OFFICE OF INDUSTRIES WORKING PAPER

U.S. International Trade Commission

The Information Technology Agreement: An Assessment of World Trade in Information Technology Products

DRAFT: NOT FOR DISTRIBUTION

Michael Anderson and Jacob Mohs
Office of Industries
U.S. International Trade Commission

October 2009

***ADDRESS CORRESPONDENCE TO*:**
OFFICE OF INDUSTRIES
U.S. INTERNATIONAL TRADE COMMISSION
WASHINGTON, DC 20436 USA

Michael Anderson and Jacob Mohs[1]
U.S. International Trade Commission

ABSTRACT

The Information Technology Agreement (ITA), a plurilateral agreement emerging from the Uruguay Round, eliminates tariffs on specific technology and telecommunications products for ascribed member countries. Primary goals of the ITA are increased trade and competition through trade liberalization for information technology (IT) products, and the global diffusion of information technology. The ITA went into effect in 1997 with 29 WTO member countries and now includes 72 WTO members. The Agreement covers over 95 percent of total world trade in IT products, currently estimated at $4 trillion. The emergence of complex global supply chains for IT products, rapid deployment of new technologies, and technology convergence since the ITA's inception, shine new light on the role of the ITA in global trade. This paper provides an overview of the ITA, the level of tariff liberalization associated with membership, and discusses the changing composition of ITA membership. The paper further examines ITA trade between 1996 and 2008, highlighting the changing composition of trade by leading exporting and importing nations and profiles ITA trade by product segment, focusing on computers, semiconductors, and telecommunications equipment. The paper finds a significant shift in ITA trade to Asia, particularly China, and to a lesser extent Eastern Europe. Increasing diversification of ITA members' trade and economic profiles and the expanding trade participation by developing countries are significant developments in global ITA trade.

[1] This paper represents solely the views of the author and is not meant to represent the views of the U.S. International Trade Commission or any of its commissioners. The invaluable assistance of Monica Reed is gratefully acknowledged. Please direct all correspondence to Michael Anderson, Office of Industries, U.S. International Trade Commission, 500 E Street, SW, Washington, DC 20436, telephone: 202-205-3249, fax: 202-205-2018, email: michael.anderson@usitc.gov.

Introduction

The Information Technology Agreement (ITA or Agreement), a plurilateral agreement emerging from the Uruguay Round, eliminates tariffs on specific technology and telecommunications products by ascribed member countries. Based on the Most Favored Nation (MFN) principle, the benefits of ITA tariff liberalization are extended to all WTO members. Primary goals of the ITA are increased trade, global diffusion of information technology, and enhanced global economic growth and welfare through trade liberalization for information technology (IT) products. The ITA was concluded in late 1996 with 29 WTO member countries and now includes 72 WTO members. This paper provides a historical perspective of ITA product trade, examining global trade flows and accession of new member countries during the 12 years of the Agreement. Trade patterns for ITA products are examined in the context of increased trade and competition and diffusion of information technology as envisioned in the Agreement. Beginning with an overview of the ITA and the level of tariff liberalization associated with membership, the changing composition of ITA membership is discussed. The paper then examines ITA trade between 1996 and 2008, highlighting the changing composition of leading exporting and importing countries and profiles ITA trade by product segment, focusing on computers, semiconductors, and telecommunications equipment. World trade in ITA products increased three-fold, expanding nearly $3 trillion since 1996, facilitated by aggressive tariff liberalization and broadening membership in the Agreement. This paper finds a significant shift in ITA trade to Asia (particularly China), and to a lesser extent Eastern Europe. Further, this shift is evident in the displacement of traditional producers and exporters of computers and telecommunications equipment by rising Asian ITA members. Other key findings include the increasing diversification of ITA members in terms of trade and economic profiles, and the expanding trade participation by developing countries.

The Agreement

At the WTO‘s Singapore Ministerial Conference, the Ministerial Declaration on Trade in Information Technology Products (Declaration)[1] was concluded by 29 signatory countries in December 1996. Activation of the provisions in the Declaration was contingent on membership comprising countries accounting for 90 percent of world trade in IT products by a deadline 4 months later (April 1, 1997). The original signatories’ trade coverage was only 83 percent. Through additional negotiations, several other countries ascribed to the Declaration, bridging the gap in trade coverage stipulated in the Declaration. With the ITA in effect on April 1, 1997, participants soon after commenced a schedule of phased duty reductions with all duties slated for elimination by 2000.[2] Because the commitments under the ITA are on a MFN basis, the bound zero duty rates for ITA products apply to all WTO members, including non-ITA members.

At the outset, the stated goals of raising living standards, enhancing global economic growth and welfare, and facilitating increased trade for information technology products rested on aggressive tariff liberalization. In accordance with the ITA, member countries agreed to “bind and eliminate all custom duties and other duties and charges” for IT products specified in the agreement.[3] While ITA provisions

[1] WTO, Ministerial Declaration on Trade in Information Technology Products (WT/MIN/96)/16, December 13, 1996.

[2] Several developing countries, including Costa Rica, India, Indonesia, South Korea, and Chinese Taipei, implemented extended duty staging to 2005 on a product-by-product basis as permitted in the Declaration.

[3] WTO, Ministerial Declaration on Trade in Information Technology Products (WT/MIN/96)/16, December 13, 1996.

call for periodic review and consultations on non-tariff barriers, the only commitments in the ITA are for tariff elimination.

Tariff Rates

A primary objective of the Declaration was to improve market access and promote global trade through elimination of bound duties on IT products on an MFN basis. Initial participants agreed to a series of four equal tariff reductions between 1997 and 2000, with certain exceptions granted to developing countries. While many developed countries maintained fairly low tariffs on IT goods prior to the Singapore Ministerial, tariff elimination on an MFN basis was central to achieving the trade and economic benefits envisioned in the ITA. Bora and Liu (2006) calculate that simple average tariffs over all ITA products was 3.6 percent for ITA members compared with 11.2 percent for non-members. According to the WTO, average bound tariff rates for ITA products for developed countries were reduced from 4.9 percent to zero (WTO 2008, 15). These initial rates ranged from 12.1 percent to 1 percent, which compared with 66.4 percent to 1.2 percent for developing countries.[4] Because of considerably higher bound rates, several developing countries implemented significant tariff liberalization to achieve duty free trade under the ITA. The largest concessions based on pre-ITA bound rates were by India (66.4 percent), Thailand (30.9 percent), and Turkey (24.9 percent). Similarly for applied tariff rates, developing countries' pre-ITA tariffs were generally higher than the average 2.7 percent for developed countries. Notable average applied tariff reductions for developing countries included India (from 36.3 percent), China (from 12.7 percent), and Egypt (from 12.1 percent).

Expanding Membership

Since the inception of the ITA with 29 original signatories,[5] ITA membership has steadily expanded, reaching 72 members in 2009,[6] with increasing participation from developing countries. Developed countries accounted for nearly all of the original signatories, with Indonesia and Turkey the only developing countries formally adopting the Singapore Ministerial Declaration (table 1).[7] Following the Singapore Ministerial in 1996, 11 additional countries ascribed to the Declaration triggering the 90 percent trade criteria and the ITA entered into force April 1, 1997. In total, 14 members, more than half of them developing countries, joined the ITA in 1997 raising total membership to 43 countries. Between 1998 and 2008, the continued shift toward greater participation by developing countries accounted for 20 of the 29 new participants (68.9 percent). Consequently, developing countries' participation expanded from 2 to 30 countries or from 6.9 percent to 41.7 percent of ITA members (figure 1). While the present composition of ITA members, based on economic status, differs from that of the WTO (41.7 percent versus nearly two-thirds are developing countries), the steady increase in participation by developing

[4] Exceptions included Macao, China, and Hong Kong, China, which already maintained duty free status for ITA products. WTO, World Trade Report 2007, 15.

[5] The European Communities (e.g EU-15) treated as individual members, with Switzerland and Lichtenstein a single customs union.

[6] WTO, Status of Implementation (G/IT/1/Rev.41), 23 October 2008. Peru, the latest member entering the ITA, submitted its ITA schedule to participants for verification and approval in 2008. USTR Web site, http://www.ustr.gov/trade-topics/industry-manufacturing/industry-initiatives/information-technology (accessed September 18, 2009).

[7] Developing countries include middle income and low income countries based on World Bank income classifications. World Bank Web site, http://web.worldbank.org/WBSITE/EXTERNAL/DATASTATISTICS/0,,contentMDK:20421402~pagePK:64133150~piPK:64133175~theSitePK:239419,00.html#Low_income (accessed August 10, 2009).

countries is a significant achievement considering IT products trade was highly concentrated between developed countries prior to the ITA (Mann and Liu, 4).[8]

TABLE 1 ITA member countries by economic status, 1996–2008

Year Joined ITA	Developed countries	Developing Countries		
	Economic status[a]			
	High Income	Upper Middle Income	Lower middle income	Low income
1996	Australia, *Austria, Belgium*, Canada, *Denmark*, *Finland*, *France*, *Germany*, *Greece*, Hong Kong, Iceland, *Ireland*, *Italy*, Japan, South Korea, Liechtenstein, *Luxembourg*, *Netherlands*, Norway, *Portugal*, Singapore, *Spain Sweden*, Switzerland, Chinese Taipei, *United Kingdom*, United States	Turkey	Indonesia	
1997	*Czech Republic*, *Estonia*, Israel, Macao, New Zealand, *Slovak Republic*	Costa Rica, Malaysia, *Poland*, *Romania*	El Salvador, India, Philippines, Thailand	
1998		Panama		
1999	Croatia	*Latvia*, *Lithuania*, Mauritius	Albania, Georgia, Jordan	Kyrgyz Republic
2000	*Cyprus*, Oman, *Slovenia*			
2001		*Bulgaria*	Moldova	
2003	Bahrain		China, Egypt, Morocco	
2004	*Hungary*, *Malta*			
2005			Nicaragua	
2006	Saudi Arabia	Dominican Republic	Guatemala, Honduras	
2007	United Arab Emirates			Vietnam
2008		Peru	Ukraine	

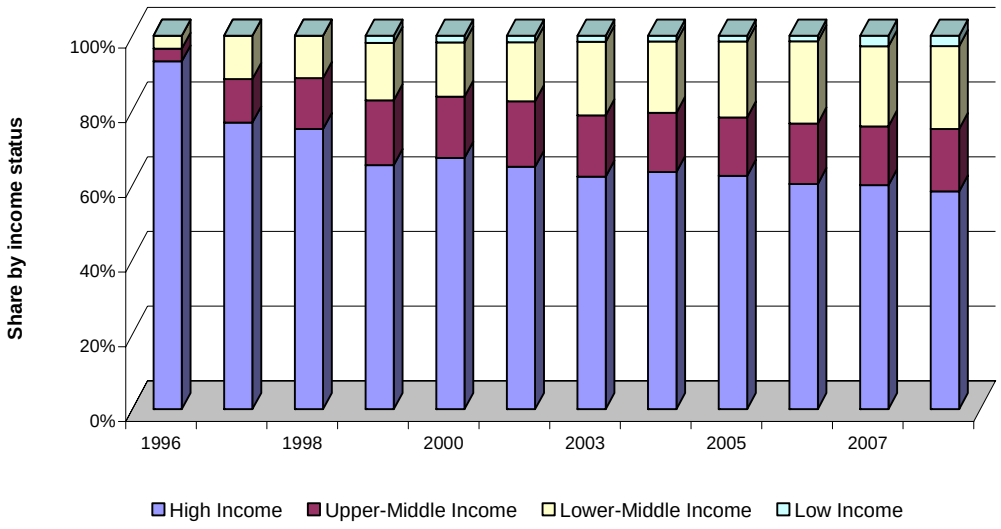
Source: Compiled by USITC staff.

Note: EU members in italics.

[a] Based on World Bank income classification.

[8] Mann and Liu report that in 1990 Japan, Europe, and the U.S. accounted for nearly two-thirds (68 percent) of the global export market for IT products.

FIGURE 1 ITA membership composition, share by income status,[a] 1996-2008



[a]Based on World Bank income classification.

The ITA participants that joined subsequent to the original signatory members also presented diverse trade and economic profiles, consistent with the increasing participation of developing countries after 1996. The diversification of membership profiles illustrates increasing interest in liberalized ITA trade. Utilizing total ITA trade (exports and imports) and per capita gross domestic product (GDP)[9] as indicators of trade activity and economic station, a diffuse pattern emerges among the post-1996 entrants. For example, Bahrain and China entered the ITA in 2003 with highly divergent economic and ITA trade profiles. Bahrain, in accordance with its developed country status, exhibited relatively high GDP ($13,726), but lower ITA trade activity ($273 million) compared to China's lower GDP ($1,270) and higher ITA trade activity ($250.2 billion) (table 2 and figure 2). Even within high income, middle income, and low income groups, the economic and trade profile of countries upon ITA entrance varied considerably. Among the high income countries Hungary, Israel, and United Arab Emirates displayed relatively higher GDP and ITA trade activity compared with Estonia and Croatia. Within the middle income group of developing countries, Malaysia and China entered the ITA with relatively strong GDP and ITA trade activity compared with Georgia and Moldova with lower GDP and nascent ITA trade activity. Despite its developing income status China's total ITA trade was $250.2 billion in 2003, exceeding the ITA trade level of Japan in 1996 ($153.6 billion). Notably, China was a leading manufacturer and trader of IT products prior to joining the ITA and deeply engaged in the global IT production chain even prior to tariff liberalization.

[9] IMF statistics , World Economic Outlook Database, April 2009 (accessed August 18, 2009).

