IMPACT OF TRADE LIBERALISATION ON THE INDIAN ELECTRONICS INDUSTRY:
Some Aspects of the Industrial Policy Dynamics of Global Value Chain Engagement

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CONTENTS

List of Figure(s)

List of Table(s)

Impact of Trade Liberalisation on the Indian Electronics Industry: Some Aspects of the Industrial Policy Dynamics of Global Value Chain Engagement*

Smitha Francis*

[***Abstract***: *This paper examines the interplay between trade liberalisation and industrial policies and its implications for industrial restructuring in order to understand how trade liberalisation has influenced Indian electronics firms' engagement in global value chains. The domestic electronics industry's pre-liberalisation development trajectory shows that there were inadequate government-directed efforts for creating technological capabilities and scale in domestic firms, and for developing synergies at the industry level. As a result, the industry's premature exposure to severe external competitive pressures with rapid trade liberalisation of the computer and telecommunications industries under the WTO's ITA-1 from 1997 became a major obstacle in its subsequent development. A significant part of the learning process required for technological catch-up and potential for systemic synergies was further lost because direct imports took over and domestic manufacturing was avoided in the case of a large number of products in the absence of strategic industrial policy support. Moreover, under successive governments' liberal FDI regimes, there were nil or ineffective industrial policy measures in place linking foreign-invested firms and the domestic supplier base to ensure positive spill-over effects. These policy failures to correct for market failures were compounded by India's FTAs with East and Southeast Asian countries, with the latter extending tariff liberalisation to consumer electronics and professional, medical, and scientific instruments. The deep and broad trade liberalisation, the liberal FDI regime, and the absence of vertical industrial policies have together removed tariff-hopping and other policy-driven incentives for MNCs and domestic firms to undertake local production. The consequences are revealed in the continuously growing electronics imports and in the particular nature of India's two-way trade in electronics products. In the case of all the major trade partners, analysis of India's bilateral intra-industry trade (IIT) undisputedly established that the rise in intra-industry trade involving both horizontal and vertical differentiation has only contributed to India's rising trade deficit with each of them. The paper argues that along with vertical industrial policies for upgrading firm- and industry-level productivity and improved infrastructure, a calibrated*

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approach towards trade and FDI policies such that they do not negate incentives for value adding local production is an imperative for enabling domestic firms to engage in global value chains in a sustainable manner.]

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***Keywords**: Indian electronics industry, intra-industry trade, free trade agreements, sectoral agreements, ITA-1, WTO-plus trade liberalisation, industrial policy, global value chains*

1. Introduction

With India's industrial production figures on a decline, there has been much discourse on manufacturing sector revival strategies. Despite the fact that the capabilities which India had accumulated on the eve of the 1990s' reforms are a legacy of her domestically-oriented industrial policies in the post-independence decades and that these have played a critical role in her development trajectory, it is common to relate the faster growth rates in Indian exports and the export success of a few sectors solely to the post-1991 import liberalisation and export promotion policies (Francis and Kallummal 2013). Misinterpreting the causal interactions between trade liberalisation, industrial policy, and indigenous capability development can lead to wrong inferences and result in inappropriate policy formulations. Towards this, it is important to examine the interactions between trade liberalisation and other industrial policies and the attendant restructuring dynamics in particular industries in a systematic manner. This is critical in strategic sectors like electronics, chemicals, transport equipment, pharmaceuticals, machinery, etc. as well as in labour-intensive industries. The present study attempts to examine the interplay between trade liberalisation and industrial policy dynamics and its implications for domestic manufacturing sector development trajectory by focussing on the electronics industry.

The electronics industry is strategic for any country because of the wide applicability of these products and technologies across sectors, and their economy-wide productivity-enhancing impact. At present, while India is considered a "global super power" in the IT services sector, the electronics industry is one of the top contributors to India's merchandise imports. After nearly two decades of trade liberalisation, the gap between country's electronics demand and domestic production capacity has only been widening. Further, according to the National Electronics Policy 2012, the value addition in domestically produced electronics products ranged between only 5 to 10 per cent in most cases.

Several parallel processes of trade and investment liberalisation have impacted the electronics industry in India. One of these is the Information Technology Agreement (ITA-1) signed by India in 1996, which is a plurilateral agreement of the WTO. ITA-1 was designed to achieve elimination of all entry barriers on information technology products in six product groups, namely, computers, telecom equipment, semiconductors, semiconductor manufacturing and testing equipment, software, and scientific

instruments. India also undertook trade liberalisation under its comprehensive Free Trade Agreements (FTAs) with East and Southeast economies such as Singapore, ASEAN, Japan, South Korea, and Malaysia. It must be remembered that this has occurred in a context wherein India has been continuously liberalising its foreign direct investment (FDI) policies since 1991.

Trade liberalisation through FTAs has been argued to enable rapid and "efficient industrial restructuring"[1] by allowing countries to participate in global production networks and global value chains (GVCs). As well recognised, production sharing between countries by multinational corporations (MNCs) involved in regional or global production networks typically leads to an expansion in two-way trade (simultaneous increase in exports and imports) across those countries, in particular, intra-industry trade in intermediate goods (Athukorala (2003), Fukao, Ishido and Ito (2003), and Haddad (2007)). Analysis based on the Harmonised System (HS) categorisation of trade flows at the 2-digit level showed that there has been a significant increase in two-way trade in India's global trade in electrical machinery and non-electrical machinery, apart from others such as petroleum & petroleum products, gems & jewellery, organic chemicals, articles of iron and steel, automobiles, etc. In addition to these sectors, India has witnessed increased two-way trade with Indonesia, Malaysia, Thailand, and Singapore in the category of optical, photo, technical, and medical, apparatus also (Francis 2011). It should be noted that the HS chapters of electrical machinery, non-electrical machinery, and optical, photo, technical, and medical apparatus together constitute most of the electronics products.

The increase in India's two-way trade with these Southeast economies has been linked to the industrial restructuring being carried out by MNCs in the region, in response to the WTO-plus trade liberalisation that India began undertaking with these countries under the Early Harvest Program of the Thai-India FTA (2004) and the Comprehensive Economic Cooperation Agreement (CECA) with Singapore in 2005 (Kumar 2007 and Francis 2009). Francis and Kallummal (2013) argued further that the significant increase observed in India's two-way trade in intermediate products with these countries would point towards India's growing involvement with GVCs centred on ASEAN and China. It was also argued that the emerging MNC-driven industrial restructuring involving India and the East Asian economies was likely to intensify in particular industries, including the electrical and non-electrical machinery industries, following the entry into force of the overlapping FTAs with ASEAN, South Korea, Japan, and Malaysia (Francis 2015b).

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[1] India's participation in FTAs, especially with the East and Southeast Asian economies, had been argued to offer mutually beneficial linkages through dynamic industrial restructuring within the region leading to greater competition and improved efficiency; as well as gains from greater inter- and intra-industry specialisation, economies of scale, and learning-by-doing (Francis and Kallummal 2013 and Francis 2015b).

Apart from foreign MNCs, however, industry-level restructuring in response to trade liberalisation clearly involves consequent changes in domestic firms' business strategies too. As a result, production restructuring undertaken by the latter also contributes to changes in the industry's trade pattern. That is, rapid and deep trade liberalisation through overlapping FTAs has wider ramifications for domestic industrial development than currently acknowledged (Francis and Kallummal 2013). This case study of the electronics industry is an attempt to examine these issues empirically.

1.1 Statement of the Problem and Methodology

The increase in India's two-way trade with Southeast Asian economies seems to offer preliminary evidence of India's integration into electronics industry value chains. However, whether India obtains broad-based productivity benefits from the opportunities for MNC-driven industrial restructuring arising from trade liberalisation (such as greater inter- and intra-industry specialisation, economies of scale, and learning-by-doing) depends on India's position in the value chain for particular products (Francis and Kallummal 2013). This is because the division of labour in a specific product is the fundamental determinant of how the value added and profits are distributed among different countries involved in its value chain. Above all other factors, division of labour in GVCs, particularly under tariff-free trade, is based on countries' relative technological capabilities.[2] That is, the nature of participation of a country in an industry's GVCs (under tariff-free trade) can be a reasonable proxy for the level of national technological capabilities in that particular industry. To the extent that India is involved in production networks in the electronics industry, it is expected to be reflected in high shares of intra-industry trade (IIT) in intermediate products.

However, the rapid trade liberalisation under the ITA-1 and the subsequent WTO-plus liberalisation under India's comprehensive FTAs in the region have significantly changed the incentives facing producers in the Indian electronics industry. At one level, in the context of a liberal investment policy regime that had nil or ineffective industrial policy measures in place to develop competitive indigenous production and technological capability build-up,[3] deep trade liberalisation under overlapping FTAs not only enlarges the market, but also removes the tariff-hopping and other policy-driven incentives for

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[2] Also see the empirical evidence from UNCTAD (2012 and 2016).

[3] Here the reference is to vertical industrial policies which seek to influence the pattern of national industrial development by policy interventions that guide and promote investment domestically towards new activities and sectors with higher productivity, better paid jobs and greater technological potential (i.e., increasing returns activities). Policies aimed at promoting backward and forward linkages between foreign-invested enterprises and domestic supplier firms in particular sectors also belong to this category. In contrast, horizontal industrial policies seek to improve infrastructure, business entry and exit regulations, taxation and customs administration, investment promotion and facilitation, etc., while carrying out hands-off trade and financial liberalisation to allow greater play of market forces.

MNCs to maintain parallel operations in India along with other countries for the same product lines. This leads them to rationalise their operations to exploit "locational advantages". That is, MNCs can meet the demand in specific regional or even global markets in particular products through affiliates in particular countries and choose to close similar production facilities in others (Kumar 2007, Francis and Kallummal 2013, and Francis 2015b). At another level, deep and broad trade liberalisation- in the absence of industrial policies to build up national technological capabilities and a competitive domestic production base- , also increases domestic firms' incentives for importing raw materials and intermediate products from FTA partners to carry out local assembly of final products, or may completely remove their incentive to undertake any local production/assembly and lead to increased trading in electronics.

Thus all two-way trade observed at an aggregated level may not be a reflection of IIT at the product level. If India has adequate production capabilities in several product lines, it would help integrate India into GVCs, which would get reflected in an increase in IIT at sufficiently dis-aggregated product levels**.** If that is not the case, trade liberalisation under the ITA-1 and FTAs would have only led to increased import dependence, and therefore, an increase in inter-industry trade when we consider data at the product level. It would appear that the latter would be a clear-cut outcome if there was no attempt on the government's part to develop domestic technological and manufacturing capabilities, and to support indigenisation of production by foreign-invested companies prior to and along with tariff liberalisation. Trade flow analysis at a sufficiently disaggregated level is therefore needed to examine the nature of the observed increase in India's electronics two-way trade. This is crucial to understanding the development trajectory and the level of national sufficiency in this strategic industry.

