



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

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## ***Abstract***

The Information Technology Agreement (ITA), a multilateral agreement emerging from the Uruguay Round, eliminates tariffs on specific technology and telecommunications products for 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. It covers over 95 percent of total world trade in IT products, currently estimated at \$4 trillion annually. 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, describes 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

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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 to Eastern Europe. Significant developments in global ITA trade include, increasing diversification of ITA members' trade and economic profiles and expanding trade participation by developing countries.

## **Introduction**

The Information Technology Agreement (ITA or Agreement), a multilateral agreement emerging from the Uruguay Round, eliminates tariffs on specific technology and telecommunications products by signatory 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 on 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.

The paper begins with an overview of the ITA and the level of tariff liberalization associated with membership, continuing with a discussion of the changing composition of ITA membership. Then it 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. The paper highlights a threefold expansion of world trade in ITA products since 1996, facilitated by aggressive tariff liberalization and broadening ITA membership. It finds a significant shift in ITA trade to Asia (particularly China) and to a lesser extent Eastern Europe, evident in the displacement of traditional producers and exporters of IT equipment by rising Asian ITA members. Other key findings include the increasing diversification of ITA members in terms of

trade and economic profiles and expanding trade participation by developing countries.<sup>2</sup>

## The Agreement

In December 1996, at the WTO's Singapore Ministerial Conference, 29 signatory countries<sup>3</sup> concluded the Ministerial Declaration on Trade in Information Technology Products (Declaration),<sup>4</sup> establishing the ITA. Activation of the provisions in the Declaration was contingent on the ITA's member countries accounting for 90 percent of world trade in IT products by a deadline four months later (April 1, 1997). The original signatories' trade coverage, however, was only 83 percent. Through additional negotiations, several other countries signed the Declaration, bridging the gap in trade coverage by the Declaration's deadline. With the ITA in effect as of April 1, 1997, participants soon after commenced a schedule of phased duty reductions, with all duties slated for elimination by 2000.<sup>5</sup> Because 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 IT 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.<sup>6</sup> While ITA provisions call for periodic review and consultations on nontariff barriers, the only commitments in the ITA are for tariff elimination.

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<sup>2</sup> Developing countries status based on World Bank income classifications as noted herein.

<sup>3</sup> The European Communities (e.g., EU-15) are treated as individual members, with Switzerland and Liechtenstein a single customs union.

<sup>4</sup> WTO 1996.

<sup>5</sup> 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.

<sup>6</sup> WTO 1996.

## ***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 had 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 before the Agreement 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 1 percent to 12.1 percent, which compared with 1.2 percent to 66.4 percent for developing countries.<sup>7</sup> Because they had considerably higher bound rates before the Agreement, 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 those of 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, ITA membership has steadily expanded, reaching 72 members in 2009,<sup>8</sup> with increasing participation from developing countries. Developed countries accounted for nearly all of the original signatories, with Indonesia and Turkey the only

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<sup>7</sup> Exceptions included Macao, China, and Hong Kong (China), which already maintained duty-free status for ITA products (WTO 2007).

<sup>8</sup> WTO 2008. Peru, the latest member entering the ITA, submitted its ITA schedule to participants for verification and approval in 2008 (USTR 2009).

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

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

Source: Compiled by USITC staff.

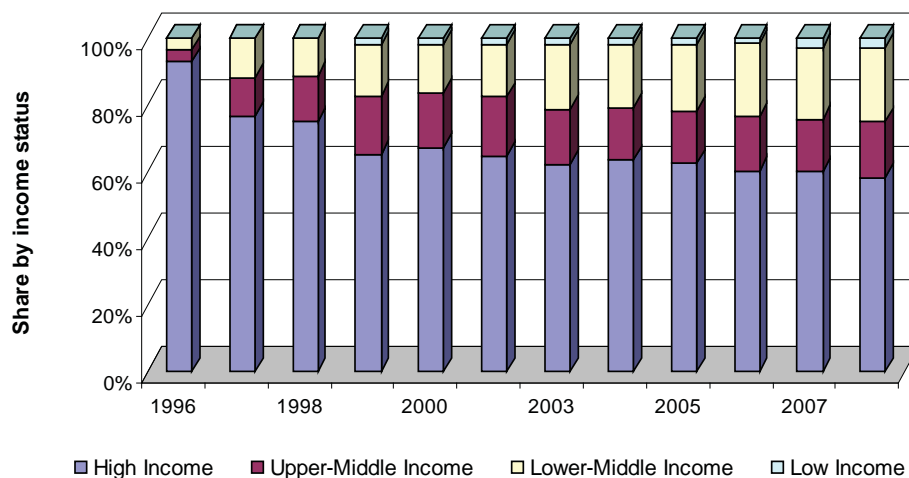
Note: EU members are in italics.

<sup>a</sup> Based on World Bank income classification.

developing countries formally adopting the Declaration (table 1).<sup>9</sup> Following the Singapore Ministerial in 1996, 11 additional countries signed the Declaration triggering the 90 percent trade criteria and the ITA entered into

<sup>9</sup> Developing countries include middle income and low income countries based on World Bank income classifications (World Bank 2009).

**FIGURE 1** ITA membership composition, share by income status,<sup>a</sup> 1996-2008



Source: Compiled by USITC staff from UN Comtrade database.

<sup>a</sup>Based on World Bank income classification.

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, developing countries accounted for 20 of the 29 new participants (68.9 percent); 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, in terms of economic status, differs from that of the WTO (nearly two-thirds of WTO members are developing countries), the steady increase in participation by developing countries is a significant achievement, considering that pre-ITA trade in IT products was highly concentrated among developed countries (Mann and Liu, 4).<sup>10</sup>

The ITA participants that joined after 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. Using total ITA trade (exports and imports) and per capita gross domestic

<sup>10</sup> In 1990 Japan, Europe, and the United States accounted for nearly two-thirds (68 percent) of the global export market for IT products (Mann and Liu 2007).

product (GDP)<sup>11</sup> as indicators of trade activity and economic status makes it possible to illustrate the heterogeneity of 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, showed a 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 the United Arab Emirates displayed higher GDP and ITA trade activity than 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's lower GDP and nascent ITA trade activity. Despite its developing income status, China's total ITA trade was \$250.2 billion in 2003 when it joined the ITA, exceeding the ITA trade level of Japan (\$153.6 billion) in 1996, when it entered the ITA. 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 before tariff liberalization.

## **ITA Products**

Recognizing the social and economic benefits derived from liberalized trade and diffusion of information technology products (WTO 1996), the 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. Products covered under the ITA are listed in two annexes to the Declaration, commonly referred to as Attachments A and B.<sup>12</sup> Attachment A is a positive list of items at the 6-digit Harmonized Schedule (HS) level, separated into two sections (A1 and A2). Attachment B includes product descriptions but not any corresponding HS code, whether

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<sup>11</sup> IMF 2009.

<sup>12</sup> Ibid., Annex.