TABLE 2 ITA membership countries by economic status, 1997–2008

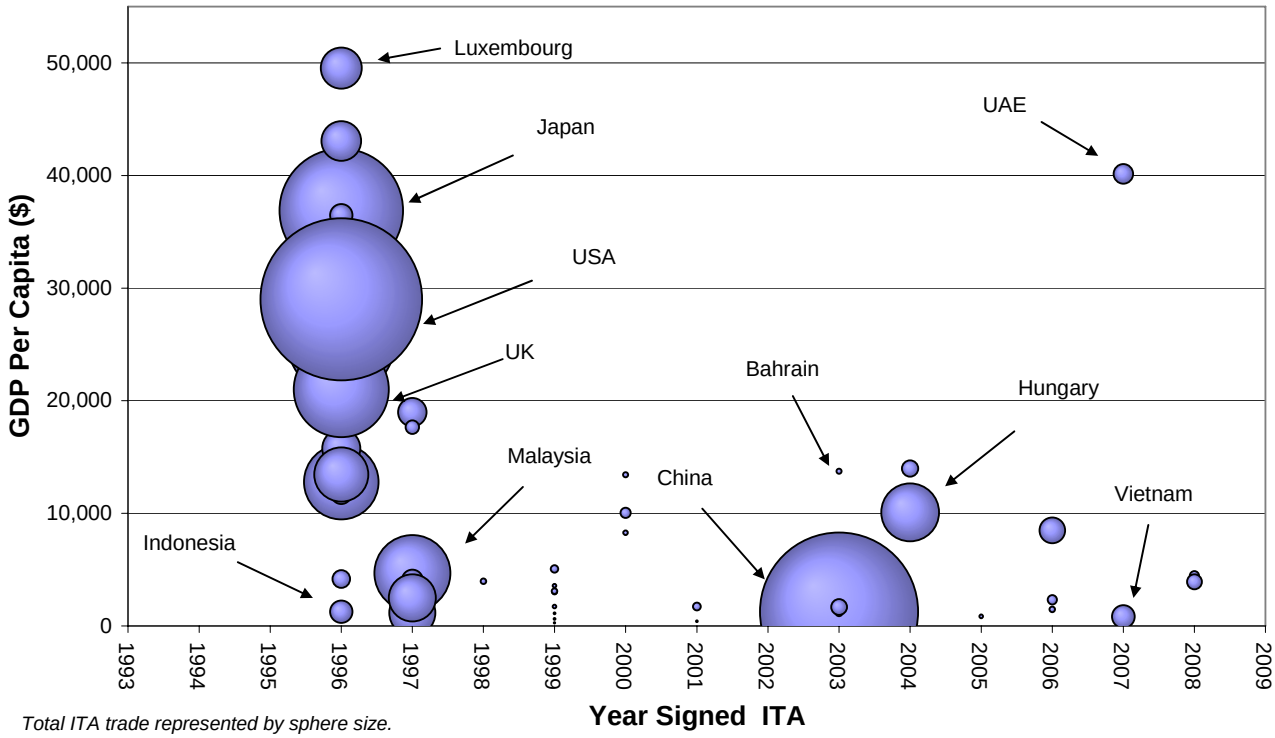
Country	Year joined ITA	Economic status[a]	GDP per capita	Total ITA trade
			Dollar	Million $
Hungary	2004	High Income	10,090	33,673
Israel	1997	High Income	18,993	8,169
Saudi Arabia	2006	High Income	8,490	6,600
Czech Republic	1997	High Income	5,545	5,885
United Arab Emirates	2007	High Income	40,147	4,000
Malta	2004	High Income	13,987	2,770
New Zealand	1997	High Income	17,656	1,942
Slovak Republic	1997	High Income	3,984	1,406
Slovenia	2000	High Income	10,045	1,148
Estonia	1997	High Income	3,581	788
Croatia	1999	High Income	5,058	617
Cyprus	2000	High Income	13,425	278
Bahrain	2003	High Income	13,726	273
Oman	2000	High Income	8,271	255
Malaysia	1997	Upper Middle Income	4,693	58,416
Poland	1997	Upper Middle Income	4,064	4,542
Romania	1997	Upper Middle Income	1,567	948
Peru	2008	Upper Middle Income	4,453	948
Bulgaria	2001	Upper Middle Income	1,712	654
Costa Rica	1997	Upper Middle Income	3,508	629
Lithuania	1999	Upper Middle Income	3,098	361
Panama	1998	Upper Middle Income	3,954	316
Latvia	1999	Upper Middle Income	3,038	275
Mauritius	1999	Upper Middle Income	3,571	144
China	2003	Lower Middle Income	1,270	250,202
Thailand	1997	Lower Middle Income	2,496	22,368
Philippines	1997	Lower Middle Income	1,170	21,460
India	1997	Lower Middle Income	410	3,077
Morocco	2003	Lower Middle Income	1,688	2,664
Ukraine	2008	Lower Middle Income	3,920	2,338
Guatemala	2006	Lower Middle Income	2,325	941
Egypt	2003	Lower Middle Income	1,197	625
Honduras	2006	Lower Middle Income	1,474	361
Nicaragua	2005	Lower Middle Income	843	173
Jordan	1999	Lower Middle Income	1,720	169
Moldova	2001	Lower Middle Income	407	46
Georgia	1999	Lower Middle Income	627	38
Albania	1999	Lower Middle Income	1,130	37
El Salvador	1997	Lower Middle Income	2,077	0
Vietnam	2007	Low Income	835	5,375
Kyrgyz Republic	1999	Low Income	260	26

Source: Compiled by USITC staff.

Note: EU members in italics

[a]Based on World Bank income classification.

FIGURE 2 Profiles of ITA members, by income and trade levels



Total ITA trade represented by sphere size.
Source: Compiled by USITC staff from UN Comtrade

ITA Products

Recognizing the positive social and economic benefits derived from liberalized trade and diffusion of information technology products,[10] drafters of the Ministerial Declaration identified specific products for which duties and other charges would be eliminated. Participants agreed to implement binding duty eliminations through a schedule of concessions covering products in categories such as computers, software, telecommunications, semiconductors, semiconductor manufacturing equipment, scientific and measuring equipment, and related parts. Explicit product coverage under the ITA is comprised of two annexes to the Declaration, commonly referred to as Attachments A and B.[11] Attachment A is a positive list of items at the 6-digit Harmonized Schedule (HS) separated into two sections (A1 and A2). Attachment B includes product descriptions with no corresponding HS code, regardless of their inclusion in Attachment A. The descriptive approach in the Attachment B list is designed to cover products regardless of specific HS codes (Mann and Liu, 8) and to address divergent

[10] WTO, Ministerial Declaration on Trade in Information Technology Products (WT/MIN/96)/16, December 13, 1996).
[11] Ibid, Annex.

national positions in coverage of complex, multifunction products (Dreyer and Hindley, 4). Common products under Attachments A1, A2, and B with their initial number of 6-digit HS codes are noted in table 3. Notable IT products outside the scope of the ITA, mainly consumer electronic products, include CRT television sets, video cameras, and certain photocopiers.[12]

TABLE 3 Representative ITA products and number of HS codes, by attachment

	Number of HS codes	Sample Products
Attachment A1	112	**Computers and Computer Peripherals**; Personal computers, laptops, work stations, monitors, keyboards, hard drives, CD-ROM drives, smart cards, printers, scanners and other input/output units **Telecommunications Equipment**; telephone sets, cordless phones, mobile handsets, pagers, answering machines, switches, routers, hubs, modems, fiber optic cables **Semiconductors**; micro processors, integrated circuits, printed circuits, diodes, resistors **Software**; magnetic tapes, unrecorded media **Office Equipment;** certain photocopy machines, fax machines, cash registers, adding machines, calculators, automatic teller machines (ATM) **Scientific and Measuring Devices;** spectrometers, chromatographs, flow meters, gauges, optical radiation devices **Other;** Loudspeakers, still digital cameras, parts
Attachment A2	78	**Semiconductor manufacturing equipment (SME)**; etching and stripping apparatus, vapor deposition devices, sawing and dicing machines for wafers, spinners, ion implanters, wafer transport, handling and storage machines, injection molds, optical instruments, parts and accessories
Attachment B	13[a]	Computers, electric amplifiers, flat panel displays, network equipment, monitors, pagers, CD and DVD drives, plotters, printed circuit assemblies, removable storage devices, and set top boxes

[a] Attachment B products are covered regardless of where they are classified in the HS system. ITA Committee members have made attempts to narrow divergences in the customs classification of some Attachment B products (WTO G/IT/W6/Rev.3) though there is no agreed upon list. This paper uses such codes as a proxy.

Source: WTO and compiled by Commission staff.

ITA Trade[13]

Global IT trade has grown substantially under the ITA. Beginning in 1996 through 2008 total ITA products trade (imports and exports) expanded 10.1 percent annually, albeit unevenly, from $1.2

[12] For details on ITA negotiating history, including product coverage see Fleiss and Sauve, *Of Chips, Floppy Disks and Great Timing: Assessing the WTO Information Technology Agreement*, 1997, paper prepared for Institut francais des relations internationales and Tokyo Club Foundation.

[13] Trade data based on appropriate HS nomenclature for each year. See box 1 for further details regarding the dataset and attendant complexities.

trillion to $4.0 trillion. The strong growth in ITA trade exceeded that of manufactures trade, which expanded 7.1 percent annually during the same period (figure 4). ITA trade expansion was steepest between 1996 and 2000, growing 17.5 percent, but declined between 2000 and 2002 (-2.8 percent) as the internet boom of the 1990's abruptly reversed, adversely affecting IT spending and investment (Goldman Sachs, 4).[14] In 2002, however, ITA products trade growth resumed, but at a lower trajectory (10.4 percent).

BOX 1 Data challenges and changing classifications

Changes to the HS system resulting from several factors including technological developments impede attempts at pinpointing precise values in ITA trade. The HS system underwent nomenclature revisions in 2002 and more significantly in 2007, complicating the construction of a consistent times series for ITA product trade. As noted by the WTO, "The ITA committee has already started to discuss how to update the products list into the new nomenclatures, but it proved very difficult to reach an agreement due to the complexity of HS amendments and the remaining classification problems under the old nomenclature (HS1996)."[a] Quantifying trade in Attachment B products is additionally challenging because each country has provided their own list of tariff codes (usually at the national line level (i.e. 8- or 10-digit level)) where these products may be classified and some countries have not provided a list.

Because no WTO approved ITA product list exists for HS 2007, estimates were constructed for this analysis. For example, 6-digit codes provided in the ITA for Attachments A1 and A2 reflect World Customs Organization (WCO) transpositions as a proxy. However, many such products are breakouts (i.e. ex-outs) at the 6-digit level and ITA members have identified specific national tariff lines within these subheadings to cover these products. In our estimation, the HS 2007 system includes 354 sets of changes, 70 impacting the ITA. In Attachment A1, 54 of 111 subheadings are impacted, and 53 of 58 subheadings in Attachment A1. For Attachment B, while there is no agreed upon list, it is estimated that approximately 51 of 72 subheadings are impacted for products where a code was listed. Consequently, the integrity of ITA trade data in 2007 and 2008 likely reflects transposition challenges with HS 2007. For example, uneven 2007-2008 trade in office equipment stems in part from significant classification changes. Despite the challenges attendant with the HS 2007 nomenclature, utilizing the HS 2002 list after 2006 may significantly understate trade, as several ITA products are not captured starting in 2007.[b] To mitigate this, a constructed data set was employed, using the nomenclature appropriate for each year.[c] The data set also segregates products covered in both Attachments A and B to avoid possible duplication.[d] Finally, ITA product segments (e.g. computers, semiconductors, etc.) are based on HTS product descriptions, and in instances where products are covered in both Attachments and their use may span multiple segments (e.g. printed circuit assemblies), segmentation relied on USITC product digests.[e] Therefore this paper present a conservative approximation of the aggregate ITA trade data. Using this dataset, changes in trade patterns, product composition, country market share, are examined as the new members ascribe to tariff liberalization embodied in the ITA.

[a] http://www.wto.org/english/thewto_e/coher_e/wto_wco_e.htm.

[b] For example, cellular telephones, classified in HS 2002 under 8525.20, are classified under 8517.12 in HS 2007, a new 6-digit subheading not contained in HS 2002.

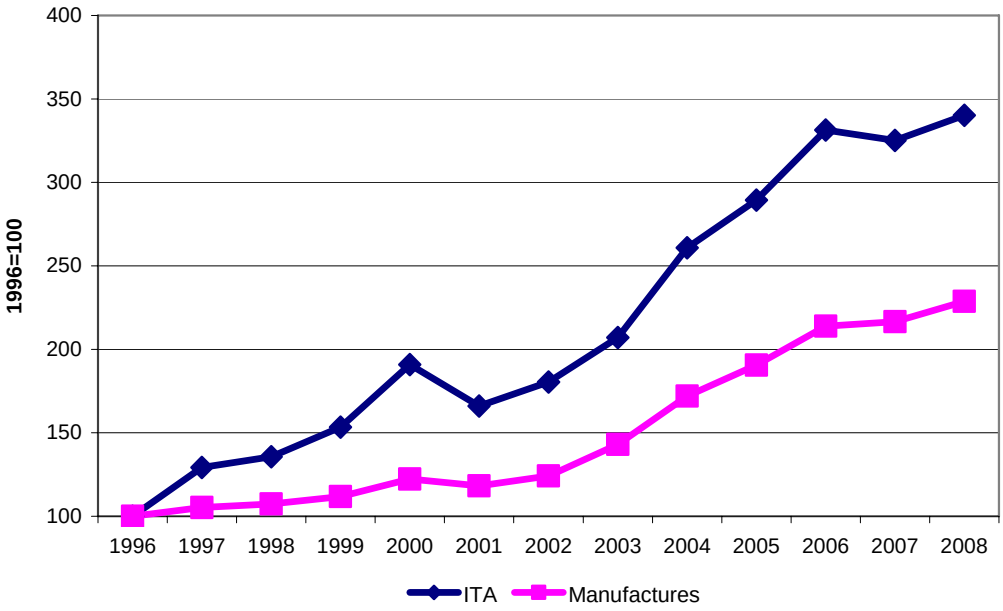
[c] The data for 1996–2001calculates the total base on the 1996 Ministerial Declaration, the list from 2002-2006 calculates the total based on the WTO's transposition into HS 2002. For 2007–2008, the total is calculated using a list transposed into HS 2007. While imperfect and likely understating trade for certain ITA products, using the HS 2007 produces a more representative dataset.

[d] Appendix A illustrates ITA total trade by segregated Attachment lists during 1996–2008.

[e] See USITC publication 4089, "Shifts in U.S. Merchandise Trade 2008," Investigation No. 332-345. http://www.usitc.gov/research_and_analysis/trade_shifts.htm.

[14] U.S. technology investment was down 7 percent in 2001 and 9 percent in 2002, reacting sharply to excesses associated with the tech bubble (Goldman Sachs, "Independent Insight: IT Spending Survey", November 2008).

FIGURE 3 ITA and manufactures total trade, 1996–2008



Source: Compiled by USITC staff from UN Comtrade database.

As a share of global trade, ITA product trade peaked in 2001 at 18.4 percent. While ITA's share declined slightly to 15.2 percent in 2008, it remains above the 1996 level of 13.8 percent (table 4). This share, however, likely understates the economic significance of this product group. Since the inception of the ITA, prices of technology products have trended downwards (WTO 2008, 16),[15] masking the increasing level of ITA trade.