While the traditional Grubel-Lloyd (GL) index can be applied for any level of aggregation, it does not capture the nature of specialisation involved in intra-industry trade (IIT) as distinguished between horizontal and vertical product differentiation. IIT itself can be: IIT in horizontally differentiated (i.e. similar priced) products and IIT in vertically differentiated products (i.e. differing by quality, and hence, price) (Fontagné *et al*. 1996). VIIT is characterised by differences in created capabilities (rather than static factor endowments), which play the critical role in the division of labour in GVCs. An increase in VIIT in bilateral trade flows at a product level may therefore be considered as reflecting increased participation in GVCs (more later).

Towards examining these issues, this study involves analysis of the structural changes in the pattern of trade flows in the electronics industry since the 1990s and analysing the industrial policy dynamics that has impacted this restructuring. In particular, trade liberalisation under the ITA-1 and the recent FTAs are examined. The analysis will seek to understand the extent to which increased two-way trade in the electronics industry reflects increase in vertical IIT due to India's involvement in electronics industry value chains and explore India's position along the value chain.

Given our focus on trade flows, the study involved identifying and collating trade data that is available in the HS classification, which is concordant with the International Standard Industrial Classification (ISIC). This study uses trade flow data at the HS 6-digit level available from the WITS website. Data based on the 1996 HS nomenclature is used, for which the time series starts with 1996 data, the year before ITA-1 entered into force.

Under the HS 1996 nomenclature, there are a total of 5113 items at the 6-digit level. Starting from the ISIC Rev.1 categories of non-electrical machinery and electrical machinery, we used concordance tables between various ISIC revised classifications to arrive at ISIC Rev.3 categories (at the 4-digit level) representing electronics sub-sectors. Subsequently, we used concordance between ISIC Rev. 3 and HS 1996 to arrive at a list of HS products belonging to the electronics industry. A definition guide to the electronics industry from the World Electronics Yearbook that gives HS 4-digit level product groups of electronics industry sub-sectors (that are concordant with SITC Revision 3) was also used while finalising the list of HS 1996 products chosen as belonging to the electronics industry. The final comprehensive list of 372 products at the HS 6-digit level also included some products like unrecorded media (see *Annexe 1*).

The remainder of this paper is organised as follows. Following a brief discussion on the post-independent evolution of industrial policy in the electronics industry, Section 2 analyses the nature of trade liberalisation under the ITA-1 and FTAs. Section 3 carries out an in depth analysis of electronics industry trade flows. Section 4 enquires into the nature of the observed two-way trade for understanding the development of IIT involving India's major trading partners. This involves the decomposition of India's bilateral electronics industry trade flows into inter-industry trade, horizontal IIT, and vertical IIT and estimating them using the methodology described therein. Section 5 makes concluding observations.

2. Industrial Policy and Trade Liberalisation in the Electronics Industry

2.1 Industrial Policy Dynamics in the Electronics Industry: A macro view

India had stressed upon indigenous technological capability development early on in its independent history. By the late 1960s, the concept of IT as an industry had begun to take root as a direct outcome of government-supported programmes and policies (Kallummal, 2012). On the electronics hardware front, while the Indian government had pursued a highly restrictive policy framework for electronics industry in favour of self-reliance in the post-independence period, there was limited opening up in the early 1980s, which involved a series of reforms for ensuring a greater play of market forms. The industry experienced significant growth in the 1980s as compared to the late 1970s (Joseph 1989 and Majumdar 2010).

One of the industrial policy measures that pushed Indian IT software firms to strive for competitiveness was the fact that these firms were required to export software in the

early days of the industry, while the government provided most of the infrastructural support. On the other side, the high tariffs for the hardware sector meant that there was some domestic production of hardware products including PCs, peripherals, and components. This was aided by the general reduction in duty on components and liberal import of capital goods for component manufacture under the Components Policy of 1981. Meanwhile, all segments of the domestic PC industry grew under high tariffs and quantitative restrictions.

However, the nature of incentives for software exports and the absence of vertical industrial policies led to a disconnect between subsequent boom in software export growth and the domestic IT hardware and telecommunication production trajectories. This is despite the fact that the Telecommunication Policy of 1984 had opened up telecom equipment manufacture to the private sector and the Computer Policy of the same year had allowed all Indian companies to enter all segments of the computer industry without any capacity restrictions. In fact, the mid-1980s saw the highest number of industrial licences and letters of intent in electrical equipment and telecommunication (Majumdar 2010, p. 73). The 1984 Computer Policy had also emphasised that planning for software development must be integrally connected with the plan for hardware development and system engineering. But under the Computer Software Policy of 1986, import of computer systems on a custom duty free basis was allowed for 100 per cent software export, without reference to indigenous angle clearance.[4] This is a clear reflection of the lack of coherence in the industrial policies of the time. Similar policies were continued under the Software Technology Parks of India (STPI) Scheme launched in 1990. Given that the governments did not seek to link the increase in demand for computers that originated from the growth of software exports to domestic hardware producers through vertical industrial policies, this meant that the local IT hardware and related component producers did not benefit from the growth in software exports either to realise the economies of scale necessary to make them viable, or by facing the competitive pressure to build up technological capabilities along with advancements in the ICT sector. There was inadequate policy focus to push existing domestic producers in computers, telecommunication equipment, or parts and components to improve their productivity.

By the 1990s, the computer sector had come to be characterised by three segments: premium producers like Wipro who controlled the upper-end market; large volume producers like Sterling Computers and HCL who survived on lower per unit margins; and finally, a large number of assemblers catering to the lower-end market (Chandrasekhar 2005, 70). But the disconnect between the growth of the software and hardware segments of the Indian information and communication technology (ICT) sector had become entrenched with the initiation of export-oriented economic reforms from the early 1990s. This presents a significant contrast to the electronics industry development trajectories in countries such as Singapore, South Korea, or Taiwan, where

[4] See Table 1 on page 5 in Kumar and Joseph (2004), and also pp. 4–6.

the governments adopted various combinations of vertical industrial policies for production upgradation and skill development in selected industry segments within an overall industrial development strategy, which involved performance-linked incentivisation to induce productivity growth while pursuing simultaneous trade strategies of import substitution and export promotion.[5]

It appears that the Indian state, which was able to identify the developmental opportunities in the software sector way back in the sixties and seventies, was myopic when it came to the electronics manufacturing sector. This may be attributed to three factors. Firstly, the government failed to build on the synergies that arise from the integral interconnectedness of the software sector and the ICT hardware sectors through coherent and coordinated industrial policies. Secondly, there was a misreading of the software export success sector. The proponents of economic reforms in 1991 attributed the growing export potential of the software sector to its "comparative advantage", while paradoxically, the export success that India has had in software exports was based on the "acquired comparative advantage" developed through explicit and implicit public policy support consistently since the 1950s, along with a strategic alliance between the public and the private sectors.[6] Thirdly, from the early 1990s onwards, partly due to BoP concerns and partly owing to the increased negotiation strength of software firms arising from their export success, the export interests of software firms increasingly came to dominate the policymaking framework, and contributed to relegating any erstwhile policy intention of developing national capabilities in the hardware sector to the backburner (Kallummal and Francis, 2012).

In the telecom equipment sector, even though the country had built up considerable capability in the design and manufacture of digital switching equipment domestically – led by public sector research and manufacturing firms and aided by the public procurement policy of the government – the lack of "a credible innovation policy and proper technology forecasting" meant that the domestic telecom research sector did not create enough capability in mobile switch technologies which began gaining prominence in the 1990s (Mani 2005, p. 315). After the government had opened up the telecom equipment sector to 100 per cent FDI in 1991, five leading MNCs had set up manufacturing facilities in India in the early 1990s – Alcatel, Lucent Technologies, Ericsson, Siemens, and Fujitsu[7] – owing to the public procurement policy of the then main domestic consumer, the Department of Telecom. Consequently, when the increase in domestic demand for telecom equipment following the de-licensing of telecom services in 1999 came to be driven by growth in the cellular mobile and internet services segments, the shift away from fixed switches benefited these global players, all of whom have been involved in assembly (Mani 2005, pp. 287–315). As of now, the Indian telecom

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[5] See detailed discussions in Lall (1996), Wade (1990), Amsden (2001 and 2006), etc.

[6] See Kallummal (2012), Saraswati (2013), Mathur (2007), Saith and Vijayabaskar (2005), and Kumar and Joseph (2004).

[7] Some of these were joint ventures. See Mani (2005).

manufacturing sector is dominated by Alcatel and Ericsson, and more recently, by Huawei and ZTE (Ernst 2014, p. 3).

In the case of the consumer electronics industry, although internal liberalisation (relaxation of licensing requirements) took place in 1996 and import liberalisation occurred only later under the FTAs, the lack of government policies pursuing indigenous capability build-up meant that domestic producers did not invest in scale or new technologies during the period of protection. Thus they could not adjust to the increased competition from foreign investors who had set up local production. Consequently, this segment has also been dominated by MNCs such as Sony, LG, Samsung, etc.

Similarly, the lack of a strategic policy thrust for developing strong and varied technological capabilities has meant that while India currently has a strong integrated circuit (IC) design base located within MNCs, Indian chip design engineers lack the breadth and depth in capabilities required for semiconductor fabrication, component manufacturing, as well as in system design and systems manufacturing (Ernst 2014, p. 24).

2.2 Trade Liberalisation under the ITA-1 and FTAs

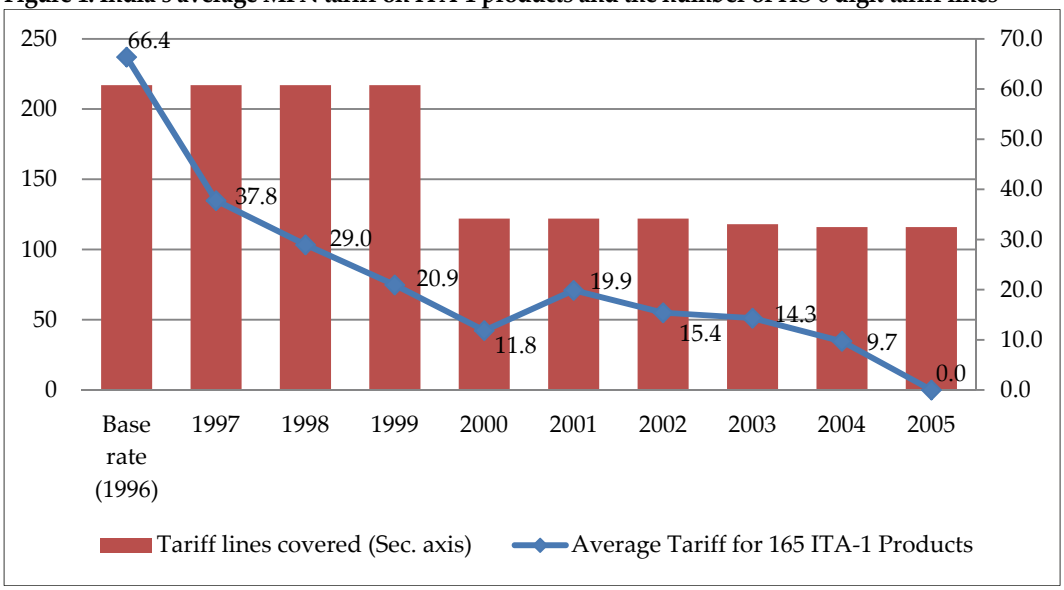
Given the incoherence in industrial policy approach cemented by an understanding of market-led industrialisation that gives credence only to passive industrial policies, India's decision to join the ITA-1 in 1996 was driven by the government's belief that lowering duties on a range of ICT products under the ITA-1 would boost the competitive advantage of India's software exports. The ITA-1 was designed to establish tariff-free trade in a total of 165 products belonging to computers, telecom equipment, semiconductors, semiconductor manufacturing and testing equipment, software and scientific instruments.