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

Country	Year joined ITA	Economic status <sup>a</sup>	GDP per capita (\$)	Total ITA trade (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
Slovakia	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

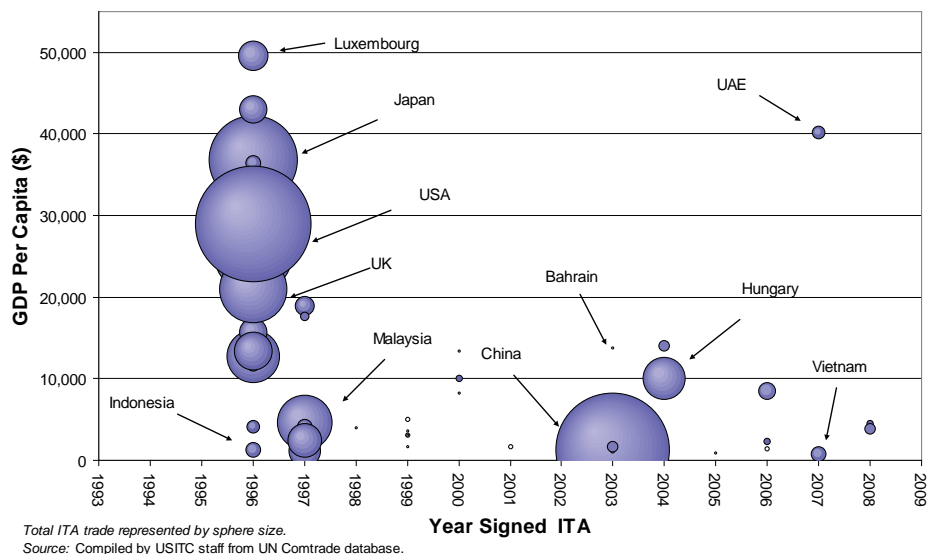
Source: Compiled by USITC staff.

Note: EU members are in italics

<sup>a</sup> Based on World Bank income classification.



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



or not they are included 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 national positions in coverage of complex, multifunction products (Dreyer and Hindley, 4). Common products listed in Attachments A1, A2, and B, along with the number of 6-digit HS codes included in the original list, 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.<sup>13</sup>

## ITA Trade

Global IT trade has grown substantially under the ITA.<sup>14</sup> From 1996 through 2008 total ITA products trade (imports and exports) expanded 10.1 percent annually, albeit unevenly, growing from \$1.2 trillion to \$4.0 trillion. The strong

<sup>13</sup> For details on ITA negotiating history, including product coverage, see Fleiss and Sauvé 1997.

<sup>14</sup> Trade data are based on appropriate HS nomenclature for each year. See box 1 for further details regarding the dataset and attendant complexities.

<b>TABLE 3</b> Representative ITA products and number of HS codes, by attachment		
	<b>Number of HS codes</b>	<b>Sample Products</b>
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: microprocessors, 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 <sup>a</sup>	Computers, electric amplifiers, flat-panel displays, network equipment, monitors, pagers, CD and DVD drives, plotters, printed circuit assemblies, removable storage devices, set-top boxes

Source: WTO, and data compiled by Commission staff.

<sup>a</sup> 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.

growth in ITA trade exceeded that of manufactures trade, which expanded 7.1 percent annually during the same period (figure 3). ITA trade expansion was steepest between 1996 and 2000, growing 17.5 percent annually, but declined between 2000 and 2002 (-2.8 percent) as the internet boom of the 1990s abruptly reversed, adversely affecting IT spending and investment (Friar, et

### **BOX 1** Data challenges and changing classifications

Changes to the HS system resulting from several factors, including technological developments impede attempts to pinpoint 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).”<sup>a</sup> Quantifying trade in Attachment B products is additionally challenging because most countries provided their own list of tariff codes, usually at the national line level (i.e. the 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, the authors have constructed estimates 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 affected, as are 53 of 58 subheadings in Attachment A2. For Attachment B, while there is no agreed-upon list, it is estimated that approximately 51 of 72 subheadings are affected for products where a code was listed. Consequently, the veracity of ITA trade data in 2007 and 2008 is likely affected by transposition challenges with HS 2007. For example, uneven 2007-2008 trade in office equipment stems in part from significant classification changes. Despite the challenges posed by the HS 2007 nomenclature, utilizing the HS 2002 list after 2006 may significantly understate trade, as the HS 2002 list fails to capture several ITA products starting in 2007.<sup>b</sup> To mitigate this, a constructed data set was employed, using the nomenclature appropriate for each year.<sup>c</sup> The data set also segregates products covered in both Attachments A and B to avoid possible duplication.<sup>d</sup> Finally, ITA product segments (e.g., computers, semiconductors) 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.<sup>e</sup> Therefore, this paper presents a conservative approximation of the aggregate ITA trade data. The authors have used this data set to examine changes in trade patterns, product composition, and country market share, as new members adopted tariff liberalization embodied in the ITA.

<sup>a</sup> [http://www.wto.org/english/thewto\\_e/coher\\_e/wto\\_wco\\_e.htm](http://www.wto.org/english/thewto_e/coher_e/wto_wco_e.htm).

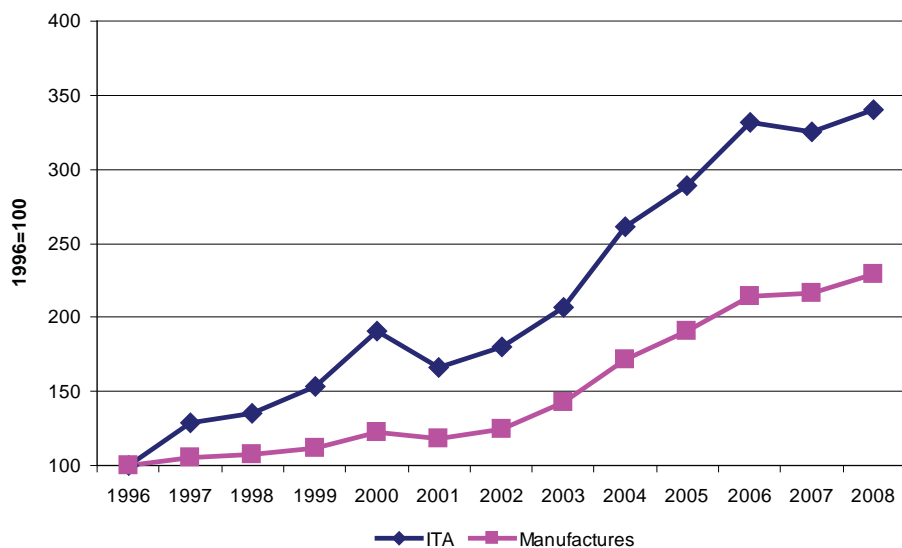
<sup>b</sup> For example, cellular telephones, classified in HS 2002 under 8525.20, are classified in HS 2007 under 8517.12, a new 6-digit subheading not contained in HS 2002.