TABLE 4 ITA trade compared with manufactures trade, share and growth rates, selected years

	Share of total trade	Compound annual growth rate		
	2008	1996–2008	1996–2000	2001–2008
		Percent		
ITA Total Trade	15.2	10.7	17.5	10.8
Manufactures Total Trade	65.5	7.1	5.2	9.9

Source: Compiled by USITC staff from UN Comtrade database.

[15] Based on U.S. import values between 1996 and 2005, average unit prices for IT products declined 6 percent annually compared with a 1 percent increase for all other manufactured goods (WTO World Trade Report 2008, 16).

TABLE 5 ITA exports, top 30 countries and growth rates, selected years

Number	Exporter	Exports 2008	Share of total 2008	Compound annual growth rates		
				1996-2008 [a]	1996-2000 [a]	2001-2008
		Thousand $		Percent		
1	China	463,685,179	24.6	33.5	29.2	38.1
2	Japan	173,712,915	9.2	4.3	7.9	7.2
3	Singapore	146,781,694	7.8	7.1	5.6	11.8
4	Germany	142,524,685	7.8	9.0	7.2	11.2
5	United States	142,470,901	7.6	1.9	10.2	1.0
6	Korea, South	124,747,772	6.6	13.1	18.1	17.0
7	Netherlands	80,490,648	4.3	9.8	13.4	11.5
8	Mexico	64,610,222	3.4	13.1	19.2	10.2
9	Chinese Taipei	53,435,374	2.8	9.8	39.5	0.0
10	Malaysia	43,475,140	2.3	3.0	11.9	0.6
11	France	42,985,486	2.3	3.9	7.5	4.9
12	United Kingdom	39,170,154	2.1	-0.8	7.7	-4.8
13	Thailand	37,657,450	2.0	10.7	13.3	13.2
14	Czech Republic	27,529,537	1.5	28.5	18.1	34.8
15	Hungary	27,516,996	1.5	37.2	81.8	22.8
16	Ireland	24,606,914	1.3	3.0	16.0	-4.3
17	Italy	23,684,093	1.3	2.1	-0.7	3.9
18	Sweden	22,399,212	1.2	4.7	8.0	11.0
19	Belgium	18,559,404	1.0	7.6	8.5	6.8
20	Finland	17,743,663	0.9	9.2	18.2	8.8
21	Austria	15,885,611	0.8	10.8	9.4	12.2
22	Philippines	15,582,762	0.8	11.0	56.6	-4.6
23	Canada	14,746,829	0.8	-0.5	12.7	-2.1
24	Switzerland	14,619,955	0.8	5.6	4.2	8.5
25	Slovak Republic	13,060,477	0.6	36.8	10.1	60.1
26	Poland	11,851,929	0.6	29.3	13.3	43.1
27	Spain	11,034,632	0.6	7.7	6.7	9.5
28	Israel	7,317,840	0.4	6.1	22.4	1.0
29	Denmark	6,967,475	0.4	6.9	9.0	7.3
30	Norway	4,568,130	0.2	10.0	3.4	15.6
	World	1,882,022,074		10.6	17.7	10.7
	EU 15	440,673,667	23.4	6.0	8.9	6.2
	EU External only	199,487,510	10.6			9.4

Source: Compiled by USITC staff from UN Comtrade database.
[a] Data starts in 1997 for Singapore, Malaysia, Russia, Brazil, Slovak Republic, and Philippines. Data starts in 1998 for Thailand. *Note*: Belgian data in 1996 includes Luxembourg.

TABLE 6 ITA imports, top 30 countries and growth rates, selected years

Number	Importer	Imports 2008	Share of total 2008	Compound annual growth rates		
				1996-2008[a]	1996-2000[a]	2001-2008
		Thousand $		Percent		
1	United States	305,082,078	14.3	6.2	12.1	7.4
2	China	279,582,232	13.1	24.4	25.2	25.3
3	Hong Kong, China	183,994,486	8.6	14.3	12.7	17.7
4	Germany	135,253,735	6.3	8.5	8.7	9.3
5	Singapore	106,436,489	5.0	6.2	5.8	11.1
6	Japan	95,821,222	4.5	5.7	9.5	6.8
7	Korea, South	77,368,758	3.6	9.0	12.4	12.7
8	Netherlands	75,045,283	3.5	9.7	14.9	10.7
9	Mexico	71,774,690	3.4	13.5	24.3	9.7
10	United Kingdom	69,048,943	3.2	3.1	9.5	3.4
11	France	60,873,645	2.5	6.0	8.2	8.1
12	Malaysia	52,919,855	2.5	5.5	8.6	7.2
13	Canada	40,083,796	1.9	4.1	10.8	4.7
14	Italy	39,840,656	1.9	6.3	7.6	7.9
15	Spain	38,107,998	1.8	11.6	8.8	16.2
16	Thailand	33,837,547	1.6	9.6	9.2	11.9
17	Czech Republic	26,957,270	1.3	19.3	9.1	25.1
18	Russian Federation	25,146,828	1.2	17.9	-15.7	38.7
19	Hungary	24,583,846	1.2	25.4	46.7	17.8
20	Philippines	24,463,013	1.1	3.1	-0.6	5.9
21	Chinese Taipei	24,036,619	1.1	6.0	48.9	-7.6
22	Belgium	22,902,964	1.1	7.8	8.4	7.2
23	Brazil	22,173,634	1.0	8.1	2.5	13.5
24	Australia	21,238,066	1.0	6.7	4.7	12.9
25	Sweden	19,934,993	0.9	6.0	7.0	10.8
26	Switzerland	17,058,388	0.8	6.0	6.5	8.3
27	Austria	16,699,116	0.8	9.4	9.6	10.9
28	Ireland	16,230,409	0.8	3.9	16.3	-2.8
29	Slovak Republic	12,877,092	0.6	22.7	-1.3	38.5
30	Finland	12,678,786	0.6	9.3	12.5	11.0
	World	2,131,461,652		10.9	17.4	10.9
	EU 15	472,359,584	22.2	7.2	9.9	8.1
	EU 15 External	302,642,656	14.2			10.5

Source: Compiled by USITC staff from UN Comtrade database.
[a] Data starts in 1997 for Singapore, Malaysia, Russia, Brazil, Slovak Republic, and Philippines. Data starts in 1998 for Thailand. *Note*: Belgian data in 1996 includes Luxembourg.

Shifting Trade Patterns

Twelve years of duty-free trade in ITA products triggered substantial changes in trade patterns and market shares for ITA member countries. A prominent feature of expanding ITA trade is the broadening participation of Asian countries, particularly China, and an increasingly important role for other developing countries. While especially high growth rates[16] of ITA trade are observed throughout Asian countries, some ITA member countries benefited more than others. Among Asian and developing countries the rapidly expanding role of China stands out; China has emerged to become the largest single player in the global ITA market. Outside of Asia, several Eastern European countries experienced an upsurge in ITA trade.

Broader Asia Shifts

Asia's role in ITA trade grew extensively during the last decade. While not all countries within Asia gained equally, several Asian ITA countries are now leading exporters and importers and centers for global production networks for ITA products.

Asian ITA exports grew rapidly between 1996 and 2008, led principally by China and to a lesser extent Singapore, South Korea, and Thailand. Annual export growth rates were strongest for China (33.5 percent),[17] South Korea (13.1 percent), Chinese Taipei (9.8 percent), and Philippines (11.0 percent) (table 5).[18] Similarly, import growth rates were strong, led by China (24.4 percent),[19] and also Thailand (9.6 percent), South Korea (9.0 percent), Singapore (6.2 percent), and Japan (5.7 percent) (table 6). Asian ITA members now represent 5 of the 10 largest exporters and importers of ITA products.

Japan, formerly the leading exporter of ITA products, is now the second largest Asian exporter behind China, ceding market share due to sharper growth in exports by other Asian countries. Japan's export market share fell from a 1996 high of 18.6 percent to only 9.2 percent in 2008. Despite the decline in ITA export shares in Japan, the robust increase in ITA market share for several other Asian countries, punctuated by China, indicates a significant shift in manufacturing capabilities for ITA products towards Asian countries, particularly developing countries.

Shifting ITA trade patterns in Asia are consistent with the increasingly fragmented production of goods across the Asian region. Diversified production chains allow producers to benefit from an individual country's comparative advantages (Capannelli, 3). Moreover, products covered by the ITA are conducive to this production model, and therefore play a major role in global production networks (Slaughter 2003, 27). Fragmentation based specialization has become a key component of the economic landscape in Asia (Athukorola, 15), with much of the change taking place since the inception of the ITA.

China

China's rise to preeminence in the global ITA market is the most significant shift in ITA trade in Asia, and the world. When the original member countries concluded the ITA in 1996, China accounted for 3 percent of total ITA trade. By 2008, China accounted for nearly 19 percent of total ITA trade, surpassing the U.S., the next largest trader at 11.2 percent. During this period, China's total ITA trade

[16] Growth rates are compound annual growth rates unless otherwise indicated.

[17] ITA exports from Hong Kong, China grew 13.0 percent annually.

[18] Malaysia's ITA trade grew at an annual rate of 10.2 percent from 1997-2006, then declined sharply, due largely to incomplete data reporting for HS 2007.

[19] ITA imports from Hong Kong, China increased 14.3 percent annually.

value grew at a remarkable annual rate of 29.0 percent, more than twice the global average of 10.7 percent. Presently, China is the largest exporter and second largest importer of ITA products (tables 5 and 6). Through its WTO accession and commitment to join the ITA,[20] China gained MFN access to major markets, and became an increasingly attractive location for export orientated foreign direct investment (FDI) (Fung, Korhonen, Li, and Ng, 9),[21] contributing to China's rapidly growing export and import share in the ITA market. Indeed, China's ITA trade accelerated subsequent to its WTO commitments to reduce trade impediments, including tariff elimination for ITA products. In 2001 for example, global ITA exports declined 13.0 percent, but Chinese exports of ITA products grew 19.9 percent. By 2003, when China entered the ITA, it was already the third largest exporter, and the fourth largest importer of ITA products. In 2004, China expanded its market share becoming the world's largest exporter of ITA products. In 2005, China surpassed both the EU and the U.S. to become the largest country in terms of overall ITA trade.

Increased FDI had a major role in China's accelerating ITA exports, as multinational corporations sought to reduce costs by directly adding capacity in China (WTO 2008, 18). Once China joined the WTO, products exported from China were guaranteed MFN access to other countries, providing strong incentives for multinational corporations to establish production and assembly operations in China.

The ITA further improved China's export capabilities by lowering the cost of intermediate ITA goods through tariff elimination. China recognized that tariffs acted as a tax for Chinese firms seeking to enhance participation in global production networks (Borrus and Cohen, 12-14). One example of China's expansion into global production networks is the Pearl River delta which has become the largest location in the world for electronics contract manufacturing (Luthje, 1). Consequently, China has become a critical hub in global production networks for ITA goods, and has emerged as the fastest growing supplier to the world of many ITA products including computers, telecommunications equipments, and associated ITA parts.[22]

The rise of China and other developing ITA members in Asia represent a major shift in ITA trade, but not the only shift. The increasing export shares of Eastern European countries are also significant and reflect similar characteristics to the rise of Asia.

Eastern Europe

Eastern European countries are rapidly expanding their share of ITA trade. Four countries, all ITA members, stand out: Hungary, Slovak Republic, Czech Republic, and Poland. Between 1996 and 2008, total ITA trade grew by 30.0 percent for Hungary, 27.5 percent for the Slovak Republic, 22.9 percent for the Czech Republic, and 15.4 percent for Poland.

For each of these four countries, exports expanded faster than imports. For example, the Slovak Republic's annual export growth was 60.1 percent between 2001 and 2008, whereas import growth was 38.5 percent over the same period. The Slovak Republic, Czech Republic, Hungary, and Poland combined, account for barely 4 percent of global ITA trade, yet their export growth rate is remarkable and worth noting.

The rise of Eastern European countries in ITA trade reflects continued restructuring of production networks in the information technology industry (OECD 2008, 107). This region is a critical hub in global supply networks of ITA products, with corporations making export oriented investments, setting up factories to export to western Europe and the world. For example, according to Radosevic (14), FDI

[20] China's accession to the WTO in 2001 included a commitment to join the ITA, which occurred in 2003.

[21] According to Fung, Korhonen, Li, and Ng, China's WTO accession was the catalyst for a new surge in FDI inflows, focused on manufacturing, during a time when worldwide FDI was declining.

[22] See section *"Shifting Trade in Product Segments"* herein.

was the primary vehicle for the integration of Eastern European electronics firms into global supply networks, and "EU demand is a strong focal point" in new production networks. ITA countries in Eastern Europe provide advantages of geographic proximity and cultural ties (Fung, Korhonen, Li, and Ng, 7), and therefore have benefited from the location decisions of EU and multinational corporations, particularly following tariff liberalization under the ITA.

In addition to tariff liberalization, the EU integration process also helped to drive the expansion of ITA trade in Eastern Europe (WTO 2008, 18). According to the European Commission, large flows of FDI from traditional EU members have increased the technological content of new EU member countries'[23] export baskets (EU 2009, 53).

These shifting trade patterns towards Asia, China, and Eastern Europe illustrate the rise of developing countries and geographic diversification in global trade of ITA products.

Comparison of Developed and Developing Members

Since the launch of the ITA, developing countries have gradually gained market share from developed trading countries. Developed countries still account for 67.1 percent of world ITA exports, but have expanded at a much slower rate, gradually ceding market share to developing countries, China in particular (figure 4). Developing country ITA members comprised 3.4 percent of total ITA exports in 1996, but climbed rapidly to 32.9 percent of total exports by 2008.