Under the mandate of the ITA-1, the participating countries had agreed to eliminate all tariffs as well as other duties and charges on these products in four equal stages in 1997, 1998, 1999 and 2000. But under the Special and Differential Treatment (S&DT) principles, the developing country signatories of ITA-1 – Costa Rica, Indonesia, India, South Korea, Malaysia, Chinese Taipei, and Thailand – had flexibility in cutting their tariffs to zero by 2005.

India's 1996 average base duty of 66.4 per cent on the 165 products dropped to 37.8 per cent in March 1997. The average tariff continued to drop at regular intervals to 12 per cent in 2000 and further to about 10 per cent in 2004, and was completely eliminated by 2005 (Kallummal, 2012). In fact, the narrow policy focus on IT software export promotion meant that India stood out among developing countries in average applied tariff reduction as well as in terms of the number of tariff lines that were brought under concessions.[8]

[8] India offered concessions on 66 per cent of its pre-ITA-1 tariff rates (Ernst, 2014; p. 19). This was far greater than the concessions of even a country like Thailand (30.9 per cent), which was well

Figure 1: India's average MFN tariff on ITA-1 products and the number of HS 6 digit tariff lines



Source: Kallummal (2012)

However, as shown in Majumdar (2010), tariff liberalisation and increase in foreign investments from the early 1990s or other policies such as decrease in industrial licensing and reduction in excise duties, did not result in greater competition and improved productivity in the electronics hardware industry. This study analysed total factor productivity growth (TFPG) for organised sector electronics firms for two periods 1993–98 and 1999–2004. As compared to the first period, all the four sub-sectors, computer hardware, consumer electronics, telecommunication, and components, had witnessed a significant net decline in TFPG in the second period after external liberalisation was intensified from 1997 onwards under the ITA-1. The poor productivity growth of electronics firms despite liberalisation was explained by the fact that as competition increased due to liberalisation, R&D per sales witnessed a sharp decline for firms in the industry. R&D expenditure as a percentage of capital imports also decreased substantially for the computer hardware and consumer electronics sub-sectors (Majumdar 2010, p. 76). This clearly reflected the shift in firms' preference to undertake investments to assimilate imported technology rather than develop in-house technology through R&D, in the absence of any industrial policy emphasis on promoting indigenous technological development.

Thus when protection was withdrawn, the small computer assemblers were in no position to use the opportunity afforded by protection to build capabilities of a kind that would allow them to compete with large international suppliers (Chandrasekhar 2005). On the other hand, with the government not enforcing any programs of R&D-based

integrated into electronics production networks and might have stood to gain from the trade liberalisation.

competitive production in the premium segment, the premium producers chose to enjoy the large profit margins, and also did not concentrate on developing indigenous sources of supply of components and accessories for reducing costs, or on developing innovation capabilities.[9] As a result, many of them moved into trading or other activities. The same was true of the other sub-sectors too. For example, in the telecom equipment industry, printed circuit boards (PCBs) and other components account for around 90 per cent of the product cost. But currently, with the exception of cable harnesses and packaging, no such components are produced in India (Ernst 2014, p.2), which has led to higher import dependence among telecom assemblers. In the absence of productivity growth, only domestic firms that cater to demand for low end technological products would be able to survive increased external competition.

While this was the state of productivity performance in the Indian electronics industry by the mid-2000s, the impact of ITA-1 was exacerbated by the equally non-strategic tariff liberalisation carried out by India under its FTAs with ASEAN, Japan, and South Korea – countries that are already deeply integrated into global electronics value chains.

The India-ASEAN FTA came into force in 2010. Out of the total 216 non-ITA-1 electronics tariff lines (at the HS 6-digit level) for which India made tariff liberalisation commitments to ASEAN, only 11 were kept in the Sensitive Track and two were excluded.[10] India made 170 non-ITA-1 tariff lines duty free by 2013 (Normal Track-1) (*Table 1*). For 96 tariff lines, this trade liberalisation was drastic as their MFN tariff in the base year 2007 was 10 per cent, which was reduced to zero over just three years between 2010 and 2013. Another 73 products saw their tariffs reduced from 7.5 per cent to zero in 2013 (*Table 2*).

Table 1: Distribution of Non-ITA-1 Electronics Products Liberalised under the India-ASEAN FTA
(Number of HS 6-digit tariff lines)

Base MFN rate in 2007 ***(Per cent)***	*0*	*7.5*	*10*	*Total*
Excluded List	0	2	0	2
Normal Track-1	1	73	96	170
Normal Track-2	0	21	12	33
Sensitive Track	0	6	5	11
Total non-ITA tariff lines	**1**	**102**	**113**	**216**

Source: Author's calculation based on India's tariff reduction schedule with ASEAN-5 in India-ASEAN FTA

Importantly, another 33 tariff lines became duty free in 2016 (Normal Track-2). These include products and parts like loudspeakers and their parts, TV picture tubes of 20", etc.

[9] Chandrasekhar (2005, pp. 71–2).

[10] Interestingly, one of these already had an MFN duty of zero in 2007.

Table 2: Major Non-ITA-1 Electronic Products that became Tariff-free in 2013 under the India-ASEAN FTA

Products with base year (2007) duty of 10 per cent	*Products with base year (2007) duty of 7.5 per cent*
Professional video tape recorders, radio broadcast receivers, electric air heaters, cooking devices, personal weighing machines, electrical signalling/traffic control equipment for railways and their parts, other electric sound or visual signalling apparatus and their parts, photographic/cinematographic equipment like cameras, projectors, instant print cameras, etc. and their parts, etc. Microwave tubes (magnetrons, klystrons etc.), parts of cathode-ray tubes, TV camera tubes, vacuum tubes and other valves, etc.	Radar apparatus, communication jamming equipment, transformers, photocopy machines, office-type offset printing machinery, automatic circuit breakers, navigational instruments, range of equipments used in medical, surgical, dental or veterinary sciences including MRI and X-ray machines and their parts, measuring and checking instruments and their parts, etc.
Number of products = 96	Number of products = 73

Source: Author's compilation based on India's tariff reduction schedule with ASEAN-5 in India-ASEAN FTA

It is important to note that while consumer electronics and professional apparatus such as video cameras, photocopiers, medical equipments, etc. were not included under ITA-1 tariff liberalisation, several of them got liberalised under the ITA-1-plus tariff reduction schedules under the FTAs.

In the case of India's CEPA with South Korea, which also came into force in 2010, 8 non-ITA-1 product lines (E0; 2010) that had MFN duty of 12.5 per cent in the base year 2006 came under duty free trade immediately (*Table 3*). However, in five years, that is, from January 2014, another 60 tariff lines (E-5) with MFN duty of 12.5 per cent in 2006 came under duty free trade (E-5). A further 277 lines (E-8) became tariff free from January 2016. Only products listed under the excluded category (EXC) are totally exempt from tariff reduction.

Table 3: Distribution of Non-ITA-1 Electronic Products Liberalised under the India-South Korea CEPA (Number of HS 6-digit tariff lines)

Base MFN rate in 2007 (Per cent)	*E-0*	*E-5*	*E-8*	*EXC*	*RED*	*SEN*	*Total non-ITA tariff lines*
0	1	0	0	0	0	0	1
12.5	8	60	277	45	21	16	427

Source: Author's calculation based on India's tariff reduction schedule with South Korea in India-South Korea CEPA

Tariffs for products under the Sensitive list (SEN) have been getting reduced in ten equal annual stages from 2010 and will get to half their base rates by January 2019. An important product in this category is TV, imports of which were not liberalised under the ITA-1 or the ASEAN FTA. All TV sets (of screen size less than 35 cm up to 105 cm),

including LCD TVs (of screen size between 25 cm and 63 cm) had a duty of 12.5 per cent in 2006.These have been getting reduced since 2010. Meanwhile, LCD TV sets of screen size below 25 cm became duty free from January 2016 (E-8).

India's CEPA with Japan came into force in 2011. Under this, India will bring down the tariffs on 132 non-ITA-1 HS 6 digit lines with 10 per cent base duty to zero in ten equal reductions (B10) by 2020 (*Table 4*). Another 206 product lines with base duty of 7.5 per cent will also become duty free by 2020. 36 non-ITA-1 tariff lines denoted with "X" were excluded from any duty reduction or elimination.

Table 4: Distribution of Non-ITA-1 Electronic Products Liberalised under the India-Japan CEPA
(Number of HS 6-digit tariff lines)

Base duty (2007 MFN) (Per cent)	*Number of Non-ITA tariff lines*			*Total non-ITA tariff lines*
	A	*B10*	*X*	
5	0	3	0	3
7.5	0	206	0	206
10	0	132	0	132
Total	**1**	**341**	**36**	**378**

Note: Duties on tariff lines denoted by A were reduced to zero in 2011.
Source: Author's calculation based on India's tariff reduction schedule with Japan in India-Japan CEPA

It is clear that the margin of preference obtained under these FTAs for imports from ASEAN, South Korea and Japanese firms were as high as 12.5 and 10 per cent in several non-ITA-1 electronics products. Thus the drastic tariff liberalisation of the computer and telecommunications industries under the ITA-1 got broadened by the WTO-plus liberalisation carried out by India under its FTAs with ASEAN, South Korea and Japan, with the latter extending it to several non-ITA-1 electronics products, including consumer electronics and home appliances as well as professional, medical and scientific instruments and their parts.