<sup>c</sup> The data for 1996–2001 calculates the total base on the 1996 Ministerial Declaration, while the list for 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 data set.

<sup>d</sup> Appendix A illustrates ITA total trade by segregated Attachment lists during 1996–2008.

<sup>e</sup> See Shifts in U.S. Merchandise Trade 2008 (2009).

**FIGURE 3** ITA and manufactures total trade, 1996–2008



Source: Compiled by USITC staff from UN Comtrade database.

al. 2008, 4).<sup>15</sup> In 2002, however, ITA products trade growth resumed, but at a comparatively slower pace (10.4 percent).

As a share of global trade, ITA product trade peaked in 2001 at 18.4 percent. While the 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),<sup>16</sup> masking the increasing level of ITA trade.

<sup>15</sup> U.S. technology investment was down 7 percent in 2001 and 9 percent in 2002, reacting sharply to excesses associated with the tech bubble (Friar, et al. 2008).

<sup>16</sup> 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 2008).

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

	Share of total trade (percent)	Compound annual growth rate (percent)		
	2008	1996–2008	1996–2000	2001–2008
ITA total trade	15	11	18	11
Manufactures total trade	66	7	5	10

Source: Compiled by USITC staff from UN Comtrade database.

### ***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<sup>17</sup> for 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, importers, and centers for global production networks ITA products.

Asian ITA exports grew rapidly between 1996 and 2008, led principally by China and to a lesser extent by Singapore, South Korea, and Thailand. Annual export growth rates were strongest for China (33.5 percent),<sup>18</sup> South Korea (13.1 percent), Chinese Taipei (9.8 percent), and Philippines (11.0 percent) (table 5).<sup>19</sup> Similarly, import growth rates were strong for several Asian countries, led by China (24.4 percent)<sup>20</sup> and including Thailand (9.6 percent),

<sup>17</sup> Growth rates are compound annual growth rates unless otherwise indicated.

<sup>18</sup> ITA exports from Hong Kong, China, grew 13.0 percent annually.

<sup>19</sup> Malaysia's ITA trade grew at an annual rate of 10.2 percent from 1997–2006, and then declined sharply, due largely to incomplete data reporting for HS 2007.

<sup>20</sup> ITA imports from Hong Kong, China, increased 14.3 percent annually.

**TABLE 5** ITA exports, share of exports (2008), and growth rates (selected years) for top 30 ITA countries

Number	Exporter	Exports 2008, (thousand \$)	Share of total, 2008	Compound annual growth rates		
				1996– 2008 <sup>a</sup>	1996– 2000 <sup>a</sup>	2001– 2008
				Percent		
1	China	463,685,179	25	34	29	38
2	Japan	173,712,915	9	4	8	7
3	Singapore	146,781,694	8	7	6	12
4	Germany	142,524,685	8	9	7	11
5	United States	142,470,901	8	2	10	1
6	South Korea	124,747,772	7	13	18	17
7	Netherlands	80,490,648	4	10	13	12
8	Mexico	64,610,222	3	13	19	10
9	Chinese Taipei	53,435,374	3	10	40	0
10	Malaysia	43,475,140	2	3	12	0
11	France	42,985,486	2	4	8	5
12	United Kingdom	39,170,154	2	-0.8	8	-4.8
13	Thailand	37,657,450	2	11	13	13
14	Czech Republic	27,529,537	2	29	18	35
15	Hungary	27,516,996	2	37	82	23
16	Ireland	24,606,914	1	3	16	-4.3
17	Italy	23,684,093	1	2	-0.7	4
18	Sweden	22,399,212	1	5	8	11
19	Belgium	18,559,404	1	8	9	7
20	Finland	17,743,663	0	9	18	9
21	Austria	15,885,611	0	11	9	12
22	Philippines	15,582,762	0	11	57	-4.6
23	Canada	14,746,829	0	-0.5	13	-2.1
24	Switzerland	14,619,955	0	6	4	9
25	Slovakia	13,060,477	0	37	10	60
26	Poland	11,851,929	0	29	13	43
27	Spain	11,034,632	0	8	7	10
28	Israel	7,317,840	0	6	22	1
29	Denmark	6,967,475	0	7	9	7
30	Norway	4,568,130	0	10	3	16
	World	1,882,022,074		11	18	11
	EU-15	440,673,667	23	6	9	6
	EU-15 external only	199,487,510	11			9

Source: Compiled by USITC staff from UN Comtrade database.

Note: Belgian data in 1996 include Luxembourg.

<sup>a</sup> Data start in 1997 for Singapore, Malaysia, Russia, Brazil, Slovakia, and Philippines. Data start in 1998 for Thailand.

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, above all China, indicates a significant shift in manufacturing capabilities for ITA products towards Asian countries, particularly developing Asian countries.

The 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). Because the products covered by the ITA are conducive to this production model, they 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 United States, the next largest trader at 11.2 percent. During this period, China's total ITA trade 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,<sup>21</sup> China gained MFN access to major markets and became an increasingly attractive location for export-oriented foreign direct investment (FDI) (Fung, et al. 2008, 9),<sup>22</sup>

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<sup>21</sup> China's accession to the WTO in 2001 included a commitment to join the ITA, which occurred in 2003.

<sup>22</sup> 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 (Fung, et al. 2008).

**TABLE 6** ITA imports, share of imports (2008), and growth rates, (selected years) for top 30 ITA countries

Number	Importer	Imports 2008 (thousand \$)	Share of total, 2008	Compound annual growth rates		
				1996– 2008 <sup>a</sup>	1996– 2000 <sup>a</sup>	2001– 2008
				Percent		
1	United States	305,082,078	14	6	12	7
2	China	279,582,232	13	24	25	25
3	Hong Kong, China	183,994,486	9	14	13	18
4	Germany	135,253,735	6	9	9	9
5	Singapore	106,436,489	5	6	6	11
6	Japan	95,821,222	5	6	10	7
7	South Korea	77,368,758	4	9	12	13
8	Netherlands	75,045,283	4	10	15	11
9	Mexico	71,774,690	3	14	24	10
10	United Kingdom	69,048,943	3	3	10	3
11	France	60,873,645	3	6	8	8
12	Malaysia	52,919,855	3	6	9	7
13	Canada	40,083,796	2	4	11	5
14	Italy	39,840,656	2	6	8	8
15	Spain	38,107,998	2	12	9	16
16	Thailand	33,837,547	2	10	9	12
17	Czech Republic	26,957,270	1	19	9	25
18	Russian Federation	25,146,828	1	18	-15.7	39
19	Hungary	24,583,846	1	25	47	18
20	Philippines	24,463,013	1	3	-0	6
21	Chinese Taipei	24,036,619	1	6	49	-7.6
22	Belgium	22,902,964	1	8	8	7
23	Brazil	22,173,634	1	8	3	14
24	Australia	21,238,066	1	7	5	13
25	Sweden	19,934,993	0	6	7	11
26	Switzerland	17,058,388	0	6	7	8
27	Austria	16,699,116	0	9	10	11
28	Ireland	16,230,409	0	4	16	-3
29	Slovakia	12,877,092	0	23	-1.3	39
30	Finland	12,678,786	0	9	13	11
	World	2,131,461,652		11	17	
	EU-15	472,359,584	22	7	10	
	EU-15 external only	302,642,656	14			

Source: Compiled by USITC staff from UN Comtrade database.