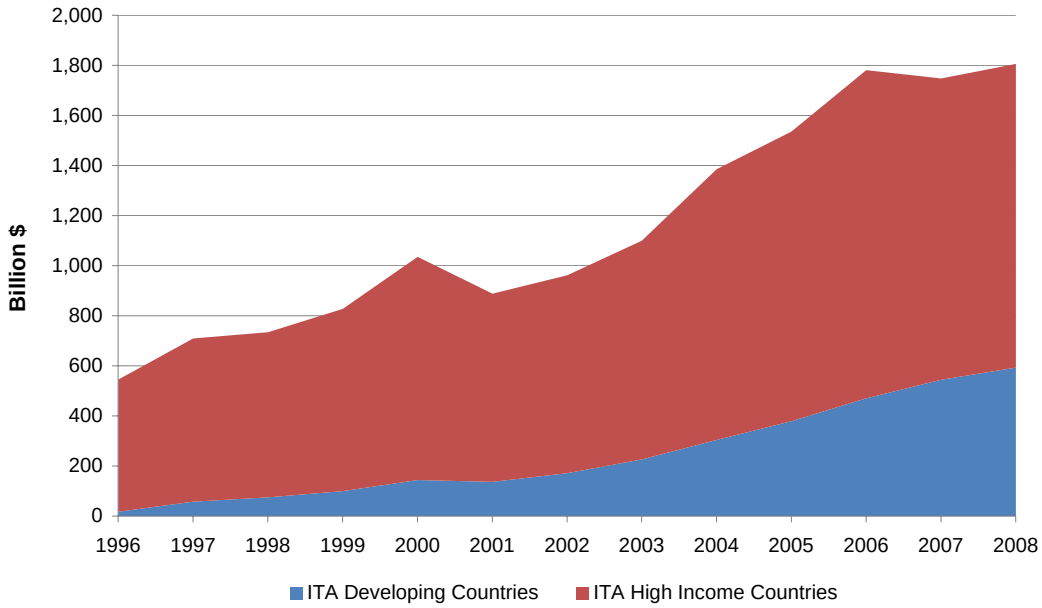
Between 1996 and 2008, developing countries' exports expanded at an annual growth rate of 33.6 percent, compared to 7.2 percent for developed countries. Although some of the early growth for developing countries reflects improved consistency in reporting of export data, from 2001-08, developing country ITA exports still expanded more than three times as fast as developed country ITA exports.

Based on year-over-year measurements of export growth, developing country trade expanded faster between 1996 and 2000, and declined less sharply during 2000-02. Developing country ITA exports expanded at 33.3 percent in 1999 and 43.6 percent in 2000. In contrast, developed country ITA exports expanded at 10.3 percent in 1999 and 22.5 percent in 2000. Following the peak in the technology boom, developing country exports declined at a slower rate, 5.4 percent year-over-year compared to a 15.6 percent decline for developed countries.[24] Broadening participation and increasing market share of developing countries in the ITA trade represents another major shift in ITA trade patterns.

[23] Hungary, Slovak Republic, Czech Republic, and Poland each joined the EU as part of the 2004 expansion.

[24] It should be noted that these calculations include countries not yet signed onto the ITA in the given years; the MFN nature of the ITA provides all WTO members tariff duty free access to all markets for ITA member countries.

FIGURE 4 Developing and developed (high income) ITA exports 1996–2008



Note: Includes only ITA members
Source: Compiled by USITC staff from UN Comtrade database.

Role of non-ITA countries

ITA member countries account for the vast majority of total ITA trade, with a few non-ITA member countries expanding their share of ITA trade. In 2008, non-ITA countries accounted for only 6 percent of total ITA trade, yet several non-ITA countries have a significant and growing foothold. Despite non-member status, Mexico, Russia, Brazil, and South Africa, have demonstrated strong ITA trade since 1996. In particular, Mexico's export role and Russia's import growth are both noteworthy.

Mexico is the only non-ITA member in the top 30 ITA exporters, ranking 8th in 2008 (table 5). As a WTO member, its exporters benefit from the MFN nature of the Agreement. Additionally, on the import side, Mexico unilaterally instituted "ITA plus" which eliminates duties on a wide variety of critical inputs, machinery, and finished products in the electronics and IT sectors (Padiema-Peralta, 1). These lower cost inputs provide a competitive price advantage to Mexican producers and exporters. Moreover, due to the NAFTA, there is established ITA production networks linking Mexico with the U.S. and Canada; in 2008, 87 percent of Mexico's ITA exports went to either Canada or the U.S.

Russia is rapidly increasing imports of ITA products despite being outside the WTO and the ITA. While the rest of the world benefited from the technology boom of 1996-2000, Russia's ITA imports declined by 15.7 percent, with the country suffering from a severe financial crisis in 1998. Yet, since 2001, Russian imports of ITA products have grown annually by 38.7 percent (table 6), albeit from a relatively small base. Russia is primarily an importer of ITA products, rather than an exporter. They are a major exporter of information and communication services (OECD 2008, 91). The ITA does not cover

services, but Russia's strong position in the related services industry may explain its demand for products covered by the ITA. Russia's main sources of ITA imports are China, Germany, and Hungary.

Product Segment Profiles

While many ITA products are readily identifiable, others are parts or intermediary products with functions across multiple broad categories. In examining the growth and composition of ITA products the covered goods are grouped into eight general product segments as noted in table 1, namely: computers and peripherals (computers) office equipment, scientific and measuring devices (scientific devices), semiconductors, semiconductor manufacturing equipment (SME), software, telecommunications equipment, and other ITA products and parts (other).[25] While annualized growth rates for most product segments exceeded 10 percent, import and export growth rates were strongest for other products (other ITA products and parts), office machines,[26] semiconductors, and telecommunications during 1996-2008. Rapidly rising trade in other products is consistent with the proliferation of intermediary goods and parts trade fueled by expanding global product networks (Athukorala, 7). Strong growth rates in semiconductors and telecommunication segments, in part, reflects expanding uses of semiconductors in IT products and advances in cellular communications.

The composition of ITA trade during the past twelve years was dominated by semiconductors and computer trade, despite ceding market share to other fast growing products including telecommunications and other products. The internet boom of the 1990's and declining prices for personal computers and semiconductors (Aizcorbe, Flamm, and Khurshid, 12) spurred increasing demand and trade flows for these products.

Product Segment Growth Rates

Across all ITA product segments total trade increased by 10.7 percent annually between 1996 and 2008. Annualized growth of ITA trade was strongest at 17.5 percent during 1996–2000, then slowed to 10.8 percent between 2001 and 2008 reflecting, in part, the sharp decline in IT spending following the internet boom in the late 1990's. Import growth was led by other products and parts (17.0 percent), with expansion in global imports of office equipment, semiconductors, and telecommunications ranging between 15.5 percent and 13.1 percent (table 7). Similar product growth patterns emerge in global exports, with office machines and other ITA products and parts exhibiting the strongest annual growth rates (16.4 percent and 16.0 percent, respectively). Increasing trade in parts is indicative of the increasing fragmentation of the global electronics and IT supply chains. Additionally, significant technology developments surrounding the internet and mobile communications were important drivers behind the rapid trade expansion for telecommunications and office machines.[27] [28] Further, trade in office machines and other ITA products and parts at the inception of the ITA was relatively low compared with computers and semiconductors, which accounted for the majority of IT trade and of considerable focus in the negotiations leading up to the Singapore Ministerial (Fleis and Sauve, 29–32).

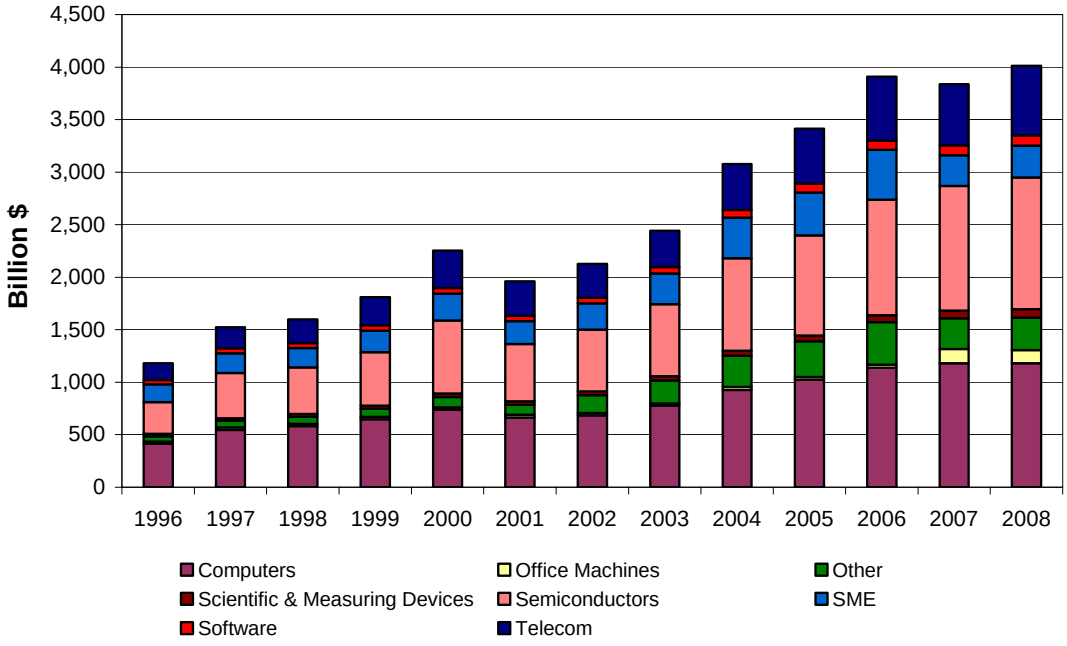
[25] Segmented according to 6-digit HS in accordance with USITC product classifications.

[26] Difficulties in reconciling trade data associated with complex HS 2007 nomenclature changes may account for some of the increase in office machine trade after 2006.

[27] Examples of technology developments include rapid adoption of cellular phones and increased popularity of multifunction printing machines. Indeed, cell phones, and printing parts and accessories accounted for 35 percent and 88 percent of total imports for their respective product segments in 2008.

[28] Uneven 2007-2008 trade in office equipment stems in part from significant HS classification changes.

FIGURE 5 ITA total trade by product, 1996–2008



Source: Compiled by USITC staff from UN Comtrade database.

TABLE 7 ITA import and export, growth rates, by product category, selected years

Category	Flow	1996	2000	2001	2008	Annual growth 1996–2008	Annual growth 1996–2000	Annual growth 2001–2008
			Thousands$				Percent	
Other	Import	25,755,884	54,044,287	50,593,669	170,142,725	17.0	20.4	18.9
Office Machines	Import	11,716,868	12,508,909	12,395,073	66,056,407[a]	15.5[a]	1.6[a]	27.0[a]
Semiconductors	Import	159,153,497	369,531,817	297,379,179	713,043,592	13.3	23.4	13.3
Telecom	Import	78,072,743	180,851,150	168,551,206	340,914,187	13.1	23.4	10.6
Scientific Devices	Import	12,064,397	16,580,565	17,895,020	40,171,254	10.5	8.3	12.2
Software	Import	19,430,181	25,569,836	25,045,653	52,362,180	8.6	7.1	11.1
Computers	Import	231,691,768	387,107,292	350,008,651	601,158,386	8.3	13.7	8.0
SME	Import	80,899,512	130,178,132	111,159,562	147,612,922	5.1	12.6	4.1
Office Machines	Export	9,673,615	11,207,972	10,864,082	60,086,400[a]	16.4[a]	3.7[a]	27.7[a]
Other	Export	23,385,248	46,501,635	44,323,728	138,769,407	16.0	18.7	17.7
Telecom	Export	79,823,837	175,432,546	159,056,944	321,572,875	12.3	21.8	10.6
Semiconductors	Export	143,321,320	323,924,248	247,443,755	541,211,042	11.7	22.6	11.8
Scientific Devices	Export	12,246,914	14,981,935	16,264,111	39,121,240	10.2	5.2	13.4
Computers	Export	182,684,635	349,687,303	316,379,366	579,872,049	10.1	17.6	9.0
Software	Export	22,403,227	26,097,693	25,469,977	46,382,620	6.3	3.9	8.9
SME	Export	87,203,921	127,583,670	106,186,643	155,006,442	4.9	10.0	5.6
TOTAL TRADE		1,179,527,569	2,251,788,989	1,959,016,618	4,013,483,726	10.7	17.5	10.8

[a] Difficulties in reconciling trade data associated with complex HS 2007 nomenclature changes may account for some of the increase in office machines trade, and some of the SME trade decrease after 2006.

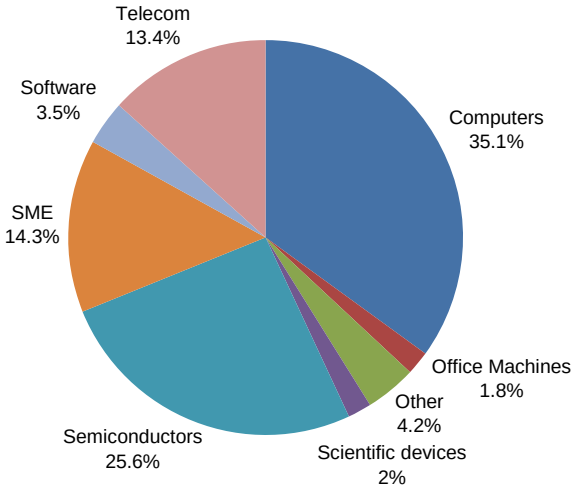
Source: Compiled by USITC staff from UN Comtrade database.

Shifting Trade in Products Segments

Computers and semiconductors dominate trade in ITA products despite rising telecommunications and parts trade. The composition of total trade in ITA products was heavily weighted to computers and semiconductors (60.7 percent in 2008) though the share of computers declined and semiconductors increased during 1996-2008 (figures 6-7). In addition to computers, which declined 6 percentage points, the share of SME total trade declined from 14.3 percent to 7.5 percent. Telecom and other products (other ITA products and parts) collectively represent 24.2 percent of 2008 trade, up from 17.6 percent in 1996.

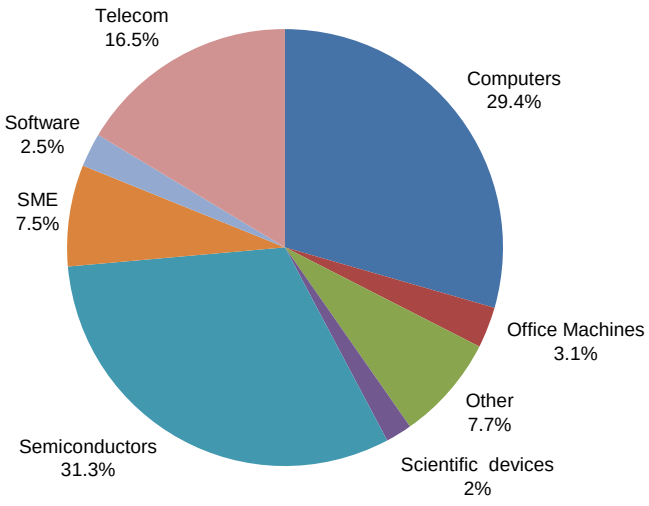
Examining imports separately, similar patterns emerge. The decline in the share of computer imports from 37 percent to 27 percent was captured by imports of semiconductors. The share of import shipments of SME also declined displaced by rising shares of telecommunications and other ITA products and parts imports. In contrast, export share for computers increased modestly, from 33 to 36 percent, along with semiconductors. Shares of telecom, SME, and to a lesser extent, scientific devices slipped 4 percentage points collectively.