It should be noted that the 2001 report of the Planning Commission's Working Group on Information Technology for the Formulation of the Tenth Five Year Plan had recognised the scenario of the IT sector to be grimmer than the other Indian manufacturing sub-sectors and had called for a clear comprehensive national policy for hardware manufacturing industry for making the Indian manufacturing sector globally competitive (Kallummal, 2012). However, it is clear that despite the realisation by the early 2000s that output and employment in the domestic electronics industry had been severely affected adversely by the import surge under the ITA-1, the governments continued with deep

and non-strategic tariff liberalisation without any attempt to link it with a coherent industrial policy for the long-term development of the industry.[11]

A trade policy that promotes duty-free imports will clearly reduce incentives for domestic production, particularly in a scenario of absent or ineffective policy push to instil productivity growth at the firm and industry levels. This also meant that trade liberalisation under the FTAs could not help Indian firms to make use of the opportunities to get involved in the electronics industry GVCs. For instance, while domestic production of TVs was being carried out through imported intermediate parts such as picture tubes (despite the relatively high tariffs), there was no attempt during the period of protection to support localisation of such major parts through innovative industrial policy measures as has been done in selected industries by China or Brazil.[12] Currently, imports of TV picture tubes have become duty-free from 2016 under the ASEAN FTA. Simultaneously, imports of the final products, LCD TVs, have also been made duty free under the South Korean CECA from 2016. This reveals the absence of any strategic intent for the development of the industry. Further, the very fact that such a tariff liberalisation schedule by India became known at least from around 2010 would have definitely influenced the local production decisions of the MNCs which dominate domestic TV production.

It is relevant to note that attracting FDI for enabling India's integration into production networks was an avowed policy objective behind the spree of FTAs with East and South East Asian countries. However, a comprehensive analysis of what are considered "real FDI" inflows[13] by Rao and Dhar (2016) showed that such inflows into the electronics sub-sectors namely, (i) office, accounting and computing machinery, (ii) radio, television & communication equipment and (iii) medical, precision & optical instruments, watches, were quite small. Thus neither the ITA-1 nor the FTAs with ASEAN countries and East Asian economies helped in attracting substantial inward FDI into the electronics industry.

Such low levels of inward FDI into India's electronics industry is in fact related to the liberal FDI policy regime in place since 1991 and the nature of trade liberalisation since

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[11] It is notable that India was among the developing country absentees from the ITA-2 agreement, which was adopted by a group of WTO member countries on 24 July 2015, committing tariff-free trade at the multilateral level in a further 155 electronics tariff lines (based on HS 2007 classification). However, this may have come too late having lost most of India's trade policy maneuverability with respect to the electronics industry under the FTAs with the GVC-linked economies in East and Southeast Asia.

[12] See UNCTAD (2014 and 2016) for the use of WTO-compatible industrial policy measures by these and other countries.

[13] Rao and Dhar (2016) consider foreign investors as belonging to two broad categories: one, who merely seek return on their investments and the other perceiving the host country operations as integral to their global operations. The first category essentially comprises a host of financial investors. It is the second category, which is considered as real FDI (RFDI).

the late 1990s, which meant that large foreign original equipment manufacturers (OEMs) and electronics manufacturing service providers have had no incentive to invest in local production in India. As a result, they typically set up only final assembly plants (Ernst 2014, p.8).

The resultant adverse impact of the above discussed tariff liberalisation policies enveloped within a liberal FDI policy regime gets reflected in the composition of imports and exports when we analyse changes in electronics industry trade flows in detail.

3. Changing Nature of Electronics Industry Trade Flows

India's electronics exports constituted 3.2 per cent of India's total manufactured exports in 1996.[14] After growing at an average annual growth rate of just 3.5 per cent during 1996–2000, they did grow faster from 2001 onwards, at an average of about 22 per cent and 31 per cent during 2001–05 and 2006–10 respectively. But subsequently, electronics exports grew at much lower rates (just averaging 2.6 per cent during 2011–14) than India's total manufactured exports. As a result, their share in manufactured exports declined to 2.7 per cent in 2014, which was lower than that in 1996. Clearly, there was no sustained favourable impact of trade liberalisation on India's electronics export performance.

On the other side, the share of electronics imports in India's total manufactured imports, which was at about 5 per cent in 1996, increased continuously and went up to nearly 12 per cent in 2003. Average annual import growth rate for electronics, which was already at about 22 per cent during 1996–2000, went up to about 35 per cent during 2002–05 and remained strong until 2011.[15] Even though growth in electronics imports became weak after 2011, the share of electronics imports in manufactured imports increased again from 2012 and stood at 9.3 per cent in 2014.

Figure 2 shows the rapid increase in electronics industry trade deficit as a result of the huge increase in electronics imports relative to exports from the mid-2000s. The diverging trends in electronics exports and imports after 2012 – when exports declined in value and imports began rising again – is captured in *Figure 3*. It also reveals the loss of importance of electronics exports among total manufactured exports. We will examine the composition of electronics exports and imports in order to understand these shifts.

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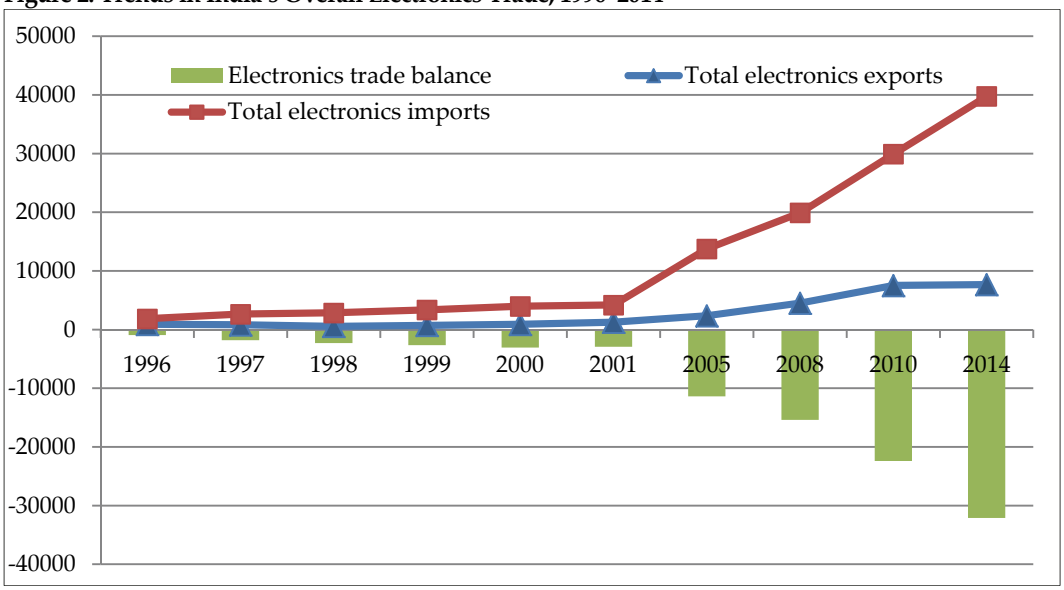
[14] In the ensuing analysis, we consider the following major break points in the time series data for the 19 years covering 1996–2014: (1) 1996 (the year prior to the beginning of tariff reduction under the ITA-1); (2) 2001 (the year immediately after the ITA-1 was implemented by all developed countries); (3) 2005 (the year by which tariffs were eliminated on all ITA-1 products by India and also the year in which the India-Singapore CECA came into being); (4) 2010 (the year in which the FTAs with ASEAN and South Korea took effect); and (5) 2014.

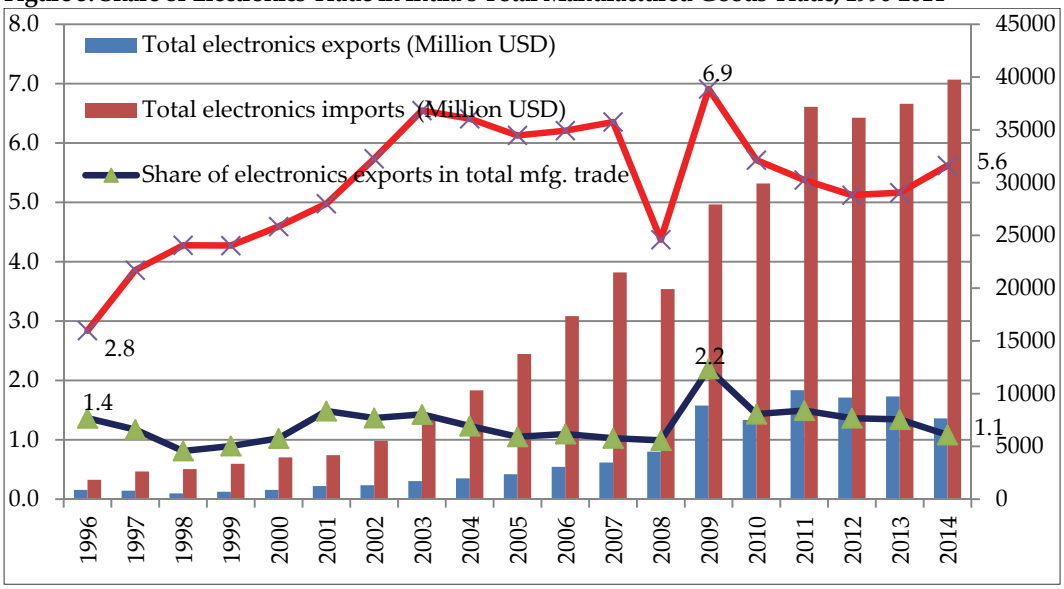
[15] These averages exclude 2001 and 2008 with negative growth rates due to global slowdown in those years.

Figure 2: Trends in India's Overall Electronics Trade, 1996–2014



Source: Author's calculations based on WITS COMTRADE data.

Figure 3: Share of Electronics Trade in India's Total Manufactured Goods Trade, 1996-2014



Source: Author's calculations based on WITS COMTRADE data.

In 1996, the top three major electronics exports were: computer storage units (such as hard disk drives); parts and accessories of computers; and automatic circuit breakers. The first two accounted for about 14 per cent each of the total. Other products constituting the top ten exports were colour TVs, hybrid and monolithic integrated circuits (ICs), magnetic tape recorders, etc (*Table 5*). By 2001, computer storage devices had moved out

of the top ten list. Parts and accessories of computers became the single largest export item with 20 per cent share of the total. Other parts of computers had the second largest share of 5 per cent of the total. X-ray tubes, magnetic discs and electro-diagnostic appliances followed with 3 per cent shares each. Photosensitive semiconductor devices and light emitting diodes (LEDs) also registered significant exports.