Note: Belgian data in 1996 include Luxembourg.

<sup>a</sup> Data start in 1997 for Singapore, Malaysia, Russia, Brazil, Slovakia, and Philippines. Data start in 1998 for Thailand.



contributing to China's rapidly growing export and import share in the ITA market. Indeed, China's ITA trade accelerated after implementing its WTO commitments to reduce trade impediments, including eliminating its tariffs on ITA products. In 2001, for example, the value of global ITA exports declined 13.0 percent, but the value of 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 United States 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 on Chinese firms seeking to enhance participation in global production networks (Borrus and Cohen 1997, 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.<sup>23</sup>

The rise of China and other developing ITA members in Asia represents 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, Slovakia, the Czech Republic, and Poland. Between 1996 and 2008, total ITA trade grew by 30.0

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<sup>23</sup> See section "Shifting Trade in Product Segments" in this article.

percent for Hungary, 27.5 percent for Slovakia, 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, Slovakia's annual export growth was 60.1 percent between 2001 and 2008, whereas import growth was 38.5 percent over the same period. Slovakia, Czech Republic, Hungary, and Poland combined account for barely 4 percent of global ITA trade, yet their export growth rate is nothing short of remarkable.

The rise of Eastern European countries in ITA trade reflects continued restructuring of production networks in the IT 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 2002 (14), FDI 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, et al. 2008, 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'<sup>24</sup> 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.

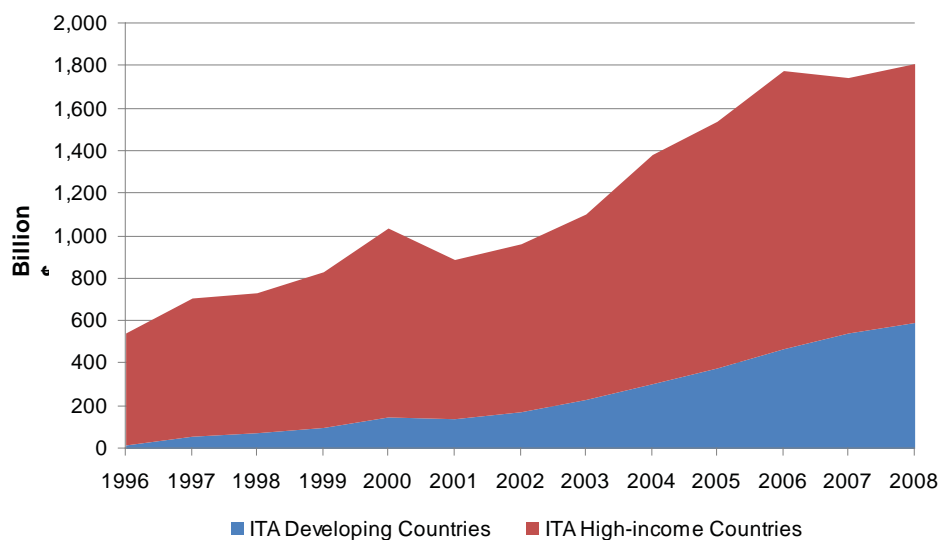
### ***Comparison of Developed and Developing Members***

Since the launch of the ITA, developing countries have gradually gained market share from developed ones. Developed countries still account for 67.1 percent of world ITA exports, they have expanded at a much slower rate,

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<sup>24</sup> Hungary, Slovakia, the Czech Republic, and Poland each joined the EU as part of the 2004 expansion.

**FIGURE 4** Developing and developed (high-income) countries' ITA exports 1996–2008



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

gradually ceding market share to developing countries, China in particular (figure 4). Developing-country ITA members generated 3.4 percent of total ITA exports in 1996, but climbed rapidly to generate 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 apparent early growth for developing countries merely reflects improved consistency in reporting of export data, from 2001 to 2008, 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 ITA trade expanded faster than that of developed countries between 1996 and 2000, and declined less sharply during 2000–02. Developing-country ITA exports expanded 33.3 percent in 1999 and 43.6 percent in 2000. In contrast, developed-country ITA exports expanded 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.<sup>25</sup> Broadening participation and increasing market share of developing countries in the ITA trade represents another major shift in ITA trade patterns.

### ***Role of non-ITA countries***

While ITA member countries account for the vast majority of total ITA trade, with a few non-ITA member countries expanded their share of ITA trade as well. 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 their nonmember status, Mexico, Russia, Brazil, and South Africa have demonstrated strong ITA trade since 1996. Mexico's export role and Russia's import growth are both particularly noteworthy.

Mexico is the only non-ITA member in the top 30 ITA exporters, ranking eighth in 2008 (table 5). Since it is 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, 2008 1). These lower-cost inputs provide a competitive price advantage to Mexican producers and exporters. Moreover, due to the North American Free Trade Agreement, there are established ITA production networks linking Mexico with the United States and Canada; in 2008, 87 percent of Mexico's ITA exports went to either Canada or the United States.

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 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 export ITA goods, it is 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

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<sup>25</sup> 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 gives all WTO members tariff duty-free access to all markets for ITA member countries.

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 authors grouped the covered goods into eight general product segments, as noted in table 1, 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”).<sup>26</sup> 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,<sup>27</sup> 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, 2008, 7). Strong growth rates in semiconductors and telecommunication segments reflects, in part, expanding uses of semiconductors in IT products and advances in cellular communications.

Semiconductors and computer trade dominated the composition of ITA trade during the past 12 years, despite ceding market share to other fast-growing products, including telecommunications and other products. The Internet boom of the 1990s and declining prices for personal computers and semiconductors (Aizcorbe, Flamm, and Khurshid, 2002, 12) spurred increasing demand and trade flows for these products.