FIGURE 6 ITA total trade by product segment, 1996



Source: Compiled by USITC staff from UN Comtrade database.

FIGURE 7 ITA total trade by product segment, 2008



Source: Compiled by USITC staff from UN Comtrade database.

Product Composition by Country

Since the Agreement went into force, developing countries account for increasing export and import shares of leading ITA products segments. Further, ITA members continue to dominate world ITA

trade relative to their non-ITA counterparts. Examining the three largest ITA product segments[29]—computers, semiconductors, and telecommunications a clear pattern emerges of robust growth in exports and imports by ITA developing countries. This growth was most pronounced for exports and imports in Asia, notably China, as several post-1996 ITA members captured increasing market share from developed countries in these products. This momentous shift in global production is most evident in computers and telecommunications exports, where China and South Korea alone have displaced the U.S., Japan, and several European countries as the leading producers and exports of these products. The elimination of tariffs under the ITA facilitated opportunities for many developing countries to enter global production networks,[30] driving shifting trade patterns for these products.

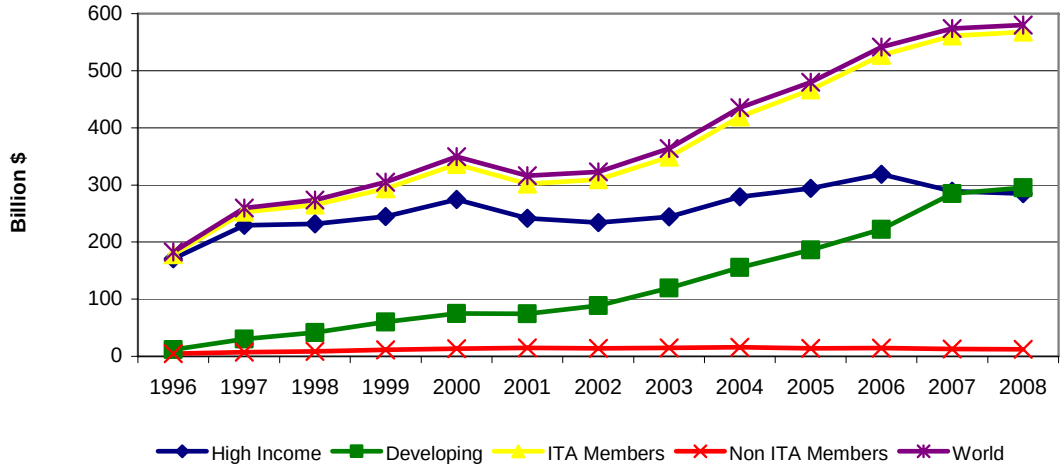
Computers

ITA members continue to dominate global computer trade, representing 98 percent of exports, unchanged from 1996. However, the shift to developing ITA members as leading exporters of computers is significant. Led by several Asian countries, particularly China, developing countries' share of global computer exports surged from 6.5 percent in 1996 to nearly 51 percent in 2008 (figure 8). The rapid expansion of computer exports by developing countries was further characterized by a 30.6 percent annual growth rate compared with 10.1 percent for developed countries between 1996 and 2008. The composition of the top ten computer exporters similarly shifted to China, and other Asian countries. In 1996, four countries, the U.S., Japan, United Kingdom, and the Netherlands accounted for over 50 percent of exports. By 2008, China and South Korea alone accounted for nearly half (46.6 percent) of exports, illustrating a significant shift and increasing concentration of global computer production and export patterns (figures 9-10). Other developing ITA members, including Malaysia and Thailand also experienced a rapid increase in computer exports since joining the ITA, accounting for 4.4 percent and 3.2 percent, respectively, of 2008 exports.

[29] Based on 2008 total trade (table 5).

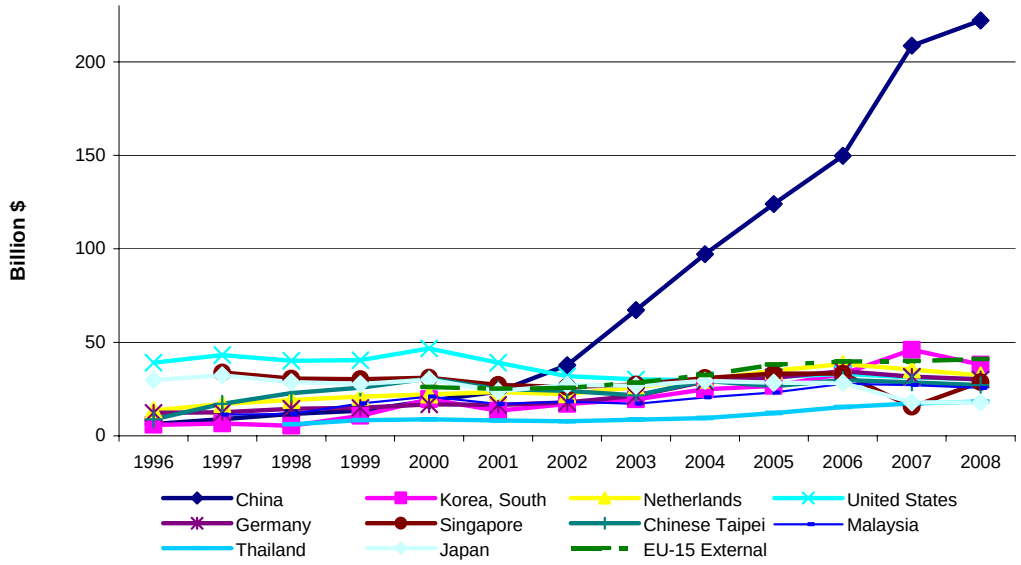
[30] According to Slaughter, developing countries may enter global production networks by leveraging comparative advantages in importing intermediate goods, adding value through these advantages, and subsequently exporting outputs to other countries (Slaughter 2003, 27).

FIGURE 8 ITA computer exports, by income and ITA status, 1996–2008



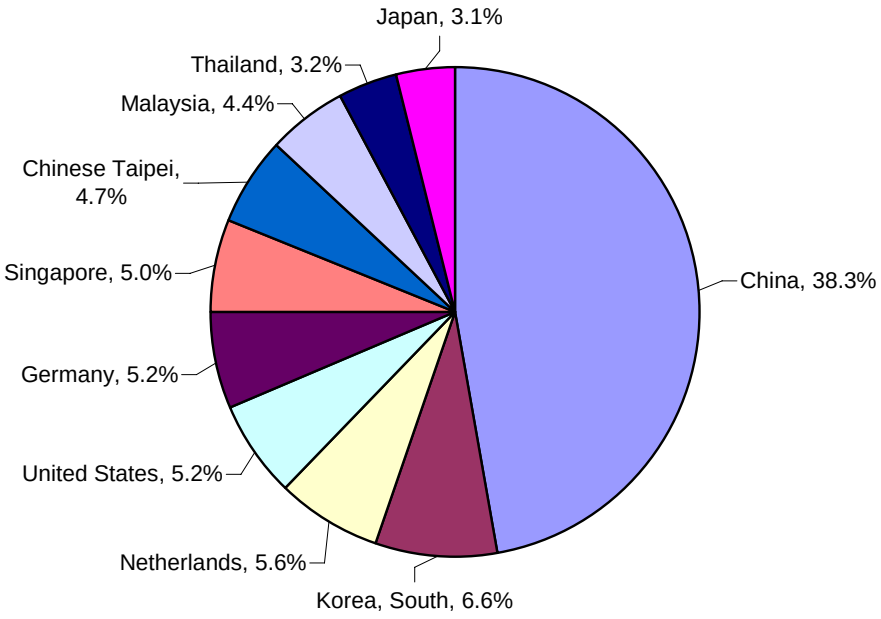
Source: Compiled by USITC staff from UN Comtrade database.

FIGURE 9 ITA computers: Top 10 exporters and EU, 1996–2008



Source: Compiled by USITC staff from UN Comtrade database.

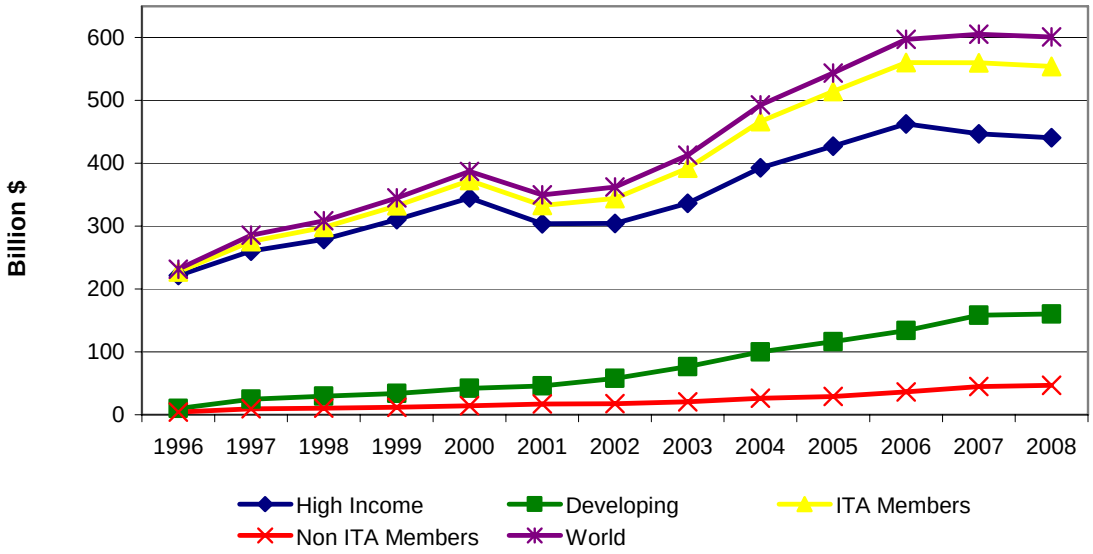
FIGURE 10 Computers: Top 10 exporters, 2008



Source: Compiled by USITC staff from UN Comtrade database.

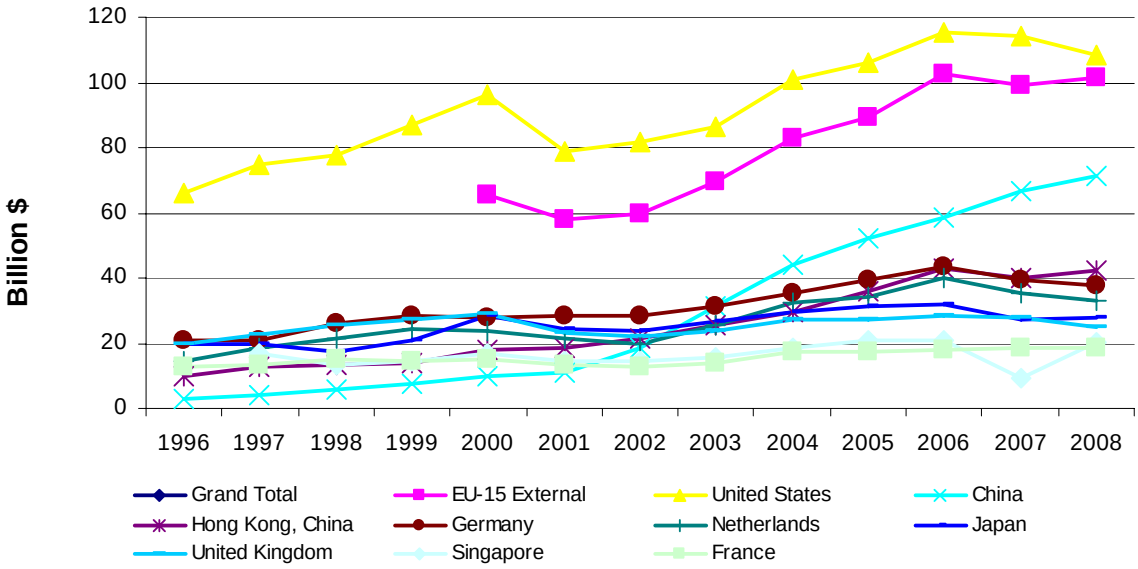
ITA members account for the vast majority of gains in computer imports since 1996 (92 percent of imports in 2008), despite increasing non-ITA member import trade (figure 11). Non-ITA members' share of computer imports increased 6 percentage points, principally driven by increasing imports from Mexico, Brazil, and Russia. These rising imports reflect duty free access to computer products under the MFN principle of the ITA and general economic expansion since 1996. The share of developing country imports expanded to 26 percent from 4 percent. Based on annual growth rates, China (29.7 percent), Hong Kong, China (12.8 percent), Mexico (18.4 percent) and Russia (30.7 percent) were principal contributors to developing country import growth since 1996. Among the top ten importers in 2008, U.S. imports increased to over $100 million, albeit unevenly. China became the second largest importer with the sharpest growth after the 2001-2002 period (figure 12). Overall, shifts in computer imports were less pronounced than exports. The U.S. Japan, Germany and other original ITA signatories were leading importers of computers in 1996. With the exception of China (12 percent), developed ITA members countries remain the leading importers of computer products in 2008 (figure 13).

FIGURE 11 ITA computer imports, by income and ITA status, 1996–2008



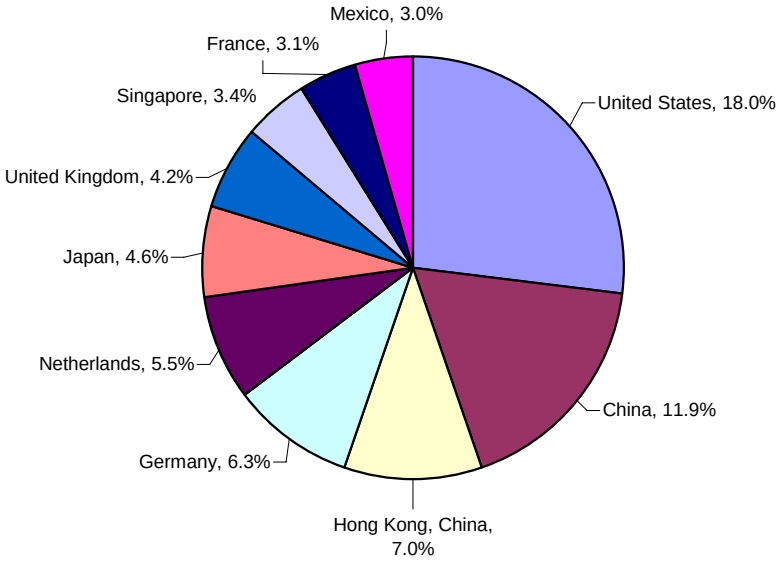
Source: Compiled by USITC staff from UN Comtrade database.