Table 5: India's Major Electronics Exports, 1996–2014

SN	*HS 1996 Product Code*	*Product description*	*Liberalisation category*	*Ranks (Based on percentage share in total electronics exports in each year)*				*Share (Percentage)*
				1996	*2001*	*2006*	*2010*	*2014*
1	852520	Transmit-receive apparatus for radio, telephone, etc.	ITA-1	63	14	5	1	7.5
2	851790	Parts of line telephone/telegraph equipment, nes.	ITA-1	28	46	18	7	6.6
3	850440	Static converters	ITA-1	54	37	1	4	5.9
4	851780	Other telephonic or telegraphic apparatus (encryption devices, data security equipment, DSL, VPN, etc.)	ITA-1	91	179	87	8	3.2
5	852812	Colour TVs	Non-ITA-1	4	12	12	5	2.9
6	901839	Syringes, needles, catheters, cannulae and the like :-- Other	Non-ITA-1	90	27	16	18	2.9
7	901890	Other instruments and appliances	Non-ITA-1	16	9	11	12	2.7
8	852390	Unrecorded sound recording media except photo/magnetic	ITA-1	29	65	63	11	2.6
9	854140	Photosensitive semiconductor devices; light emitting diodes	ITA-1	40	6	3	3	2.3
10	850490	Parts for transformers, inductors, converters, etc.	ITA-1	24	8	10	15	2.2
11	903289	Regulating or controlling instruments other than thermostats, monostats, hydraulic or pneumatic	Non-ITA-1	25	36	32	38	2.1
12	853400	Printed circuits	ITA-1	9	7	8	2	2.0

SN	HS 1996 Product Code	Product description	Liberalisation category	Ranks (Based on percentage share in total electronics exports in each year)				Share (Percentage)
				1996	2001	2006	2010	2014
13	850423	Liquid dielectric transformers :-- Having a power handling capacity exceeding 10,000 kVA	Non-ITA-1	33	11	4	6	1.9
14	852990	Other aerials	ITA-1	34	17	6	21	1.7
15	841821	Refrigerators, household type :-- Compression-type	Non-ITA-1	99	44	21	26	1.7
16	850421	Liquid dielectric transformers :-- Having a power handling capacity not exceeding 650 kVA	Non-ITA-1	12	25	28	19	1.6
17	847330	Computer parts and accessories	ITA-1	2	1	2	9	1.5
18	853650	Other switches	ITA-1	72	48	17	25	1.5
19	853620	Automatic circuit breakers	Non-ITA-1	64	61	24	34	1.4
20	903300	Parts and accessories (n.e.s.) for machines, appliances, instruments or apparatus of Chapter 90	Non-ITA-1	53	19	50	17	1.4

Source: Author's calculations based on WTIS COMTRADE.

While the cumulative share of top ten electronics exports declined continuously from about 51 per cent in 1996 to 42 per cent in 2006, there was considerable diversification especially between 2001 and 2006. By 2006, the share of computer parts and accessories came down to just 6.5 per cent although its rank dropped only to the second place. Static converters became India's largest electronics export product, with a share of 11 per cent. A lot of new products had come into the top ten export list, including transformers, medical equipments and their parts, transmit-receive apparatus for radio, telephone, etc. Exports of colour TV and parts of line telephone/telegraph equipment, nes. continued to be significant. In 2010, cell phones (within the category 'transmit-receive apparatus for radio, telephone, etc.' - HS 852520) became the single largest exports with a 20 per cent share of total electronics exports.[16] This was accompanied by significant surges in the shares of printed circuits, photovoltaic devices and LEDs, colour TVs, parts of telecom equipment, and other telephonic or telegraphic apparatus (encryption devices, data security equipment, DSL, VPN, etc.). On the contrary, computer parts and accessories registered a major drop in its share after 2006 and dropped out of the top ten list after

[16] This had led to an increase in the top ten cumulative share from 42 per cent in 2006 to 55 per cent in 2010.

2010. While transmit-receive apparatus for radio, telephone, etc. continued to be the top electronics export product, its share dropped significantly after 2010 to 7.5 per cent in 2014.

On the import side, it is seen that concentration has increased significantly. The cumulative share accounted by the top ten imports increased from about 39 per cent in 1996 to 48 per cent in 2001, and further to 58.5 per cent in 2006. Since the mid-2000s, this cumulative share has been sticky around 58 per cent (*Table 6*).

In 1996, when domestic production of computers was still significant, India's single largest import item was computer parts and accessories with a share of 9 per cent of the total. The second and third positions were held by other monolithic digital ICs, as well as parts for radio telephony, TV, radar apparatus, etc. Imports of cathode ray tubes (CRTs) for colour TVs and video monitors, as well as optical or magnetic readers were also important, which continued to be the case in 2001. However, in 2001, within five years of the tariff reduction initiated under the ITA-1, the share of computer parts and accessories went up to 16 per cent of the total, followed by computer storage units in the second rank (*Table 3*). This reflects the increase in domestic assembly of computer sets in this phase using imported parts and components that had become cheaper due to ITA-1. Similarly, there was a huge increase in the shares of telecom imports too.

Table 6: India's Major Electronics Imports, 1996–2014

SN	*HS 1996 Product Code*	*Product description*	*Liberalisation category*	*Ranks (Based on percentage share in total electronics imports in each year)*				*Share (Percentage)*
				1996	*2001*	*2006*	*2010*	*2014*
1	852520	Transmit-receive apparatus for radio, telephone, etc.	ITA-1	10	3	1	1	18.8
2	851780	Other telephonic or telegraphic apparatus (encryption devices, data security equipment, DSL, VPN, etc.)	ITA-1	69	68	22	3	7.8
3	851790	Parts of line telephone/telegraph equipment, nes.	ITA-1	15	9	8	2	6.9
4	847130	Laptops and other portable units	ITA-1	53	19	7	6	5.7
5	854230	Other monolithic integrated circuits	ITA-1	39	27	10	7	3.7
6	847330	Computer parts and accessories	ITA-1	1	1	2	5	3.6
7	852390	Unrecorded sound recording media except photo/magnetic	ITA-1	62	47	59	4	3.0

SN	HS 1996 Product Code	Product description	Liberalisation category	Ranks (Based on percentage share in total electronics imports in each year)				Share (Percentage)
				1996	2001	2006	2010	2014
8	847160	Computer input or output units	ITA-1	12	8	5	12	2.8
9	852812	Colour TVs	Non-ITA-1	109	112	14	10	2.7
10	852990	Other prepared unrecorded media for sound recording	ITA-1	3	5	4	8	2.7
11	847150	Other digital processing units, whether or not containing in the same housing one or two of the following types of unit : storage units, input units, output units	ITA-1	108	16	9	13	2.3
12	847170	Storage units	ITA-1	8	2	6	9	2.3
13	854140	Photosensitive semiconductor devices, light emitting diodes	ITA-1	73	61	26	18	1.9
14	850440	Static converters	ITA-1	24	20	12	11	1.9
15	901890	Other instruments and appliances	Non-ITA-1	11	6	11	14	1.4
16	852540	Still image video cameras and other video camera recorders	ITA-1	257	94	31	17	1.3
17	903180	Other scientific instruments, appliances and machines	Non-ITA-1	6	11	13	15	1.3
18	854389	Other machines and apparatus :-- Other	ITA-1	38	25	15	19	1.1
19	903289	Regulating or controlling instruments other than thermostats, monostats, hydraulic or pneumatic	Non-ITA-1	22	21	17	21	1.0
20	850490	Parts of transformers, converter, inductors, etc.	ITA-1	23	28	38	23	0.8

Source: Author's calculations based on WTIS COMTRADE.

By 2006, transmit-receive apparatus for radio, telephone, etc. – which had already become the third largest import by 2001 – came to top imports constituting nearly one-fourth of all electronics imports.[17] While computer parts and accessories continued in the

[17] Given that the WITS COMTRADE data does not provide 8-digit level data, we examined the 8 digit level data for India's exports and imports for the product category HS 852520 using DGCIS data. It was clearly seen that while imports of two-way radio communication equipment and

second place even in 2006, we also observe a significant increase in the shares of laptops, printers and key boards, computer storage devices, and other monolithic ICs. Transmit-receive apparatus for radio, telephone, etc**.** (HS 852520) continued to be the single largest import in 2010 and 2014 with a share of 18 per cent of the total. Other telephonic or telegraphic apparatus (encryption devices, data security equipment, DSL, VPN, etc.), along with parts of line telephone/telegraph equipment, continued to be the next largest imports. Computer parts and accessories, laptops, printers and key boards, and other monolithic digital ICs, other prepared unrecorded media for sound recording, colour TVs, etc. remained the other major imports.

Out of the top twenty imports, the majority were ITA-1 products whose import shares went up significantly following the rapid trade liberalisation under ITA-1. These included telecommunication apparatus and parts, computers, laptops, monolithic ICs, semiconductor devices and LEDs, and static converters. Exceptions among ITA-1 products whose import shares dropped were computer parts and accessories, computer storage units, and unrecorded media for sound recording. As discussed in the previous section, in the absence of strategic industrial policy support that had failed to domestically link the growth in demand for hardware arising from the success in software exports, Indian computer hardware producers lost out to imports. This got reflected in the decline in the share of computer parts and accessories within exports too. Once India began importing greater volumes of finished computers, laptops, etc., duty free, it adversely impacted most segments of the domestic computer industry and the need for parts and accessories reduced. However, as expected, import demand for computer input/output units, remained steady. On the other side, imports of cell phone parts also increased to support import-dependent assembly of cell phones ('transmit-receive apparatus for radio, telephone, etc**.'),** as did other telecom equipment imports that increased in tandem with the huge expansion in the domestic telecom market in the 2000s**.** In the case of non-ITA-1 products such as transformer parts and scientific instruments too, import demand remained significant. On the other side, import share of colour TVs, a non-ITA-1 product had already begun increasing by 2006, well before TV imports were liberalised under the India-South Korea CEPA from 2016. This, as we saw earlier, reflected the poor competitiveness and technological upgradation capabilities of the domestic TV industry, which despite having built up a few national brands like Videocon could not survive the increased import competition in the absence of productivity growth.

It is clear that given the domestic electronics industry's development path of the preceding decades without any government-directed effort in creating capabilities and scale, its sudden exposure to severe external competitive pressures with trade liberalisation under the ITA-1 from the late 1990s, which was compounded by trade

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other radio communication equipment (like VHF, UHF, and microwave equipment) dominated imports till 2001, cell phones have been the dominant import product in this category since then.

liberalisation under the FTAs from the mid-2000s has led to a continued surge in imports. It is also clearly seen that tariff liberalisation did not lead to any sustainable expansion in India's electronics exports after the initial surge.

The above analysis of the composition of imports and exports also reveals that while there was some two-way trade in computers along with their parts and accessories as well as ICs in the first period, the nature of two-way trade changed by the mid-2000s. In particular, since 2006, the majority of two-way trade is observed among various kinds of telecommunication apparatus and parts, as well as ICs, static converters, other electronic parts and components along with scientific, measuring instruments. We will examine these changes in detail in the following section. Towards this, it is useful to identify the major trading partners and those with whom there was significant two-way trade.

The cumulative share of top ten markets for Indian electronics exports dropped continuously between 1996 and 2014, falling from 80 per cent in 1996 to 55 per cent in 2014. This was mainly accounted for by the drop in the shares of the US, Singapore and the UK. In the case of electronics exports, the US was the single largest market for India throughout the study period 1996–2014. But its share in India's exports dropped from about 26 per cent to 15 per cent in 2014. The other major markets have been Singapore, Germany, UK, and the UAE, which have consistently remained among the next top five markets with varying ranks. The UAE, which was the third largest market from 2001 onwards, became the second largest in 2014.[18] Malaysia was an important market for Indian electronics exports between 1996 and 2001, but dropped out of the top six list subsequently. China, which had moved up to the seventh rank in 2005, went down to the 10th rank in 2010 and climbed up to the fourth rank in 2014. The share of India's electronics exports going to China increased from 0.2 per cent in 1996 to 4.5 per cent in 2014. The odd one out was Austria which became the second largest market in one year alone (2010) with a share of 7 per cent. However, other EU members such as France, Italy and the Netherlands continued to be among the top ten markets.