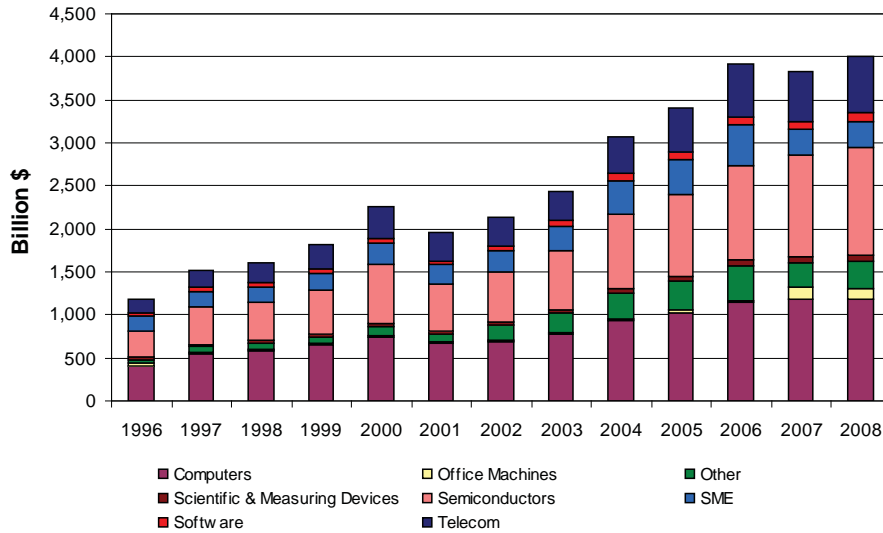
### ***Product Segment Growth Rates***

Across all ITA product segments, total trade increased by 10.7 percent annually between 1996 and 2008 (figure 5). Annualized growth of ITA trade peaked at 17.5 percent during 1996–2000, then slowed to 10.8 percent between 2001 and 2008; this decline reflected, in part, the sharp decline in IT spending following the Internet boom in the late 1990s. Import growth was led by other products and parts (17.0 percent), with expansion in global imports of

<sup>26</sup> Segmented according to 6-digit HS in accordance with USITC product classifications.

<sup>27</sup> 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.

**FIGURE 5** ITA total trade by product, 1996–2008



Source : Compiled by USITC staff from UN Comtrade database.

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 reflected 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.<sup>28 29</sup> Further, trade in office machines and other ITA products and parts at the inception of the ITA was relatively low compared with trade in computers and semiconductors, which accounted for the majority of IT trade and attracted considerable attention in the negotiations leading up to the Singapore Ministerial (Fleis and Sauve, 1997, 29–32).

<sup>28</sup> Examples of technology developments include the rapid adoption of cellular phones and the 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.

<sup>29</sup> The unevenness of the figures for 2007–08 trade in office equipment stems in part from significant HS classification changes.

**TABLE 7** ITA imports and exports, growth rates, by product category, selected years

Category	Flow	1996	2000	2001	2008	Annual growth		
						Thousands\$	1996–2008	1996–2000
Other	Import	25,755,884	54,044,287	50,593,669	170,142,725	17	20	19
Office Machines	Import	11,716,868	12,508,909	12,395,073	66,056,407a	15.5 <sup>a</sup>	1.6 <sup>a</sup>	27.0 <sup>a</sup>
Semiconductors	Import	159,153,497	369,531,817	297,379,179	713,043,592	13	23	13
Telecom	Import	78,072,743	180,851,150	168,551,206	340,914,187	13	23	11
Scientific Devices	Import	12,064,397	16,580,565	17,895,020	40,171,254	11	8	12
Software	Import	19,430,181	25,569,836	25,045,653	52,362,180	9	7	11
Computers	Import	231,691,768	387,107,292	350,008,651	601,158,386	8	14	8
SME	Import	80,899,512	130,178,132	111,159,562	147,612,922	5	13	4
Office Machines	Export	9,673,615	11,207,972	10,864,082	60,086,400a	16.4 <sup>a</sup>	3.7 <sup>a</sup>	27.7 <sup>a</sup>
Other	Export	23,385,248	46,501,635	44,323,728	138,769,407	16	19	18
Telecom	Export	79,823,837	175,432,546	159,056,944	321,572,875	12	22	11
Semiconductors	Export	143,321,320	323,924,248	247,443,755	541,211,042	12	23	12
Scientific Devices	Export	12,246,914	14,981,935	16,264,111	39,121,240	10	5	13
Computers	Export	182,684,635	349,687,303	316,379,366	579,872,049	10	18	9
Software	Export	22,403,227	26,097,693	25,469,977	46,382,620	6	4	9
SME	Export	87,203,921	127,583,670	106,186,643	155,006,442	5	10	6
<b>TOTAL TRADE</b>		<b>1,179,527,569</b>	<b>2,251,788,989</b>	<b>1,959,016,618</b>	<b>4,013,483,726</b>	<b>11</b>	<b>18</b>	<b>11</b>

Source: Compiled by USITC staff from UN Comtrade database.

<sup>a</sup> Difficulties in reconciling trade data associated with complex HS 2007 nomenclature changes may account for some of the apparent increase in office machines trade and for some of the apparent decrease in SME trade after 2006.

### ***Shifting Trade in Products Segments***

Computers and semiconductors dominated 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 that of semiconductors increased during 1996–2008 (figures 6–7). In addition to computers, which declined 6 percentage points, the share of SME in 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. Computer imports declined from 37 percent to 27 percent; computers' lost share 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. By contrast, the export share for computers increased modestly, from 33 to 36 percent, along with that of semiconductors. Shares of telecom SME, and, to a lesser extent, scientific devices slipped 4 percentage points collectively.

## **Product Composition by Country**

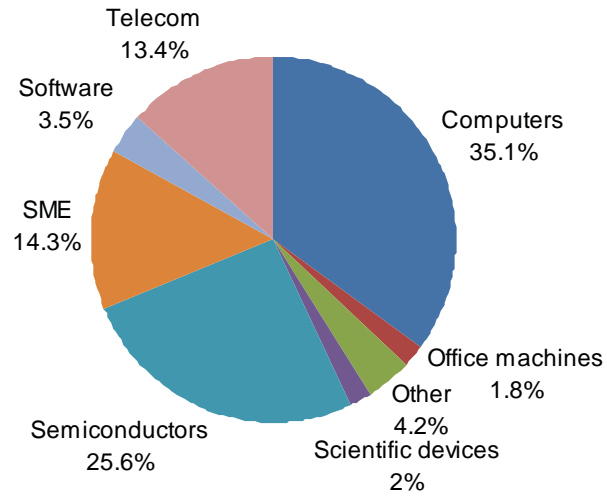
Since the Agreement went into force, developing countries account for increasing export and import shares of leading ITA product segments. Further, ITA members continue to dominate world ITA trade relative to their non-ITA counterparts. Examining the three largest ITA product segments<sup>30</sup>—computers, 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 United States, 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

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<sup>30</sup> Based on 2008 total trade (table 5).