FIGURE 12 ITA Computers: Top 10 importers and EU, 1996–2008



Source: Compiled by USITC staff from UN Comtrade database.

FIGURE 13 Computers: Top 10 importers, 2008



Source: Compiled by USITC staff from UN Comtrade database.

Semiconductors

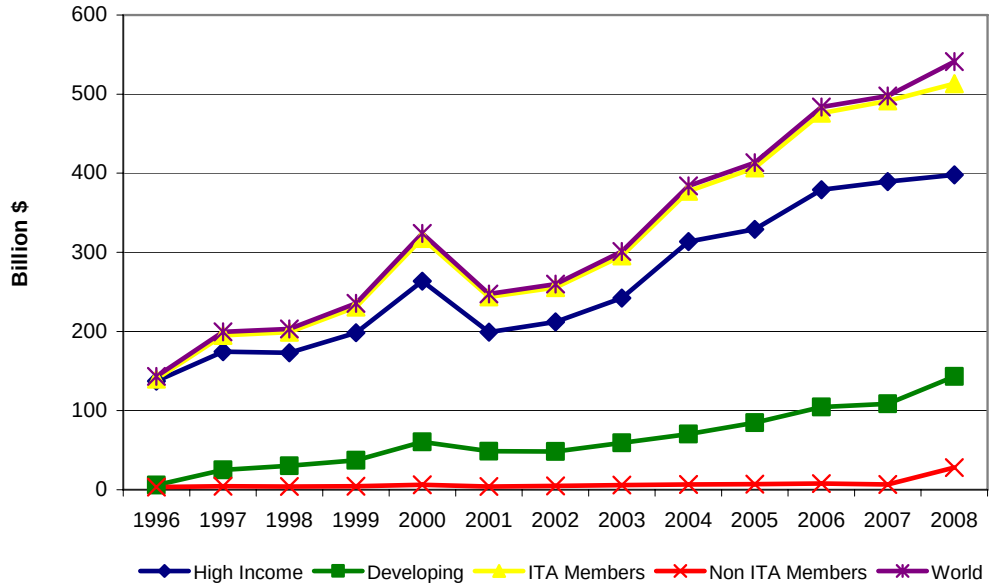
The preponderance of global semiconductor trade is conducted by ITA members, who accounted for 94.8 percent and 95.3 percent of exports and imports, respectively, in 2008. These shares have remained fairly constant, indicating ITA members captured the vast majority of growth in semiconductor trade since 1996 (figure 14). ITA developing members, and to a lesser extent Mexico, led the increase in developing countries' share of semiconductors exports, from 4.2 percent to 26.5 percent, during 1996–2008. With the exception of China, developed ITA members remained leading exporters with Singapore (15.5 percent),[31] Japan (12.9 percent), and the United States (9.0 percent) the largest exporters based on 2008 export share (figure 15). Between 1996 and 2008, Singapore and China emerged as the largest semiconductor exporters, surpassing Japan and the United States (figure 16).[32] The robust expansion of China's semiconductor exports in part reflects the global fragmentation of back end production (i.e. packaging and testing) to lower cost countries, China's policy shifts and incentives to encourage FDI in semiconductor manufacturing, and semiconductor manufacturers' desire for proximity to the world's largest market (Yinug).[33]

[31] Singapore has a long history as a leading location for semiconductor device assembly and more recently computer peripherals, including hard disk drives (Athulkorala, 4).

[32] Annual export growth rates during 1996-2008 were 13.2 percent and 33.9 percent for Singapore and China, respectively, compared with 5.5 percent and 4.1 percent for Japan and the U.S., respectively.

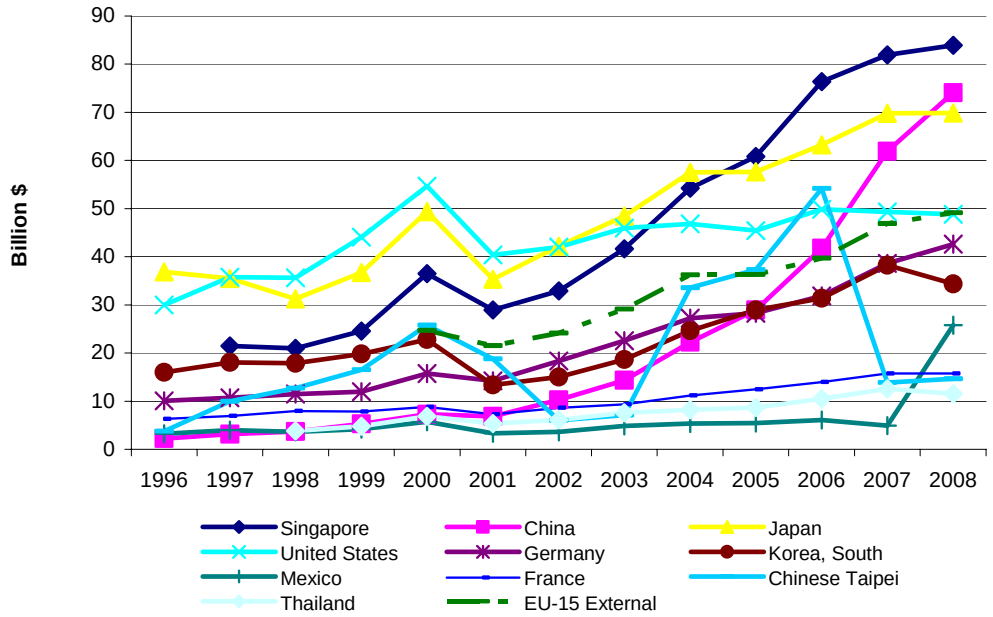
[33] Yinug notes that while front-end production (capital intensive design and fabrication) is emerging in China, foreign semiconductor firms' investments in China remain limited and often entails older generation production technology.

FIGURE 14 ITA semiconductor exports, by income and ITA status,



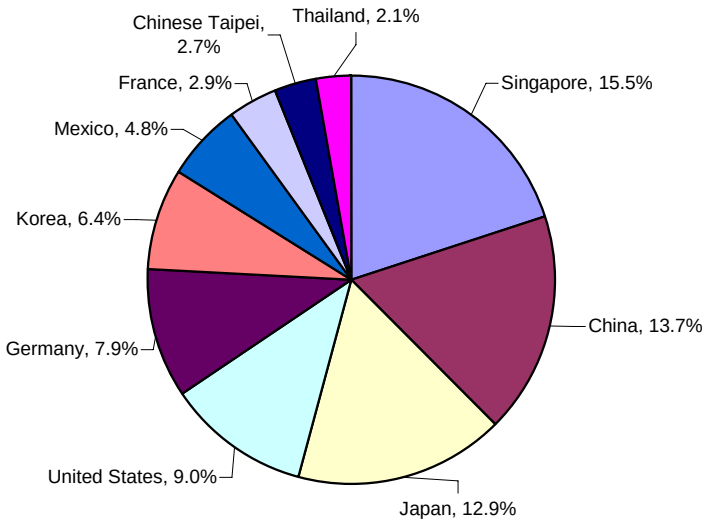
Source: Compiled by USITC staff from UN Comtrade database.

FIGURE 15 ITA semiconductor: Top 10 exporters and EU, 1996–2008



Source: Compiled by USITC staff from UN Comtrade database.

FIGURE 16 Semiconductor: Top 10 exporters, 2008



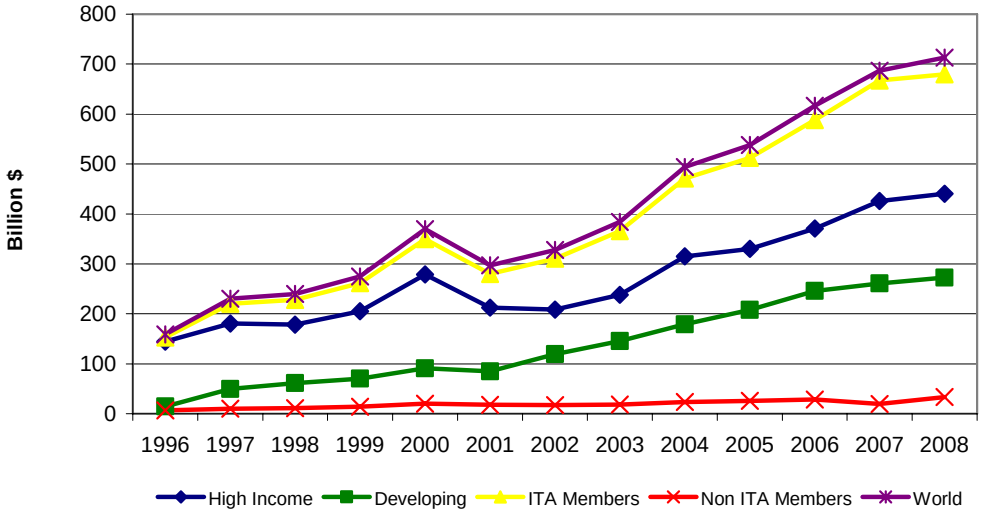
Source: Compiled by USITC staff from UN Comtrade database.

Similar to exports, ITA members accounted for the vast majority of the increase in semiconductor imports since 1996, accounting for over 95 percent of imports in 2008 (figure 17). The share of developing country imports expanded to 38.2 percent from 9.1 percent, led principally by China, with an annual import growth rate of nearly 33 percent. Other ITA developing countries experiencing strong import growth since joining the ITA include, Malaysia (6.4 percent), Philippines (4.2 percent), and Thailand (8.9 percent). The present composition of leading semiconductors importers was heavily influenced by China's exponential import growth. China's market share among the top 10 imports increased to 21.5 percent, from 3.2 percent, surpassing the U.S. and Singapore (figures 18–19) to become the largest importer.[34] Along with tariff liberalization under the ITA, the increasing concentration of electronics assembly and production in China (McClean, 2-50 to 2-54), along with the shifting global semiconductor production patterns contributed importantly to China becoming the largest semiconductor market (Yinug, 10–13).[35]

[34] China accounted for nearly one-third (32.4 percent) of semiconductor imports in 2008 when including Hong Kong, China.

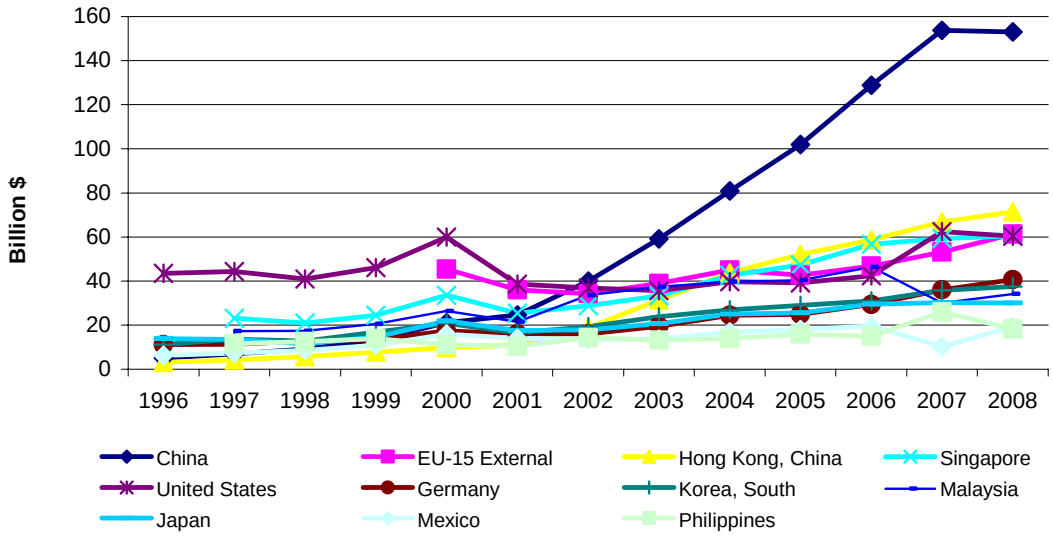
[35] See Yinug, "Challenges to Foreign Direct Investment for Hi-Tech Semiconductor Production in China" for more details on semiconductor manufacturing stages and increasing global fragmentation of production.

FIGURE 17 ITA semiconductor imports, by income and ITA status,



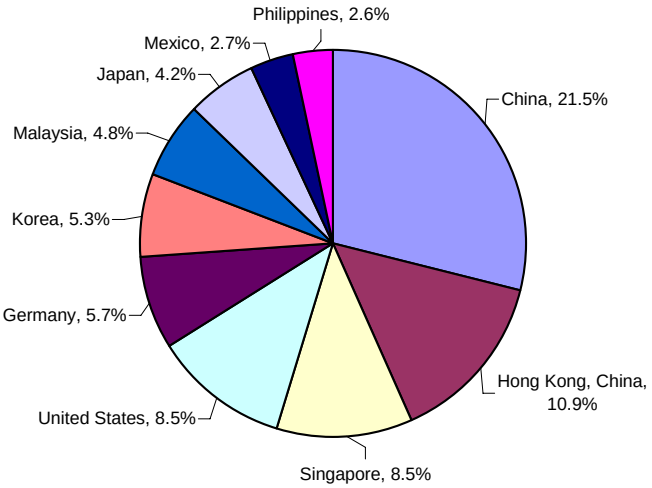
Source: Compiled by USITC staff from UN Comtrade database.

FIGURE 18 ITA semiconductors: top 10 importers and EU, 1996–2008



Source: Compiled by USITC staff from UN Comtrade database.