The sole developing country export market in the early phase was Bangladesh, which dropped in share and rank after 2001. However, Nigeria followed by Saudi Arabia, Vietnam, Turkey, Indonesia, South Africa, Brazil, Sri Lanka, etc. have become other important developing country markets with increasing shares of electronics exports. Thailand's share shows a minor increase, while that of the Philippines declined. In the case of other major FTA partners such as Japan and South Korea, there was a slight reversal in the declining shares of both these countries between 2010 and 2014. But, interestingly, the fastest growing markets during 2005–10 and 2010–14 were the African states like Guinea-Bissau, Somalia, Central African Republic, Lesotho, etc., or island

[18] This is mainly explained by the fact that the UAE, particularly Dubai, is a major import hub for the Middle East region aided by the Free Zones created in Dubai. Majority of the African market is also served through the re-export route. (E&Y, 2015)

states like Aruba, French Polynesia, Cayman Islands, St. Kitts and Nevis, Monsterrat, and Iceland, as well as some European countries like Portugal, Hungary and Estonia.

It is clear that Indian electronics exports going to developed country markets have all declined in share when compared to those to developing countries. To the extent that there are domestic firms involved in production, this would reflect domestic firms' inability to meet the standards in developed country markets with technologically superior demand. But given that the dominant producers in the Indian electronics industry are MNCs, this is reflective of their market strategy, which in turn is determined by their division of labour across countries. The above trend is evidence of the fact that because of the lack of national capabilities, MNCs' production strategy in India involves only some exports to developing countries, while being mainly geared towards the large domestic market.

It is relevant to note here that exporting to developed country markets have become more difficult because of their growing use of non-tariff measures in the form of technical barriers to trade (TBT) (Kallummal, 2012). Not only did developed countries account for a majority of the total TBT notifications to the WTO, the majority of these were national standards (Kallummal 2012).[19] Current barriers to trade are primarily linked to requirements on product standards, testing and certification, consumer protection, and the environment. Further, there are differences between the standards and regulations in the US and the EU (National Board of Trade, 2015). All of these make significantly greater demands on production sophistication in the case of exports to developed country markets. In this sense, the fact that India's export market access in developed countries has not been sustained and that firms have instead taken the low road through increased exports to developing countries is also evidence of the market failure that arises in the absence of strategic industrial policies to develop the national technological base.

When it comes to imports, the US, followed by Singapore and Japan were the top three import suppliers for India until 2001. However, the shares of India's electronics imports originating from all these countries have seen continuous decline. China became the single largest import supplier after 2001 (*Table 7*). Its share in electronics imports, which increased from 3 per cent in 1996 to 8 per cent in 2001, had shot up to 23 per cent by 2005 and continued to increase further. With a share of about 48 per cent, almost half of all India's electronics imports in 2014 originated from China. Despite the sharp drop in the US share from 22 per cent in 1996 to just 7 per cent in 2014, it has remained the second most important import supplier. Singapore's share dropped from 13 per cent to 4.5 per cent between 1996 and 2014. Japan's share dropped from 12 per cent in 1996 to about 3 per cent in 2014.

[19] National standards are specific legislations that need to be adhered to by foreign producers to operate or sell in those markets. These may be different from the internationally harmonised standards by the International Standards Organisation (ISO). For details, see Kallummal (2012).

Table 7: India's Major Suppliers for Electronics Imports, 1996-2014

(Percentage share in each year's total imports)

SN	*Country*	*1996*	*2001*	*2005*	*2010*	*2014*	*CAGR (2005-14)*
1	China	3.1	7.9	23.0	41.5	47.5	8.4
2	United States	21.6	16.5	12.3	8.0	7.3	-5.6
3	South Korea	5.1	7.3	**12.9**	5.8	5.7	-8.6
4	Singapore	13.4	12.7	9.7	6.0	4.5	-8.2
5	Germany	8.7	7.1	5.5	5.2	4.5	-2.3
6	Malaysia	5.0	7.3	5.1	4.1	4.2	-1.9
7	Vietnam	0.0	0.0	0.0	1.2	2.8	78.4
8	Japan	11.6	7.0	4.4	3.5	2.8	-5.2
9	Thailand	1.1	4.3	1.7	1.7	2.4	3.6
10	Other Asia, n.e.s.	4.4	4.1	2.6	2.4	2.3	-1.1
	Total imports						

Source: Author's calculation based on WITS COMTRADE database.

South Korea has remained the other major import supplier, with its rank ranging between 2nd and 4th. Germany has been another major supplier with its rank hovering around 5th, even as its share witnessed a drop. Similarly, Malaysia has maintained a rank around 6th position. Meanwhile, Vietnam registered one of the strongest export growth to India in electronics, with its import share jumping from 2010 onwards, the year in which the India-ASEAN FTA came into existence. As a result, Vietnam's rank among India's electronics import suppliers jumped from 221 in 1996 to 16 in 2014. Thailand also moved up from the 18th to the 9th rank between 1996 and 2014. In the 10th rank was other Asia n.e.s., which appears to be Taiwan Province of China. While the share of India's imports from most European countries experienced a drop, those of Mexico and Israel increased.

It is important to note that even though China had joined the ITA-1 only in 2004, it had tariff-free access in ITA-1 products to the Indian market from 1997 when India had begun reducing tariffs.[20] Interestingly, India's overall electronics imports from China were already dominated by ITA-1 products in 1996, reflecting the integration of China into the East Asian electronics value chains by the early 1990s. Parts for sound/video recording and reproducing apparatus as well as parts for radio/TV/transmission apparatus were the largest imports. But cathode-ray colour TV picture tubes, a non-ITA product, were the third largest imports from China in 1996. There were three more non-ITA-1 products with at least a one per cent share in imports from China in this phase. However, by 2001, the drastic trade liberalisation that India carried out under the ITA-1 meant that ITA-1 products became more significant and constituted all the top ten imports from China. There was a change in composition of the top ten imports, with an initial sharp increase in the shares of computer parts and accessories, although this declined significantly thereafter. Transmit-receive apparatus for radio & TV became the single largest electronics import from China by 2006 and has remained so. Laptops became the second

[20] This is because the ITA-1 signatories had to extend the trade liberalisation to the non-ITA members of the WTO also following the Most Favoured Nation (MFN) principle.

largest import item by 2010 and were followed by parts of electrical apparatus for line telephony/telegraphy. But an important change that occurred is that the share of colour TVs – a non-ITA product – too began increasing from 2010 onwards. By 2014, India was importing photo-sensitive semiconductor devices also from China. It is ironic that while China had not signed the ITA-1 until 2004 nor signed an FTA with India until now, Chinese firms which had matured under strategic guidance from the state were able to gain significant market access in India. The successful latecomer entry by Chinese firms into the global electronics oligopoly market was made possible only as a result of China's extensive and highly interventionist long-term industrial development strategy (Ernst 2014, p. 26 and 31).

China accounted for nearly 58 per cent of India's total electronics industry trade deficit in 2014. India's electronics trade deficit with South Korea has also increased tremendously, followed by that of Malaysia, Vietnam and Thailand (all FTA partners), while India continues to have high trade deficit with the US, Germany, Singapore and Japan. Countries with which India has had a consistent trade surplus in electronics trade are all developing countries like the UAE, Nigeria, Saudi Arabia, Bangladesh, Turkey, Kenya, Sri Lanka, Nepal and Myanmar, while South Africa has also emerged recently with trade surplus.[21]

4. Inter- and Intra-Industry Trade Patterns in the Electronics Industry

Against the backdrop of the observed intra-industry trade (IIT) flows, this sub-section carries out an in-depth analysis of bilateral trade flows in order to understand the extent and nature of India's participation in electronics value chains. The attempt here is not to examine the entire value chain, as the downstream segments of applied R&D and design and the upstream segments of marketing and retailing are well recognised to be dominated by developed country firms. While value addition from the manufacturing segment of the value chain is relatively lower compared to these service functions, following Amsden (2001) and Khan (2009), we attach special significance to accretion in productive employment, build-up and diffusion of technological capabilities and sustainability, which accrue from carrying out manufacturing processes domestically. Moreover, if any export success in services is to be sustainable, it must generate significant backward linkages in the economy, for which the existence and continuous upgradation of manufacturing capabilities is in turn necessary. Therefore we need to critically consider our understanding of IIT in order to be able to fathom the connections between trade and investment liberalisation, firm strategies, and the accompanying production restructuring.

As mentioned in the introductory section, not all increase in two-way trade observed in India's trade in HS chapters 84 (non-electrical machinery) and 85 (electrical machinery)

[21] Thus SAFTA seems to have played some role here, although it will be useful to look at bilateral trade flows to delineate the impact of the ITA-1.

can be considered as IIT. An example of such a case is the following: even as there is significant two-way trade in HS Chapter 84, this is occurring as imports of hard disk drives (HDDs) and exports of computer input or output units. That is, the country is importing the HDDs as an intermediate into the production of a final good, computer, for the domestic market. This is a case of inter-industry trade. Intermediate inputs imported by a country for use in its sale of goods to final consumers in the export market also cannot be linked to GVCs (Fontagné, Freudenberg and Gaulier 2006). This too will get captured under inter-industry trade when the imported intermediate product and the exported final good are represented by different product codes. However, this subsumes the case when intermediate products are imported by a country for assembly into a final product for export as part of an MNC's GVC strategy (and can underestimate IIT). The latter can be examined at the firm-level through an analysis of related party transactions of foreign-invested enterprises in India, which is not attempted in this study.

Once we delineate inter-industry trade, a distinction is made between varieties of IIT to capture the nature of vertical specialisation arising from participation in GVCs. In order to identify vertical and horizontal IIT, we adopt the methodology used by studies such as Fontagné, Freudenberg and Gaulier (2006), Fukao *et al*. (2003), Hurley (2003), etc. The starting point is the assumption that differences in prices (unit values) within one product category mirror differences in quality.[22] First of all, trade in those HS 6-digit products for which the difference between the bilateral export and import values is more than 10 per cent is identified as IIT. In the next step, unit values (UV) of exports and imports are employed to delineate the two types of IIT.[23] Within IIT, vertical IIT is thus identified as that portion of identified intra-industry trade, which involves products with relative export/import unit values greater than 1.25. For products which exhibit VIIT, we look at the unit value difference with a trading partner to understand whether India is exporting the higher priced, and therefore, higher quality, product within a product category or not.[24] While the decomposition of IIT based on unit value dispersion is considered the most comprehensive approach to date, unusual dispersion of unit values signals a high probability of classification failure due to the heterogeneity of the HS 6-digit heading or due to a measurement error (Fontagne *et al*., 2006).