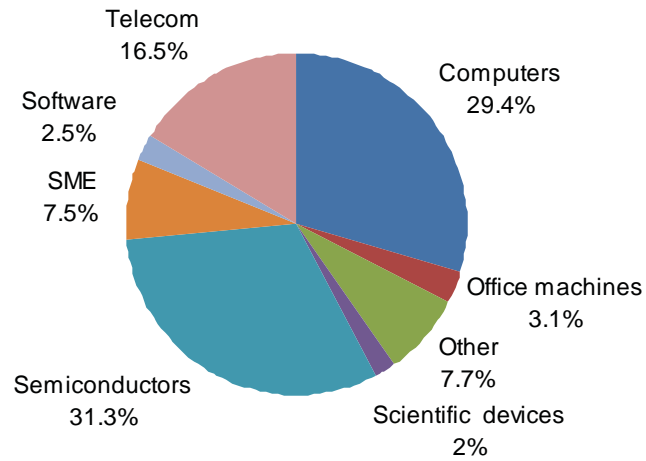


**FIGURE 6** ITA total trade by product segment, 1996



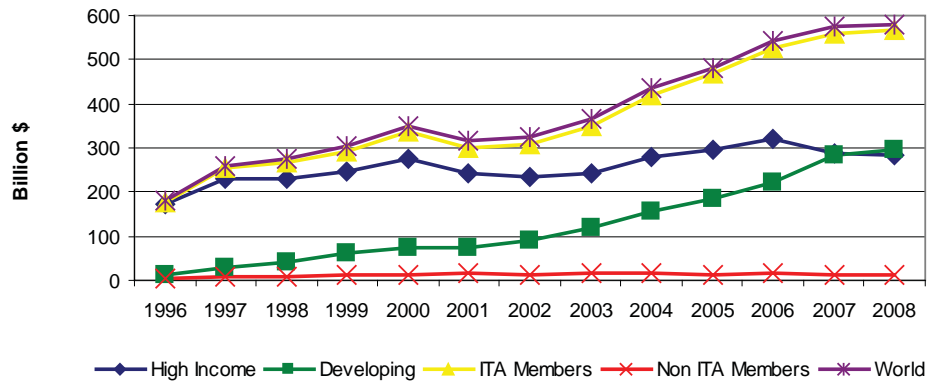
Source: Compiled by USITC staff from UN Comtrade database.

**FIGURE 7** ITA total trade by product segment, 2008



Source: Compiled by USITC staff from UN Comtrade.

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



Source: Compiled by USITC staff from UN Comtrade database.

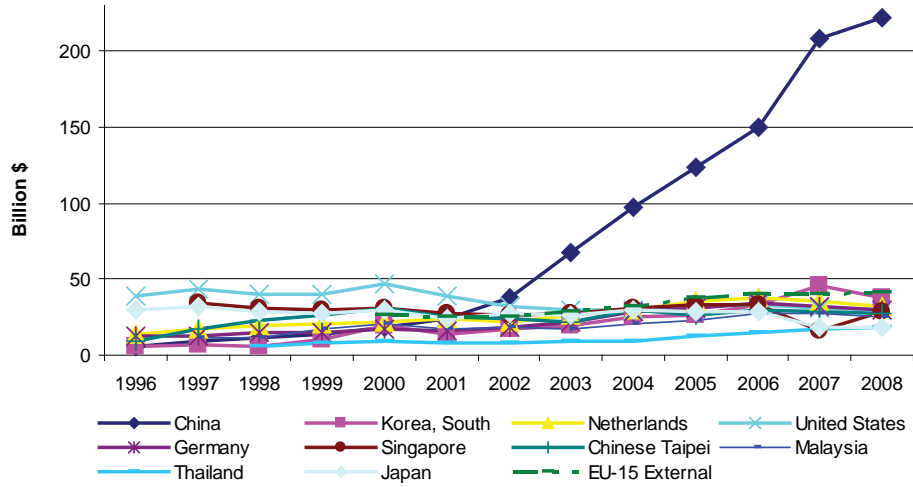
developing countries to enter global production networks,<sup>31</sup> driving shifting trade patterns for these products.

### Computers

ITA members continue to dominate global computer trade, representing 98 percent of exports, a level unchanged from 1996. However, as with other ITA goods, the shift to developing ITA members as leading exporters of computers is striking. 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 10 computer exporters similarly shifted to China and other Asian countries. In 1996, four countries—the United States, Japan, United Kingdom, and the Netherlands accounted for over 50 percent of computer exports. By 2008, China and South Korea alone accounted for nearly half (46.6 percent) of such exports, illustrating an increasing concentration of global computer production and exports (figures 9–10). Other developing ITA members, including Malaysia and Thailand,

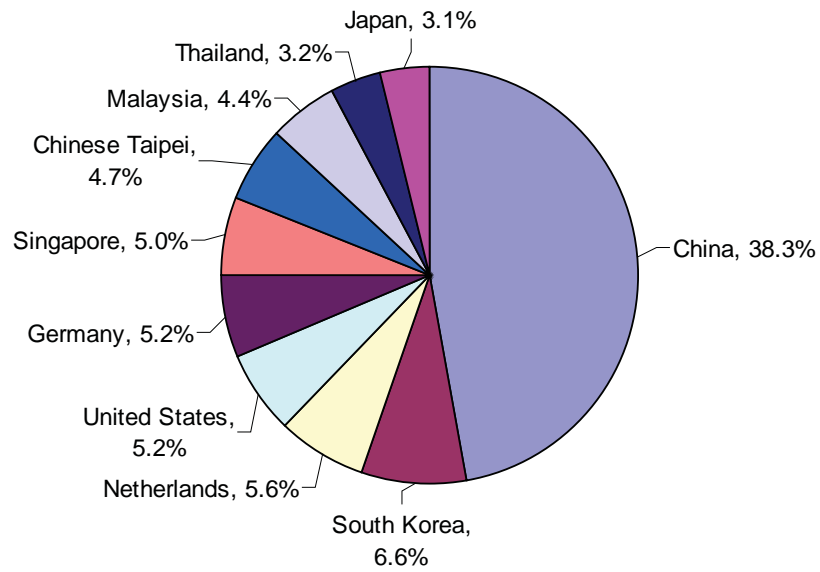
<sup>31</sup> According to Slaughter 2008, developing countries may enter global production networks by leveraging comparative advantages in importing intermediate goods, adding value through these advantages, and subsequently exporting outputs to other countries.

**FIGURE 9** ITA computers: Top 10 exporting countries and the EU, 1996–2008



Source: Compiled by USITC staff from UN Comtrade database.

**FIGURE 10** Computers: Top 10 exporters, 2008

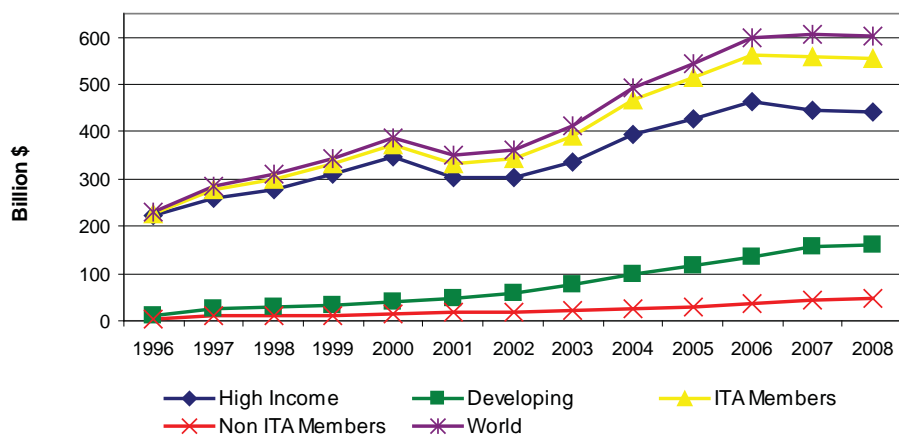


Source: Compiled by USITC staff from UN Comtrade database.