FIGURE 19 Semiconductor: Top 10 importers, 2008



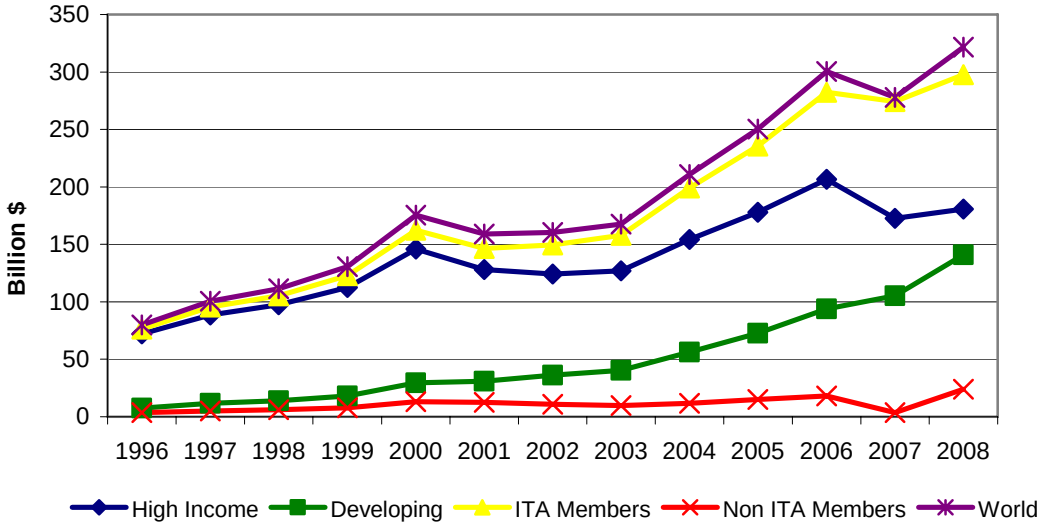
Source: Compiled by USITC staff from UN Comtrade database.

Telecommunications

ITA members accounted for over 90 percent of global telecommunications equipment trade in 1998, down slightly from 1996. Non ITA countries' share of telecommunications exports and imports were 7.4 percent and 12.5 percent, respectively in 2008. Developed countries including South Korea, the U. S., Germany, and Finland traditionally dominated telecommunications trade, but a sizeable shift towards developing country exporters, namely China, occurred subsequent to China joining the WTO and ITA. Developing countries' export share climbed from 9.5 percent in 1996 to 43.8 percent in 2008 (figure 20). Propelled by robust export growth, China and South Korea moved past the United States as the leading telecommunications exporter (figure 21).[36] While leading European exporters collectively accounted for nearly 20 percent of exports, China was the source of one-third (33.4 percent) of world telecommunications exports in 2008, followed by South Korea with 11.4 percent (figure 22), illustrating a significant shift in global telecommunications production and export patterns. The elimination of tariffs on several intermediary products, coupled with the strengthening of global electronics production networks in Asia were catalysts behind China's exponential export growth.[37]

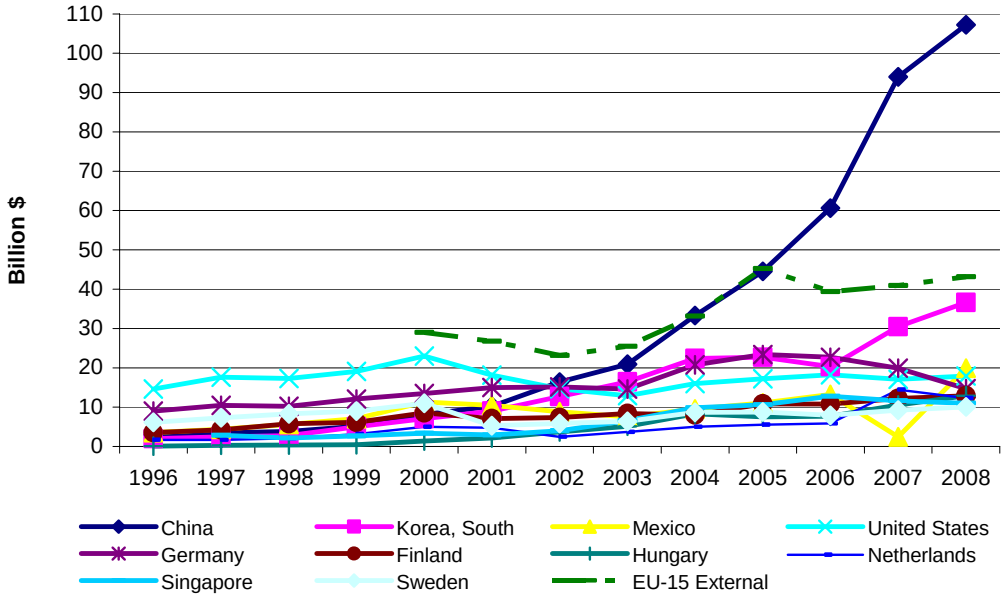
[36] China and South Korea's exports grew an annualized 35.0 percent 27.2 percent, respectively during 1996-2008.
[37] See Luthje (4) for a illustration of China's role in the global production network of cell phones for a major manufacturer.

FIGURE 20 ITA Telecom exports, by income and ITA status, 1996–2008



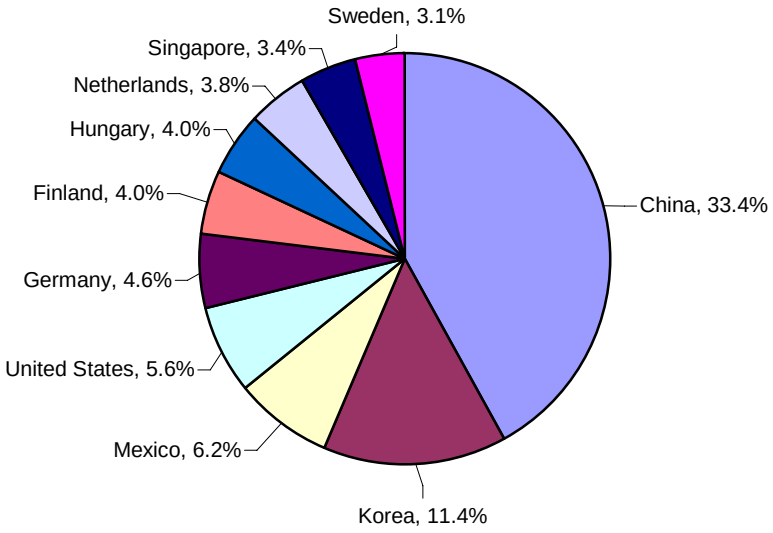
Source: Compiled by USITC staff from UN Comtrade database.

FIGURE 21 ITA Telecom: Top 10 exporters and EU, 1996–2008



Source: Compiled by USITC staff from UN Comtrade database.

FIGURE 22 Telecom: Top 10 exporters, 2008

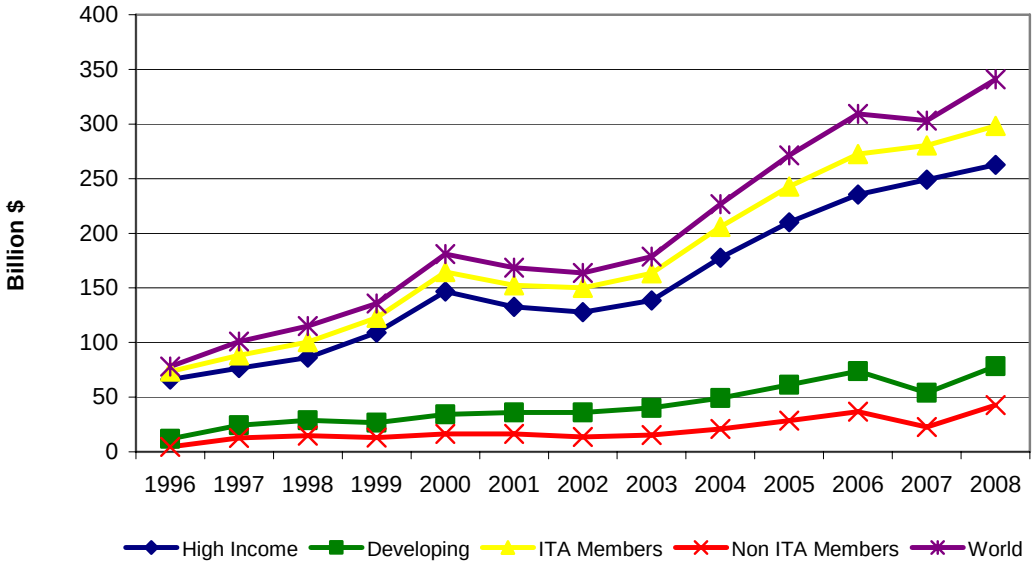


Source: Compiled by USITC staff from UN Comrade database.

Led by developed countries, ITA member's share of telecommunications imports was 87.5 percent in 2008, down slightly from 94.1 in 1996, as non ITA members, namely Mexico, expanded imports to meet growing demand for telecommunications technology (figure 26). Increasing imports from China, and to a lesser extent, Malaysia, Mexico, and the Philippines, account for the jump in developing countries' share of import trade, from 15 percent to 23 percent between 1996 and 2008. The United States and several EU members (i.e. Germany, United Kingdom, the Netherlands, and France) remain leading telecommunications importers during the period examined, accounting for 20.4 percent and 16.8 percent of 2008 imports, respectively, followed by China (including Hong Kong) at 14.1 percent (figures 24-25). The consistently high import level of developed ITA members seems consistent with the rapid growth in broadband internet and broadband wireless subscribers over the period.[38]

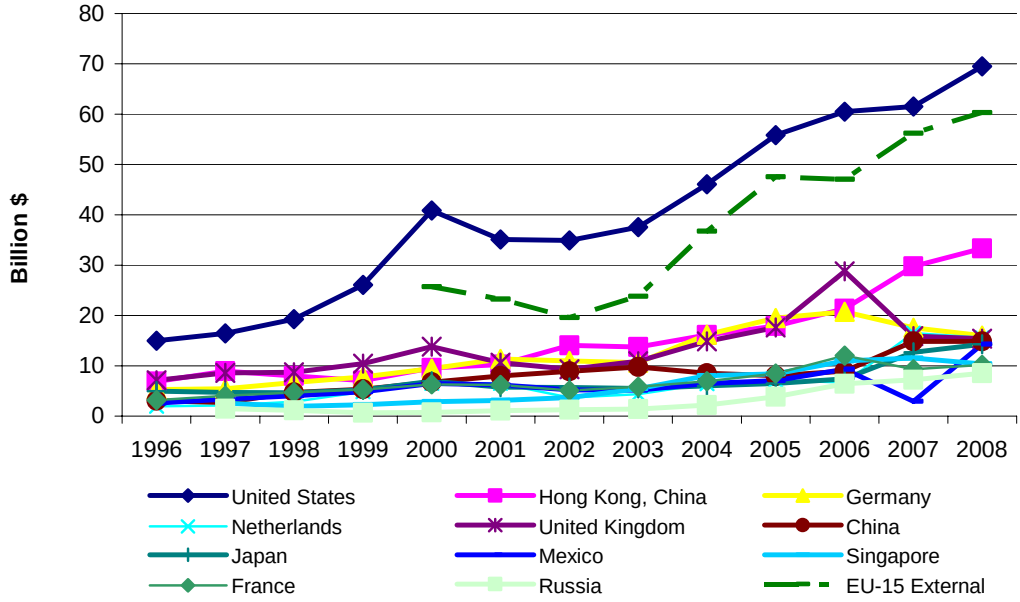
[38] Worldwide broadband wireless subscriptions surged from 20.5 million to 32.5 million between 2001 and 2008 and wireless subscriptions increased to 3.1 billion from 0.8 billion during the same period. (TIA 2008 Telecommunications Market Review and Forecast, 231–232).

FIGURE 23 ITA telecom imports, by income and ITA status, 1996–2008



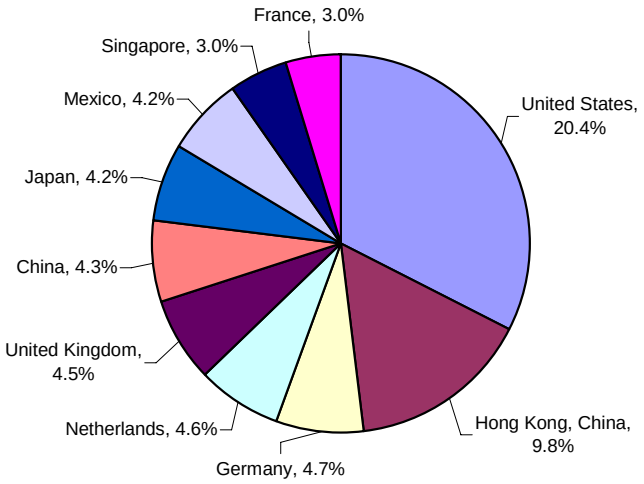
Source: Compiled by USITC staff from UN Comtrade database.

FIGURE 24 ITA telecom: Top 10 importers and EU, 1996–2008



Source: Compiled by USITC staff from UN Comtrade database.

FIGURE 25 Telecom: Top 10 importers, 2008



Source : Compiled by USITC staff from UN Comtrade database.

Achieving objectives of the ITA

To what extent have the ITA's objectives in increasing world IT production and trade, and promoting diffusion of technology, particularly among developing countries been achieved? The social and economic benefits of trade liberalization are well documented, suggesting a positive outcome from the ITA. However, in the case of tariff liberalization framed under the ITA, systematically capturing the effects of increased market access and technology diffusion through tariff elimination remains complex and imperfect (box 2). Most non-empirical work suggests that the ITA has contributed positively to enhance IT trade and technology diffusion, including among developing countries (Dryer and Hindley, 11-12). Reduced prices for IT products and heightened competition stemming from lower tariffs are commonly linked to the ITA (Suh and Poon, 388).[39] Further, the ITA is often attributed as a catalyst for the rapid growth in technological advancements and technology diffusion beyond that which would have otherwise occurred (AEA, 2; Slaughter 2003, 26). While considerable discussion and analysis remains to determine the magnitude of the ITA's impact on IT trade and technology diffusion, changes in trade patterns and ITA membership over the past twelve years demonstrates elimination of tariffs on ITA products contributed importantly to these developments in global IT trade.

[39] The results of a 2003 survey of Korean computer firms showed that firms attributed a large portion of the WTO's impact directly to the tariff reductions that occurred under the ITA. Firms surveyed viewed the WTO as a major factor contributing to improved Korean export performance from 1995 to 2002, compared to 1990-1994. Suh, Jeongwook; Poon, Jessie. "The Impact of The WTO on South Korea's Computer Industry." *The International Trade Journal*, Winter 2006.

BOX 2 Empirically estimating the ITA's impact on global trade

While empirically estimating the overall impact of the ITA remains outside the scope of this paper, several analytical challenges are noted here, which likely contribute to the limited empirical research measuring the impact of the ITA on world trade and competition in IT products. A brief review of the challenges and associated literature is provided.

