments	0.04	0.04	0.06	0.08	0.07	0.09	0.07	0.08	0.10	0.09
<b>93</b>	Other electrical Machinery	0.72	0.85	0.86	1.21	1.31	1.36	0.86	0.92	1.02	0.95
<b>94</b>	Electronic equipments(incl.TV)	0.06	0.12	0.17	0.23	0.11	0.22	0.22	0.11	0.15	0.11
<b>97</b>	Motor vehicles	0.06	0.04	0.06	0.06	0.06	0.08	0.06	0.09	0.09	0.09
<b>98</b>	Motor cycles and scooters	0.18	0.16	0.20	0.18	0.20	0.17	0.14	0.14	0.12	0.14
<b>99</b>	Bicycles, cycle-rickshaw	0.02	0.01	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01
<b>100</b>	Other transport equipments	0.01	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01
<b>101</b>	Watches and clocks	0.09	0.16	0.19	0.21	0.27	0.31	0.40	0.14	0.15	0.14
<b>102</b>	Medical, precision & optical instruments	0.06	0.06	0.11	0.12	0.13	0.11	0.11	0.13	0.13	0.10
<b>105</b>	Miscellaneous manufacturing	0.12	0.11	0.12	0.09	0.10	0.11	0.15	0.15	0.15	0.15
<b>Total</b>		0.06	0.06	0.09	0.09	0.09	0.10	0.08	0.10	0.10	0.10

*Source:* Authors' computation based on ASI, and export import database published by the ministry of commerce

**Table A2: Commodity composition of Import to domestic production ratio for network product groups. 1998 to 2007**

<b>IOTT commodity code</b>	<b>commodity description</b>	<b>1998-99</b>	<b>1999-00</b>	<b>2000-01</b>	<b>2001-02</b>	<b>2002-03</b>	<b>2003-04</b>	<b>2004-05</b>	<b>2005-06</b>	<b>2006-07</b>	<b>2007-08</b>
<b>88</b>	Electrical industrial Machinery	0.04	0.05	0.06	0.06	0.07	0.07	0.08	0.06	0.05	0.07
<b>89</b>	Electrical wires & cables	0.05	0.05	0.08	0.13	0.12	0.14	0.19	0.14	0.12	0.19
<b>90</b>	Batteries	0.06	0.08	0.10	0.10	0.11	0.13	0.15	0.20	0.20	0.26
<b>91</b>	Electrical appliances	0.07	0.09	0.15	0.18	0.14	0.17	0.23	0.26	0.33	0.26
<b>92</b>	Communication equipments	0.23	0.29	0.36	0.54	0.62	0.84	0.96	1.46	1.37	1.34
<b>93</b>	Other electrical Machinery	1.46	1.34	1.13	1.41	1.75	1.89	1.32	1.39	1.67	1.56
<b>94</b>	Electronic equipments(incl.TV)	0.31	0.49	0.61	0.58	0.51	0.63	0.85	0.56	0.92	0.81
<b>97</b>	Motor vehicles	0.03	0.04	0.03	0.03	0.02	0.03	0.02	0.03	0.03	0.04
<b>98</b>	Motor cycles and scooters	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.02	0.04	0.06
<b>99</b>	Bicycles, cycle-rickshaw	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>100</b>	Other transport equipments	0.03	0.02	0.01	0.02	0.05	0.04	0.04	0.04	0.04	0.10
<b>101</b>	Watches and clocks	0.10	0.17	0.12	0.12	0.16	0.17	0.30	0.22	0.31	0.36
<b>102</b>	Medical, precision & optical instruments	0.36	0.29	0.45	0.41	0.40	0.33	0.34	0.45	0.43	0.34
<b>105</b>	Miscellaneous manufacturing	0.69	0.58	0.44	0.47	0.58	0.51	0.70	0.73	0.75	0.91
<b>Total</b>		0.13	0.13	0.16	0.18	0.20	0.22	0.19	0.24	0.24	0.27

Source: Authors' computation based on ASI, and export import database published by the ministry of commerce