The advantage of this method is that it allows us to understand the extent of India's participation in GVCs as well as the nature of its engagement in GVCs in order to understand India's relative position *via-a-vis* her major trading partners at the product

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[22] This assumption is only acceptable with the most detailed trade data, where aggregation of different products within one product category is minimised. Since relying on national tariff line level data would restrict international comparisons (Fontagné, et al, 2006), we have used HS 6-digit trade data.

[23] As a result, we had to leave out products for which unit value data was unavailable.

[24] However, as Fontagne et al (2006) pointed out, unusual dispersion of unit values signals a high probability of classification failure due to the heterogeneity of the HS 6-digit heading or due to a measurement error.

level. This approach may be considered as going beyond the analysis that is done using the Trade-In-Value-Added (TiVA) database, especially given the disadvantages associated with the use of guesstimates in the I-O tables used for constructing TiVA.

In this study, we examined the changes in the nature of bilateral IIT in Indian electronics industry trade between 1999 and 2014.[25,26] The analysis was carried out for all of India's major import suppliers (*Table 8*). The table summarises the results of the exercise in terms of the changes in the levels of bilateral intra-industry trade (IIT) between India and these countries. It is clearly observable that between 1999 and 2014, the levels of IIT within bilateral trade increased across-the-board, with significant increase in seven out of these ten major trading partners. The largest increase was seen in the case of Vietnam, which was followed by China, South Korea, Japan and Thailand.

Table 8: Change in the Relative Importance of IIT in India's Bilateral Trade in Electronics

SN	*Trading partner*	*Share of IIT in total bilateral trade (Percentage)*		
		1999	*2014*	*Change (1999–2014) (Percentage points)*
1	China	61.0	98.2	37.2
2	South Korea	17.6	53.5	35.9
3	Singapore	90.0	90.5	0.5
4	Malaysia	91.7	98.4	6.7
5	Thailand	69.9	96.7	26.8
6	US	93.7	99.1	5.4
7	Germany	86.2	94.4	8.2
8	UK	85.3	97.5	12.2
9	Japan	65.0	94.5	29.5
10	Vietnam	3.8	92.3	88.5

Source: Author's calculations based on WITS COMTRADE.

The further decomposition of India's bilateral IIT with these countries in terms of horizontal and vertical IIT shows interesting results (*Table 8*). In the case of China and South Korea, the share of vertical IIT in total bilateral intra-industry trade showed a drastic decline by 2014. In both these cases, India was therefore trading more in horizontally differentiated products in 2014 (*Table 9*).

[25] The starting year had to be taken as 1999 as the relevant series of RBI's export and import price indices – used for deflating export-import values - has a base of 1999–2000=100. This however means that we do not have the opportunity to estimate the IIT values for 1996, to examine the pre-ITA-1 pattern.

[26] Following accepted international practice prescribed by the IMF, import values in c.i.f. terms were discounted by 10% to obtain the corresponding f.o.b. values.

Table 9: Change in the Relative Importance of Vertical IIT in India's Bilateral IIT in Electronics

SN	*Trading partner*	*Share of VIIT in bilateral IIT (Percentage)*		
		1999	*2014*	*Change (1999–2014) (Percentage points)*
1	China	99.0	78.6	-20.4
2	South Korea	100.0	47.5	-52.5
3	Singapore	96.8	96.5	-0.3
4	Malaysia	33.2	99.6	66.4
5	Thailand	77.1	98.3	21.2
6	US	18.7	25.6	6.9
7	Germany	72.3	79.6	7.3
8	UK	84.2	87.8	3.6
9	Japan	88.8	80.9	-7.9
10	Vietnam	32.3	91.0	58.7

Source: Author's calculations based on WTIS COMTRADE.

In the case of China too, it was seen that while expansion in horizontal IIT contributed to the increase in IIT between 1999 and 2014, this involved a large number of non-ITA products contrary to the pattern seen in India's overall bilateral trade with China. But as much as 96 per cent of bilateral HIIT was imports. Clearly, the volume of exports from India was very low.

In the US case, despite some increase in VIIT, the high level of IIT continued to be dominated by trade in horizontally differentiated products. But overall, imports dominated HIIT with the US and more non-ITA products than ITA-1 products were involved in this trade in 2014. India's top most exports involved in HIIT were colour TVs, electro-diagnostic devices, along with other professional instruments and appliances, parts and accessories of professional and scientific appliances, etc., which were all non-ITA products. Two ITA-1 products among the top ten horizontally differentiated exports to the US were photosensitive semiconductors and printed circuits, for which India's exports were greater than imports from the US. On the other side, top HIIT imports from the US were miscellaneous electro-diagnostic apparatus, other electrical machines and apparatus, other computers, other testing/professional appliances, other monolithic ICs, as well as a range of medical appliances and instruments, etc.

The increase in bilateral IIT observed for Germany and the UK was also mostly driven by increased trade in horizontally differentiated products. India had trade deficits with these countries too.

There is significant heterogeneity in India's electronics trade transactions with her major FTA partners. On the one side, as we saw above, in the case of two major partners, China and South Korea, most of the increased bilateral IIT was due to increase in trade in

horizontally differentiated products. On the other side, India's trade with Japan continued to be dominated by vertically differentiated products, despite a decline in its share as compared to 1999. When it comes to ASEAN partners, India's vertical IIT was always high with Singapore, which is attributable to the latter's entrepot role in the context of the East Asian electronics production networks (that was well established by the early nineties). However, we observe a significant rise in the relative importance of vertical IIT in the case of Malaysia, Thailand, and Vietnam. This would point to an increased degree of trade integration between India and the ASEAN trading partners involving vertical specialisation. However, given that some heterogeneity in products was observed at the 6-digit level categorisation of products (which was also reflected in very high unit value dispersion in certain cases), we have to keep in mind that there could be some overestimation of IIT as well as VIIT.

A comparison of India's bilateral export and import unit values (based on deflated US dollar values) in vertically differentiated products (*Table 10*) helps us to examine the relative quality levels of Indian products involved in observed bilateral IIT. It is observed that a larger proportion of India's VIIT with China in 2014 involved exports with higher unit value vis-à-vis imports when compared with 1999. This was true in the case of India's VIIT with Thailand also and to a lesser extent in the case of Vietnam and Japan. In contrast, in the case of US, Germany and South Korea, India was predominantly importing VIIT products with higher unit values. India's VIIT with Singapore and Malaysia appeared more balanced in terms of numbers.

Table 10. Status of India vis-à-vis Major Partners in Bilateral VIIT

Bilateral partner	*Percentage share of VIIT products in which India had higher unit value in 1999 (Based on number of products)*	*Percentage share of VIIT products in which India had higher unit value in 2014 (Based on number of products)*	*Share in India's electronics imports (2014)*	*India's Electronics trade balance with the partner (2014)*
China	73	85	47.5	Deficit
US	38	41	7.3	Deficit
South Korea	75	41	5.7	Deficit
Germany	30	45	4.5	Deficit
Singapore	42	55	4.5	Deficit
Malaysia	47	54	4.2	Deficit
Thailand	45	73	2.4	Deficit
Vietnam	50	65	2.8	Deficit
Japan	43	62	2.8	Deficit

Source: Author's calculations based on WTIS COMTRADE.

However, when we analysed the share of import value (based on deflated US dollar value and adjusted to f.o.b. terms) in total bilateral vertical IIT, it is seen that despite the large proportion of VIIT products in which India had higher unit value, the import share of VIIT products in bilateral VIIT had gone up in the case of China and Vietnam as well as South Korea (*Table 11*). Imports dominated VIIT in the case of Thailand, Malaysia, Japan, Singapore, and Germany too. However, in the case of the US, the share of imports in bilateral VIIT showed a dramatic decline.

Table 11. Share of VIIT Imports in Total Bilateral VIIT

Partner	*Percentage share of VIIT imports in total bilateral VIIT*	
	1999	*2014*
China	92	97
US	88	59
Germany	87	74
South Korea	53	60
Singapore	90	74
Malaysia	94	83
Thailand	92	87
Vietnam	74	92
Japan	89	84

Source: Author's calculations based on WTIS COMTRADE.

In order to further understand the relative importance of India's higher unit value exports in VIIT, we analysed their shares in bilateral trade. In the case of China, we examined the VIIT products in which India had higher export unit value bilaterally. It was observed that in only 11 out of these 175 products, Indian exports accounted for even a 0.1 per cent share in total bilateral electronics trade in 2014. On the contrary, in 13 of these products Indian imports constituted at least a one per cent share in total bilateral trade, with imports of transmit-receive apparatus for radio & TV alone accounting for 32 per cent of total bilateral electronics trade. That is, although there were a large number of products in which India had higher export unit value bilaterally, these products were not significant in bilateral trade. All major VIIT imports from China, except colour TVs, were ITA-1 products (*Table 12*).

Similarly, in the case of Vietnam, not a single product in which India exhibited higher export unit value in VIIT in 2014 had even a 0.5 per cent share in total bilateral trade. As a result, the bilateral trade share of exports of all the VIIT products in which India saw higher export unit value added up to just 1.5 per cent. On the contrary, the bilateral trade share of imports in all these VIIT products (in which India saw higher export unit value) added up to 11 per cent. The top-most vertically integrated products were again the ITA-1 product, transmit-receive apparatus for radio & TV with an import share of 48 per cent

Table 12: Major Products Involved in India's Bilateral VIIT with China, 2014

SN	*Product*	*ITA-1 product*	*Share of India's exports in bilateral trade*	*Share of India's imports in bilateral trade*	*Unit value difference (X unit value-M unit value)*
1	Transmit-receive apparatus for radio, telephone, etc.	ITA-1	0.02	31.9	Positive
2	Other telephonic or telegraphic apparatus (encryption devices, data security equipment, DSL, VPN, etc.)	ITA-1	0.05	5.6	Positive
3	Input or output units, whether or not containing storage units in the same housing	ITA-1	0.01	3.9	Positive
4	Parts and accessories of the machines of heading No. 84.71	ITA-1	0.16	3.7	Positive
5	Other	ITA-1	0.09	3.3	Positive
6	Photosensitive semiconductor devices, including photovoltaic cells whether or not assembled in modules or made up into panels; light emitting diodes	ITA-1	0.01	2.6	Positive
7	Reception apparatus for television, whether or not incorporating radio-broadcast receivers or sound or video recording or reproducing apparatus: Colour	Non-ITA	0.0	2.1	Positive
8	Other monolithic integrated circuits	ITA-1	0.1	1.9	Positive
9	Static converters	ITA-1	0.3	1.7	Positive
10	Storage units	ITA-1	0.0	1.6	Positive
11	Digital processing units other than those of sub-headings 8471.41 and 8471.49, whether or not containing in the same housing one or two of the following types of unit : storage units, input units, output units	ITA-1	0.0	1.4	Positive
12	Still image video cameras and other video camera recorders	ITA-1	0.0	1.3	Positive
13	Other devices, appliances and instruments	ITA-1	0.0	1.2	Positive

Source: Author's calculations based on WTIS COMTRADE.

in bilateral trade in 2014, followed by parts of electrical apparatus for line telephony with an import share of 14 per cent. Interestingly, all the top ten products involved in VIIT with Vietnam in 2014 were ITA-1 products. But wherever products that got liberalised under normal Track-1 or Normal Track-2 of India-ASEAN FTA came into the top thirty list, imports clearly dominated over exports.