Analytical Challenges.

The beneficial effects of the ITA are difficult to quantify owing to the complexity of data and several external factors. Because duty elimination on ITA products was staged over multiple years, with differing stages for each country, capturing a single point of full implementation is elusive. Changes in product classifications since 1996 for several ITA products under the WCO pose transposition challenges as well, particularly in 2007.[a] Further, data that isolate other duty free mechanisms outside the ITA encompassing IT products is generally not available. Because the preponderance of trade data available at the 6-digit HS level is recorded in U.S. dollars, adequately addressing fluctuations in exchange rates for numerous trading partners poses additional analytical burdens. Finally, estimating the overall impact on the ITA on global trade is further complicated by several exogenous factors during the period under examination. Since 1996, the Asian financial crisis, the internet bubble, the September 11, 2001 terrorist attacks, and recent global economic slowdown significantly affected values of world trade, and by extension, ITA products.

Limited Empirical Analysis.

A review of prior work on empirically assessing the impact of the ITA is limited. Two initial assessments at the outset of the ITA focused on the benefits to consumers and downward pressure on prices expected from tariff liberalization on ITA products. These estimates ranged between $50 billion and $100 billion in savings from duty free access to ITA goods (Unctad 1999, 4). In perhaps the most rigorous assessment of the ITA, Bora and Liu (2006) find significant trade creation under the ITA for developing countries. Comparing trade levels among WTO members participating and not participating in the ITA, they conclude that the value of bilateral trade has increased through ITA participation, and that developing countries account for most of the progress in ITA trade liberalization. They find that a non-ITA WTO member would increase imports by 14 percent from other WTO members under ITA membership. (Bora and Liu, 1, 14).[b, c] Conversely, an assessment covering ITA trade during 1997–2002 concluded that "joining the ITA had no statistically significant impact on the rise in IT imports" (Ares). This analysis examined the economics behind a country's decision to the join the ITA and postulated that recent growth of IT trade was not closely correlated to ITA tariff reductions. Another study examined the extent to which lower prices stemming from ITA tariff liberalization was a catalyst for increasing demand and diffusion of ITA products in developing countries (Joseph and Parayil, 7–8). In comparing ITA trade among developed versus developing countries during 1999-2003, the authors found that the ITA had "only a negligible or negative impact in promoting world demand for ICT goods," based on declining world exports during 2001–03. They further noted that examining ICT diffusion in developing countries, certain non-ITA countries have achieved greater success than many ITA member countries.[d]

The paucity of conclusive research on the impact of the ITA on global trade attests to the difficulties in empirically measuring the effects of the ITA and signals that further work remains.

[a] According the WTO, transposition of HS 1996 to HS 2002 for listed ITA product codes had limited impact, as only 14 subheadings were affected, most of which were simple mergers or splits. However, the HS 2007 amendments significantly altered the structure of the HS codes for a significant number of ITA products; 158 f the 241 (over 50 percent) of the HS 2002 subheadings were amended. Owing to the breadth and complexity of the HS 2007 amendments ITA members continue to review and address these changes.

[b] Bora and Liu conclude that a country's ITA imports would be 7 percent higher if it is an ITA member and the exporter is a WTO (non-ITA member) than if neither trade partner were a WTO member (base line). Conversely, if the importer is not an ITA member, its ITA imports would be 6 percent less compared to the base line.

[c] Mann and Liu conclude, based on a review of the empirical literature that ITA participation results in increased bilateral trade (Mann and Liu, 20).

[d] Joseph and Parayil utilized a Network Readiness Index, household IT spending, and telephone intensity, among others, to assess ICT diffusion (15–16).

Conclusions

Twelve years since creating the objectives of increased trade and technology diffusion through tariff elimination for many information technology goods, remarkable growth in ITA trade has occurred. Aggressive tariff liberalization facilitated growth in ITA trade from $1.2 trillion to $4.0 trillion. Notably the growth in ITA trade was nearly 11 percent annually, despite the bursting of internet bubble bursting and advent of the current global economic downturn. Primarily a domain of developed countries at its inception, the ITA has expanded participation by developing countries and, in turn, enhanced IT trade for these countries. WTO member participation in the Agreement more than doubled in the past twelve years, with developing countries representing over one-third of the 72 members by 2008. The diversification of ITA membership, previously dominated by developed countries with high trade levels in technology products, reflects significant assimilation of developing countries into the largest WTO sectoral trade agreement, and continued liberalization of tariffs in the global IT sector. Further, the increasing diversification of the economic income and trade levels of new ITA entrants after 1996, both for developing and developed countries, suggests an expanding role for ITA products in global IT trade and production.

Commensurate with expanding membership, developing members' ITA trade has increased substantially, both in terms of volume and share. Developing countries now represent more than one-third of ITA trade, with growth rates frequently outpacing their developed country counterparts. The robust expansion of ITA trade by developing countries is most evident in Asia, with China a consistently a dominate force. Already a strong trader in ITA products, China's rapid ascension to become a leading exporter and importer accelerated in conjunction with implementation of its WTO and ITA obligations. Despite the prominent role of China, other developing countries, including other Asian countries realized expanded trade opportunities following ITA membership. Further, growth in developing countries' ITA trade exceeded that of the largest non-ITA countries, demonstrating a positive proposition from ITA membership.

Highlighting the changes in composition of ITA products' trade, were computers and telecommunications which accounted for an increasing share of total ITA trade. However, strong growth in imports and exports for all ITA products occurred, with the most significant growth in telecommunications, office equipment, and semiconductors paralleling the increasing fragmentation of global production networks for all IT products. Finally, a striking shift in global production and trade patterns is most evident in computers and telecommunications where China and South Korea alone have displaced the U.S., Japan, and several European countries as the leading producers and exporters.

Bibliography

American Electronics Association (AeA). *The Information Technology Agreement.* June 2008. http://www.aenet.org/Publications/AeA_CS_ITA.asp (accessed July 14, 2009).

Ares, Jeff. "An Empirical Look at the Information Technology Agreement and its Effects on Trade." University of Vermont. May 3, 2006.

Athukorala, Prema-chandra. "China's Integration Into Global Production Networks and its Implications for Export-led Growth Strategy in Other Countries in the Region." Australian National University. Working Paper no. 2008/4, 2008.

Aizcorbe, Ana M., Flamm, Kenneth and Khurshid, Anjum. "The Role of Semiconductor Inputs in it Hardware Price Decline: Computers Vs. Communications." FEDS Working Paper No. 2002-37, August 2002.

Bora, Bijit; and Liu, Xueping. "Evaluating the Impact of the WTO Information Technology Agreement." WTO Working Paper, 2006.

Borrus, Michael and Cohen, Stephen S. "Building China's Information Technology Industry: Tariff Policy and China's Accession to the WTO." Trilateral Forum on China-Japan-U.S. Cooperation. Working Paper 105, 1997.

Capannelli, Giovanni. "Asian Regionalism: How does it compare with Europe?" April 12, 2009. http://www.voxeu.org (accessed September 22, 2009).

Dreyer, Ian and Hindley, Brian. "Trade in Information Technology Goods: Adapting the ITA to 21st Century Technological Change." European Centre for International Political Economy. Working Paper No. 06/2008, June 2008.

Finger, K.M. "An Overview of Tariff Liberalization and World Trade for ITA Products 1996-2005." Presentation at WTO ITA Symposium, March 2007, 28-29.

Fliess, Barbara A and Pierre Sauve. "Of Chips, Floppy Disks, and Great timing: Assessing the Information Technology Agreement." Paper prepared for the Institut Francais des Relations Internationals and Tokyo Club Foundation for Global Studies, 1997.

Fung, K.C., Korhonen, Iikka, Li, Ke, and Ng, Francis. "China and Central And Eastern European Countries: Regional Networks, Global Supply Chain or International Competitors?" Bank of Finland. BOFIT Discussion Paper 9/2008, 2008.

Goldman Sachs Group, US Technology Strategy. *Independent Insight: IT Spending Survey.* November 2, 2008.

Joseph, K.J and Parayil, Govindan. "Trade Liberalization and Digital Divide, An Analysis of the Information Technology Agreement of WTO." Centre for Development Studies, 2006.

Luthje, Boy. "Global Production Networks and Industrial Upgrading in China: The Case of Electronics Contract Manufacturing." East-West Center. Working Paper no. 74, October 2004.

Mann, Catherine. *Accelerating the Globalization of America: The Role for Information Technology.*Washington DC:Institute for International Economics. June 2006.

Mann, Catherine, and Liu, Xuepeng. "The Information Technology Agreement: Sui Generis or Model Stepping Stone?" Presented at the Conference on Multilateralising Regionalism Sponsored and organized by WTO – HEI, Co-organized by the Centre for Economic Policy Research (CEPR), 2007.

McClean, William J., Brian P. Matas, Richard D. Skinner, and Trevor Yancey. *The Mclean Report, 2006 Edition: a Complete Analysis and Forecast of the Integrated Circuit Industry*. Scottsdale, AZ: IC Insights Inc., 2006.

Onodera, Osamu. "Trade and Innovation: A Synthesis Paper." OECD. Trade Policy Working Papers No. 72, 2008.

Organization for Economic Co-operation and Development (OECD). *OECD Information Technology Outlook 2008.* January 2009.

Radosevic, Slavo. "The Electronics Industry In Central And Eastern Europe: A New Global Production Location," Center for the Study of Economic and Social Change in Europe, School of Slavonic and East European Studies, University College London. Working Paper 21, 2002.

Slaughter, Matthew. "Technology, Trade and Investment: the Public Opinion Disconnect." Emergency Committee for American Trade. 2002.

Slaughter, Matthew. "Tariff Elimination for Industrial Goods: Why the Gains Will Far Outweigh Any Losses." National Foreign Trade Council. 2003.

Suh, Jeongwook and Poon, Jessie. "The Impact of the WTO on South Korea's Computer Industry." *The International Trade Journal.. Volume XX No 4,* Winter 2006: 383-405.

UNCTAD. "Trade in Information Technology Products and the WTO Agreements." International Trade Center, Geneva: CDP/PLEN/18, 1999.

Telecommunications Industry Association (TIA). *TIA 2008 Telecommunications Market Review and Forecast.* 2008.

Office of the United States Trade Representative. "Information Technology." May 26, 2009. http://www.ustr.gov/trade-topics/industry-manufacturing/industry-initiatives/information-technology (accessed September 18, 2009).

Wasescha, Luzius and Schlagenhof, Markus. "Information Technology Agreement (ITA)-Towards a New Area of Sectorial Market Liberalization in WTO." Aussenwirtschaft, 53. Jahrang, 1998.

World Trade Organization (WTO). "Current Situation of Schedules of WTO Members," G/MA/63/Rev.6, 17 March 2009. (Original Document 18 June 1999).

_____. "Follow-Up Discussions From the IT Symposium: Indicative List of Issues", Committee of Participants on the Expansion of Trade in Information Technology Products, G/IT/W/14. December 20, 2004.

_____. "List Of The Changes Due To The Introduction Of HS2002 Nomenclature In Relation To The ITA Products", Note by the Secretariat, G/IT/W/22, October, 20, 2006.

_____. "Ministerial Declaration On Trade In Information Technology Products", WT/MIN/(96)/16, December 13, 1996.

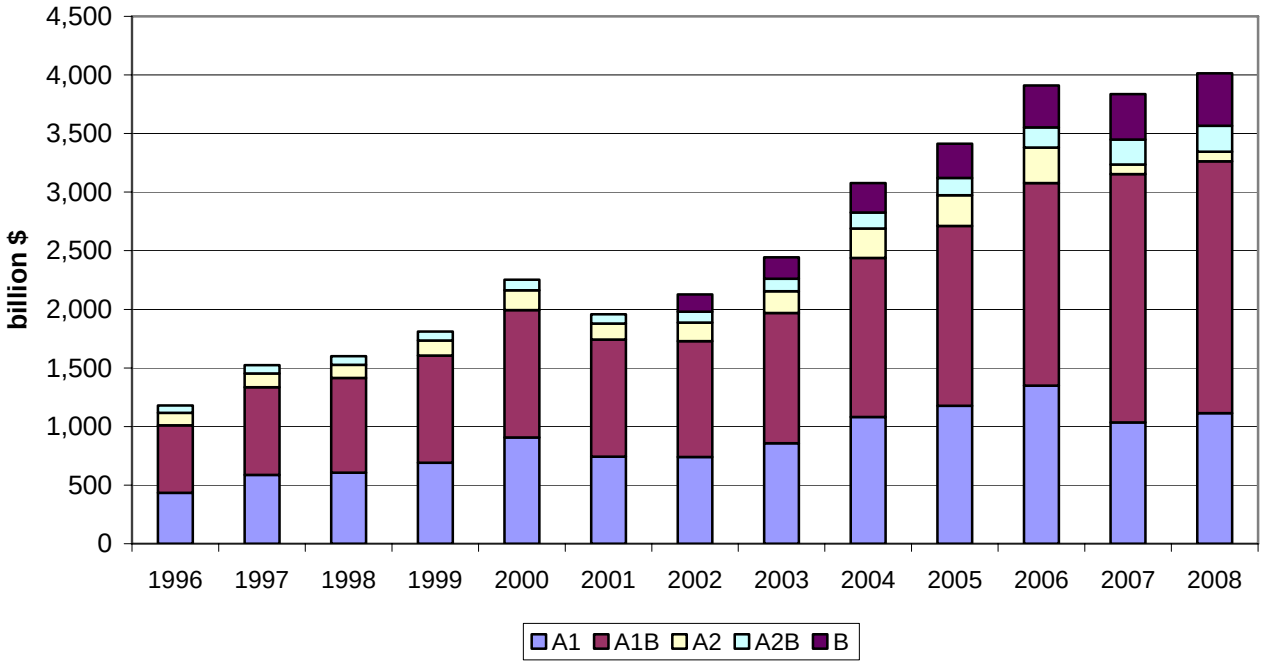
_____. "Status of Implementation", Note by Secretariat, G/IT/Rev.41, October, 23 2008.

_____. *World Trade Report 2007*. November 2007: 13-24.

Yinug, Falan. "Challenges to Foreign Direct Investment for Hi-Tech Semiconductor Production in China." *Journal of International Commerce and Economics*. USITC, May 2008.

Appendix A

Figure A1 ITA total trade by attachment, 1996-2008



Source: Compiled by USITC staff from UN Comtrade database.