**LATEST ICRIER'S WORKING PAPERS**

<b>NO.</b>	<b>TITLE</b>	<b>AUTHOR</b>	<b>YEAR</b>
331	LABOUR REGULATIONS IN INDIA: IMPROVING THE SOCIAL SECURITY FRAMEWORK	ANWARUL HODA DURGESH K. RAI	JANUARY 2017
330	LAW, SKILLS AND THE CREATION OF JOBS AS 'CONTRACT' WORK IN INDIA: EXPLORING SURVEY DATA TO MAKE INFERENCES FOR LABOUR LAW REFORM	JAI VIR SINGH DEB KUSUM DAS HOMAGNI CHOUDHURY PRATEEK KUKREJA	SEPTEMBER 2016
329	HARVESTING SOLAR POWER IN INDIA!	ASHOK GULATI STUTI MANCHANDA RAKESH KACKER	AUGUST 2016
328	A MORE SUSTAINABLE ENERGY STRATEGY FOR INDIA	MONTEK AHLUWALIA HIMANSHU GUPTA NICHOLAS STERN	JULY 2016
327	INDIA'S INFORMAL TRADE WITH PAKISTAN	NISHA TANEJA SAMRIDHI BIMAL	JULY 2016
326	INDIA – PAKISTAN TRADE: TEXTILES AND CLOTHING	NISHA TANEJA SAON RAY DEVYANI PANDE	JUNE 2016
325	IMPROVING TAXATION ENVIRONMENT: ATTRACTING FOREIGN DIRECT INVESTMENT	R. R. SINGH	JUNE 2016
324	FINANCIAL SECTOR LEGISLATIVE REFORMS COMMISSION (FSLRC) & FINANCIAL SECTOR REGULATION IN INDIA	JAIMINI BHAGWATI M. SHUHEB KHAN RAMAKRISHNA REDDY BOGATHI	JUNE 2016
323	URBAN WATER SYSTEMS IN INDIA: A WAY FORWARD	MIHIR SHAH	MAY 2016
322	SURVEILLANCE OF CHRONIC DISEASES: CHALLENGES AND STRATEGIES FOR INDIA	UDAYA S MISHRA S IRUDAYA RAJAN WILLIAM JOE ALI MEHDI	MAY 2016
321	PREVENTION OF CHRONIC DISEASES: REORIENTING PRIMARY HEALTH SYSTEMS IN INDIA	ALI MEHDI DIVYA CHAUDHRY PRIYANKA TOMAR PALLAVI JOSHI	MAY 2016
320	INNOVATION (AND UPGRADING) IN THE AUTOMOBILE INDUSTRY: THE CASE OF INDIA	SAON RAY SMITA MIGLANI	MAY 2016
319	THE IMPACT OF GLOBAL LABOUR STANDARDS ON EXPORT PERFORMANCE	KUNTALA BANDYOPADHYAY	MAY 2016

## About ICRIER

Established in August 1981, ICRIER is an autonomous, policy-oriented, not-for-profit, economic policy think tank. ICRIER's main focus is to enhance the knowledge content of policy making by undertaking analytical research that is targeted at informing India's policy makers and also at improving the interface with the global economy. ICRIER's office is located in the institutional complex of India Habitat Centre, New Delhi.

ICRIER's Board of Governors includes leading academicians, policymakers, and representatives from the private sector. Dr. Isher Ahluwalia is ICRIER's chairperson. Dr. Rajat Kathuria is Director and Chief Executive.

ICRIER conducts thematic research in the following eight thrust areas:

- Macroeconomic Management Financial Liberalization and Regulation
- Global Competitiveness of the Indian Economy
- Multilateral Trade Negotiations and FTAs
- Challenges and Opportunities of Urbanization
- Climate Change and Sustainable Development
- Physical Infrastructure including Telecom, Transport and Energy
- Asian Economic Integration with focus on South Asia
- Promoting Entrepreneurship and Skill Development

To effectively disseminate research findings, ICRIER organises workshops, seminars and conferences to bring together academicians, policymakers, representatives from industry and media to create a more informed understanding on issues of major policy interest. ICRIER routinely invites distinguished scholars and policymakers from around the world to deliver public lectures and give seminars on economic themes of interest to contemporary India.