In the case of Thailand, out of the 107 VIIT products in which India had higher unit value exports, there were just two products with more than one per cent share in total bilateral trade. These were lighting and signalling equipment as well as other medical/dental apparatus. But only in the case of the latter did Indian exports hold a greater share in bilateral trade as compared to imports. In all the other products, India's imports from Thailand significantly outweighed India's exports to that country. Within these, imports of computer storage devices constituted as much as 21 per cent of total bilateral trade, even when India showed a higher unit export value.

Among the 91 products in VIIT with Malaysia in which India exhibited higher export unit values, significant exports happened only in three products. Among these the export share was greater than import share only in two products. These were: liquid dielectric transformers and parts for burglar/fire alarms and similar apparatus. On the other side, top imports were colour TVs (with 22 per cent share - non-ITA product), followed by computer parts and accessories as well as other telephonic or telegraphic apparatus (encryption devices, data security equipment, DSL, VPN, etc.).

In VIIT trade with Singapore, India's exports were even a little bit significant in bilateral trade (with shares ranging between 0.5 per cent and 2 per cent) only in 8 out of 115 products in which India was exporting products with higher unit value. In the remaining majority of such products, imports dominated over exports. Overall, imports were more diversified compared to the cases above, with top import among VIIT products having a share of 13 per cent in bilateral trade ('other computers').

That is, even though India exported an increased number of higher value added products in the observed vertical integration with most of the major trade partners (except the US, South Korea and Germany) in 2014, they involved insignificant shares in bilateral trade. Within the vast majority of vertically traded products in which India showed higher unit export value, volume of imports far outweighed that of exports. At one level, this means that while India appears to have export capabilities in some higher value added products, the scale of such export production is abysmally low to have a significant impact on broader productivity growth. These export capabilities could be of the "enclave" sort, limited to some MNCs' production facilities. The dominance of imports evident from the detailed analysis of aggregate as well as intra-industry trade flows makes it clear that even the small level of the FDI inflows that came into the electronics sector did not result in developing substantial production capabilities domestically. This, as we discussed earlier, is due to the fact that incentives for domestic production were negated by the non-strategic trade liberalisation which created larger markets for duty-

free trade in electronics products, and the absence of industrial policies promoting domestic linkages or technological development.

At another level, the above finding could also mean that only a small proportion of the imported intermediates got used in export production, which in turn points towards significantly increased import intensity of domestic production. The continuing growth in India's total electronics imports despite the declining trend in electronics exports would also point to this. The reason why this is not getting captured in higher inter-industry trade levels could be because of the inclusion of different types of products under the same 6-digit category. This is possible in such an industry with rapid technologic changes, owing to the rise of new products. This might have resulted in some classification errors[27] and could lead to an overestimation of IIT and VIIT even at the 6-digit level. This would point to an underestimation of inter-industry trade in electronics even at the 6-digit level. Thus it is important to interpret the individual bilateral IIT results presented above with care. Further, the above discussion points to the potential for serious flaws in interpreting IIT results as reflecting countries' engagement in GVCs, without considering them in the context of the value of exports and imports.

However, the findings undisputedly establish that the observed rise in overall intra-industry trade, whether it involved horizontal or vertical product differentiation, has only contributed to India's rising trade deficit with all her major electronics trading partners. If productivity were simply a function of the type of machinery and intermediate goods used, then the availability of intermediate inputs following trade and investment liberalisation under the ITA-1 and FTAs should have helped India to be a manufacturer of quality electronic products, especially given that many of the operating technologies are freely available. What is missing, as Khan (2010) has argued, is the mix of organizational, operational and technological capabilities and skills that can only be developed through actual experience. This is the part of the learning process that is lost when domestic manufacturing is avoided and direct imports take over. This implies that apart from firm- and industry-level productivity and economy-wide 'infrastructural' conditions, the existence of incentives for domestic production are important. This clearly points to the need to re-evaluate the premises underlying India's current trade and industrial policies, including those being pursued with the purported objective of promoting GVC engagement.

5. Conclusion

This paper examined the interplay between trade liberalisation and industrial policies and its implications for India's electronics industry restructuring, towards understanding whether and how trade liberalisation has influenced India's engagement in GVCs.

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[27] The very high unit value dispersion observed in some products categorised as VIIT could also be a reflection of this.

It is clear that given the domestic electronics industry's development path of the preceding decades without adequate government-directed effort for creating technological capabilities and scale in domestic firms, the industry's exposure to severe external competitive pressures with rapid trade liberalisation under the ITA-1 from the late 1990s created a major obstacle in its development trajectory. The tariff liberalisation of the computer and telecommunications industries under the ITA-1 was worsened by the tariff liberalisation under India's FTAs with East and Southeast Asian countries, with the latter extending it to several non-ITA-1 products, including consumer electronics and home appliances as well as professional, medical and scientific instruments and their parts.

A trade policy that promotes duty-free imports will clearly reduce incentives for domestic production in the absence of other policies that promote domestic production. Moreover, the fact that there was no industrial strategy guiding tariff liberalisation in any strategic manner led to many final products becoming duty-free, while several components had to be imported paying tariffs. Despite having the advantage of a large domestic market, this became an adverse factor influencing producers' incentives even for domestic assembly, in the absence of a sufficiently developed domestic parts and components supply base. Moreover, successive governments' policies towards FDI with a hands-off approach meant that there were also no policies linking foreign invested firms and the domestic supply base (unlike, for instance, the indigenisation policy in the automobile industry), which could have let to vertical spillage effects and technological upgrading among domestic firms. Consequently, trade liberalisation has only seen India's growing demand for electronics products leading to high import dependence. The underlying reason behind the erosion of electronics manufacturing capabilities appears to be the absence of a visionary state with a long-term industrial development strategy, which guides trade liberalisation and ensures focussed implementation of structural support policies that push firms to be productive and innovative as well as ensure backward linkages from foreign invested companies to the domestic supplier base, as it happened in South Korea, Taiwan, and more recently, in China.

The consequences are in the nature of the observed increase in India's two-way trade in electronics products. It appears that there is overestimation of IIT even while using 6-digit level data given that there is some heterogeneity in products at the 6-digit level categorisation of products. Even so, irrespective of whether horizontal IIT or vertical IIT dominated bilateral IIT, imports outweighed exports. The findings undisputedly establish that the observed rise in overall intra-industry trade, involving both horizontal and vertical differentiation has only contributed to India's rising trade deficit with all her major electronics trading partners. Wherever there was an increase in trade integration between India and the ASEAN trading partners involving vertical specialisation that might be interpreted as being driven by engagement in GVCs, India's exports involved insignificant volumes compared to imports. This analysis clearly points to the potential for serious flaws in interpreting IIT results as reflecting countries' engagement in GVCs,

without considering them in the context of the value of exports and imports. The study findings also established that this kind of development trajectory has made the country's production lines and consumption heavily dependent on other countries' production systems, in particular, China.

The development trajectory of the Indian electronics industry clearly shows that in the absence of coherent and coordinated industrial policy support to effectuate the firm-level, industry-level and economy-wide productivity conditions, non-strategic trade and investment policy liberalisation diluted and negated incentives for local production for both Indian and foreign producers. The huge increase in aggregate import dependence that has been experienced by the Indian electronics industry, the low level of FDI into the electronics industry, and the evidence in import growth thrown up by the analysis of inter-industry and intra-industry trade are all stark reflections of the impact of the interplay between the trade and investment policy liberalisation that has been carried out by India and the market failures associated with non-strategic trade and investment liberalisation. This clearly points to the need to re-evaluate the premises underlying India's current trade and industrial policies, including those being pursued with the purported objective of promoting GVC engagement.

Trade and investment policies and other industrial policy measures for skill and technological capability development have to be coordinated within a strategic industrial development vision to achieve sustainable development of any industry. This implies that along with vertical industrial policies for upgrading firm- and industry-level productivity and improved infrastructure, a calibrated approach towards trade and FDI policies such that they do not negate incentives for value adding local production is an imperative for enabling domestic firms to engage in global value chains in a sustainable manner.Government efforts to reinvigorate investments into the electronics industry and the continuing desire to enter into new FTAs need to keep these policy lessons in mind. These findings also have implications for other industries and other developing countries.

Annexe 1: Concordance Table for Electronics Products across ISIC Revised Classifications

ISIC (R1)	*ISIC (R2)*	*ISIC (R3)*	*ISIC (R3.1)*	*Industry Segment*
360	3825	2919	2919	Manufacture of weighing machines
		3000	3000	Manufacture of office, accounting & computing machinery
	3829	2930	2930	Manufacture of domestic appliances n.e.c. (domestic cooking ranges, refrigerators, laundry machines)
370	3832	3110	3110	Manufacture of radio transformers
		3120	3120	Manufacture of semi-conductor circuits
		3190	3190	Manufacture of visual and sound signalling and traffic control apparatus
		3210	3210	Manufacture of electronic valves and tubes and other electronic components including fixed and variable electronic capacitors
		3220	3220	Manufacture of television and radio transmitters and apparatus for line telephony and line telegraphy
		3230	3230	Manufacture of television and radio receivers, sound or video recording or reproducing apparatus and associated goods and radio transmitters and apparatus for line telephony and line telegraphy
		3311	3311	Manufacture of X-ray apparatus; electrotherapeutic apparatus
		3312	3312	Manufacture of radar equipment, radio remote control apparatus
		3530	Not included	Manufacture of communication satellites
391	3851	3311	3311	Manufacture of surgical, medical, dental equipment, instruments and supplies; orthopaedic and prosthetic appliances
		3312	3312	Manufacture of instruments and appliances for measuring and controlling equipment, except industrial process control equipment
		3313	3313	Manufacture of industrial process control equipment

ISIC (R1)	*ISIC (R2)*	*ISIC (R3)*	*ISIC (R3.1)*	*Industry Segment*
	3852	3000	3000	Manufacture of photo-copying machines (R3)
		3311	3311	Manufacture of ophthalmic instruments
		3312	3312	Manufacture of scientific measuring instruments
392		3320	3320	Manufacture of optical instruments and photographic equipment
393	3853	3330	3330	Manufacture of watches and clocks
395	3902	3692	3692	Manufacture of musical instruments

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