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.

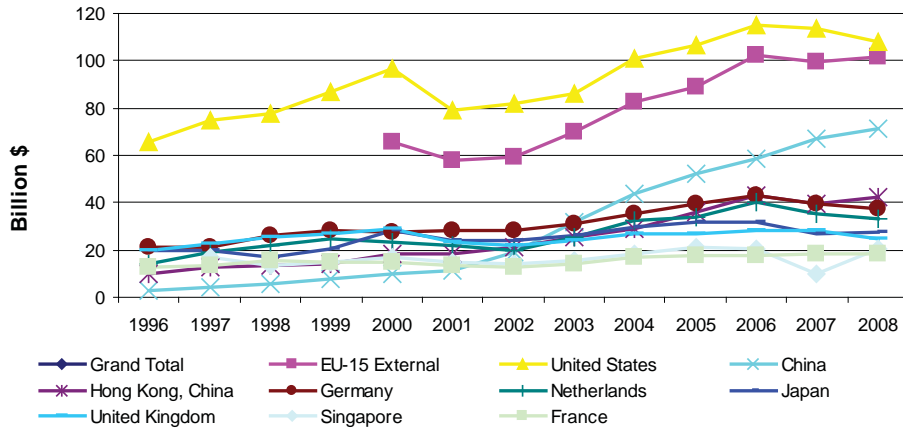
ITA members account for the vast majority of gains in computer imports since 1996 (92 percent of imports in 2008), despite increasing non-ITA member import trade (figure 11). Non-ITA members' share of computer imports increased 6 percentage points, principally driven by increasing imports from Mexico, Brazil, and Russia. These rising imports reflect two factors: 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 10 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 those in computer exports. The United States, 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 remained the leading importers of computer products in 2008 (figure 13).

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



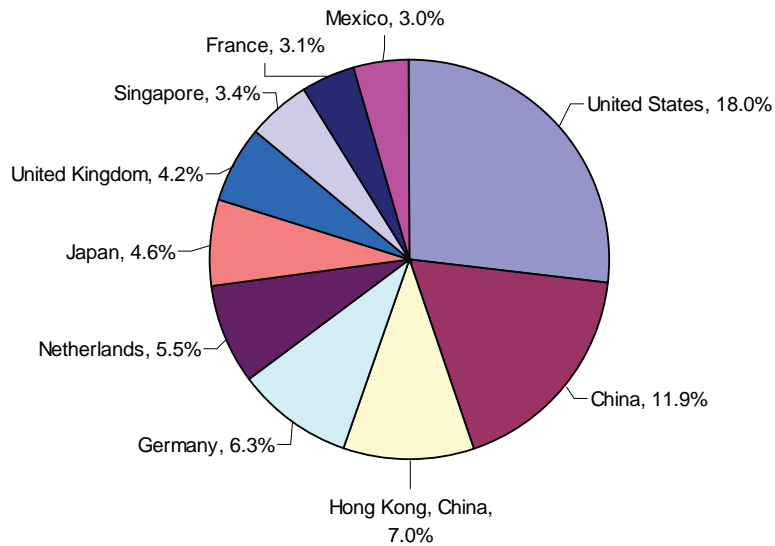
Source: Compiled by USITC staff from UN Comtrade database.

**FIGURE 12** ITA Computers: Top 10 importing countries and the EU, 1996–2008



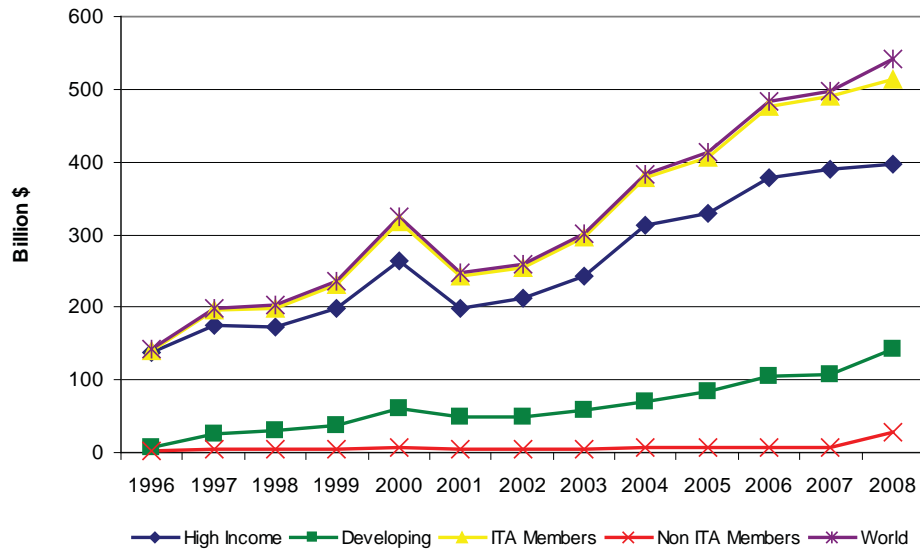
Source: Compiled by USITC staff from UN Comtrade database.

**FIGURE 13** Computers: Top 10 importers, 2008



Source: Compiled by USITC staff from UN Comtrade database.

**FIGURE 14** ITA semiconductor exports, by income and ITA status, 1996–2008



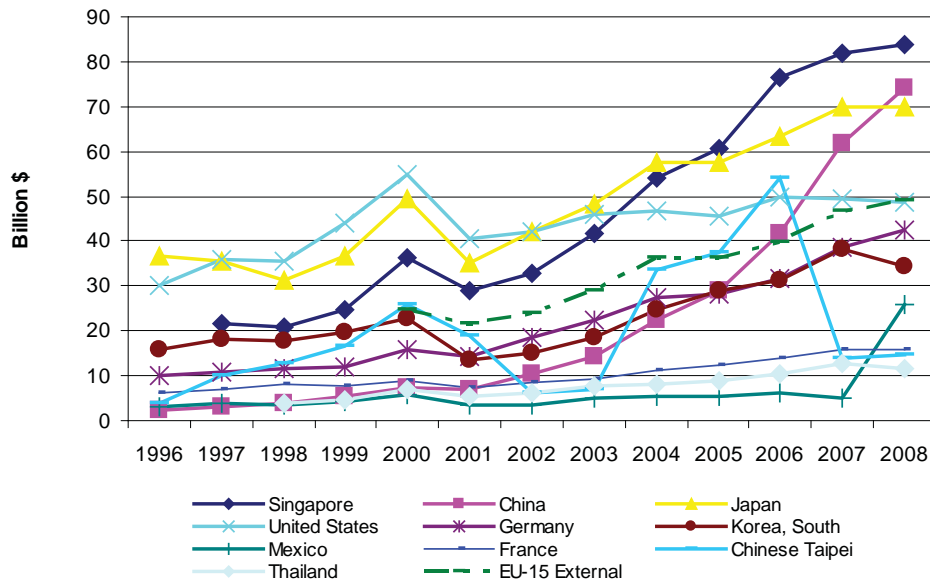
Source: Compiled by USITC staff from UN Comtrade database.

### ***Semiconductors***

The preponderance of the global semiconductor trade was 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 that ITA members captured the vast majority of growth in semiconductor trade since 1996 (figure 14). Between 1996 and 2008, Singapore and China emerged as the largest semiconductor exporters, surpassing Japan and the United States (figure 16).<sup>32</sup> ITA developing-country members, and to a lesser extent Mexico, led the increase in developing countries' share of semiconductor exports, which rose from 4.2 percent to 26.5 percent during 1996–2008. However, with the exception of China (13.7 percent of exports), developed ITA members remained leading exporters

<sup>32</sup> 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.

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



Source: Compiled by USITC staff from UN Comtrade database.

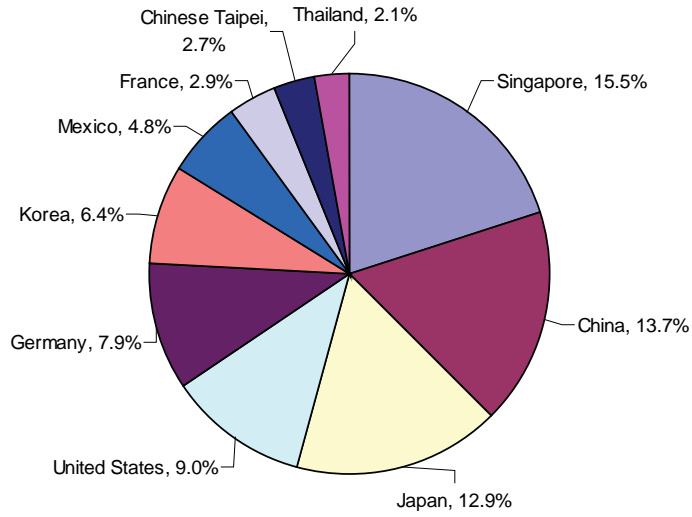
with Singapore (15.5 percent),<sup>33</sup> Japan (12.9 percent), and the United States (9.0 percent) the largest exporters based on 2008 export share (figure 15). The robust expansion of China’s semiconductor exports in part reflects the global fragmentation of back-end production (i.e., packaging and 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).<sup>34</sup>

Similar to exports, ITA members accounted for the vast majority of the increase in semiconductor imports since 1996, generating over 95 percent of imports in 2008 (figure 17). The share of developing country imports expanded to 38.2 percent from 9.1 percent during 1996–2008, led principally by China, with an annual import growth rate of nearly 33 percent. Other ITA

<sup>33</sup> Singapore has a long history as a leading location for semiconductor device assembly, and more recently, computer peripherals, including hard disk drives (Athulkorala 2008).

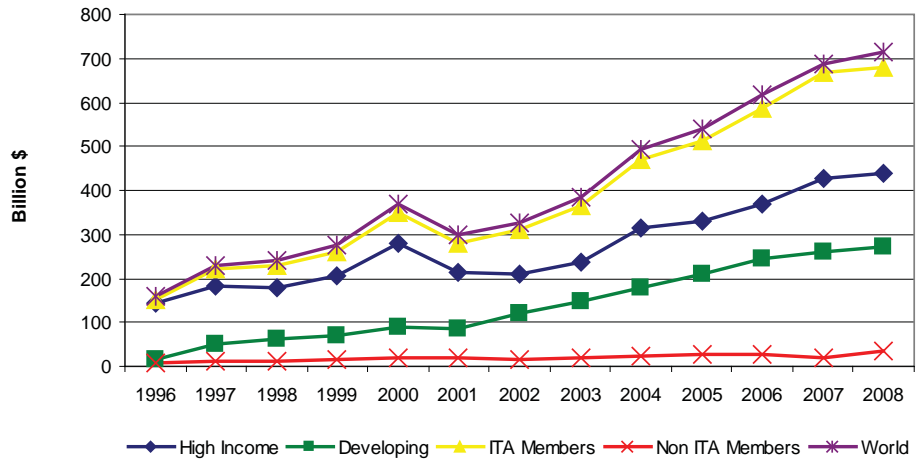
<sup>34</sup> Yinug 2009 notes that while front-end production (capital-intensive design and fabrication) is emerging in China, foreign semiconductor firms’ investments in China remain limited and often entails the use of older-generation production technology.

**FIGURE 16** Semiconductor: Top 10 exporters, 2008



Source: Compiled by USITC staff from UN Comtrade database.

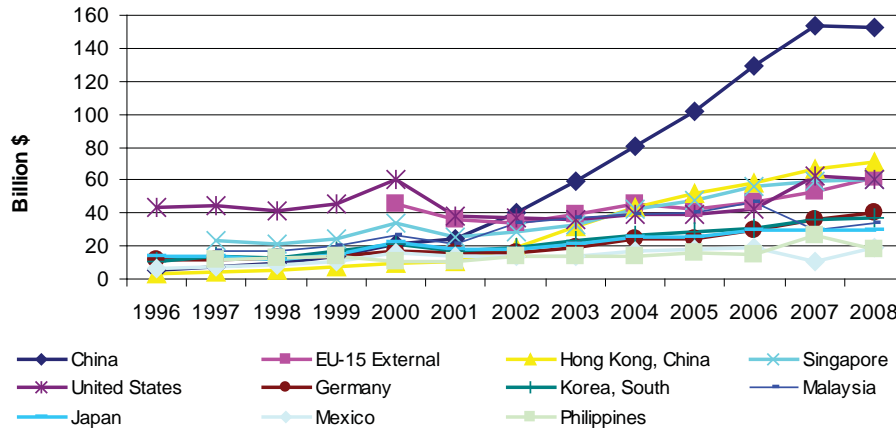
**FIGURE 17** ITA semiconductor imports, by income and ITA status, 1996–2008



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

developing countries experiencing strong import growth since joining the ITA included, Malaysia (6.4 percent), the Philippines (4.2 percent), and Thailand (8.9 percent). The present composition of leading semiconductor 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 United States and Singapore (figures 18–19) to become the largest importer.<sup>35</sup> Along with tariff liberalization under the ITA, the increasing concentration of electronics assembly and production in China (McClellan, 2006, 2-50 to 2-54), along with the shifting global semiconductor production patterns, contributed heavily to China’s becoming the largest semiconductor market (Yinug, 2008 10–13).<sup>36</sup>

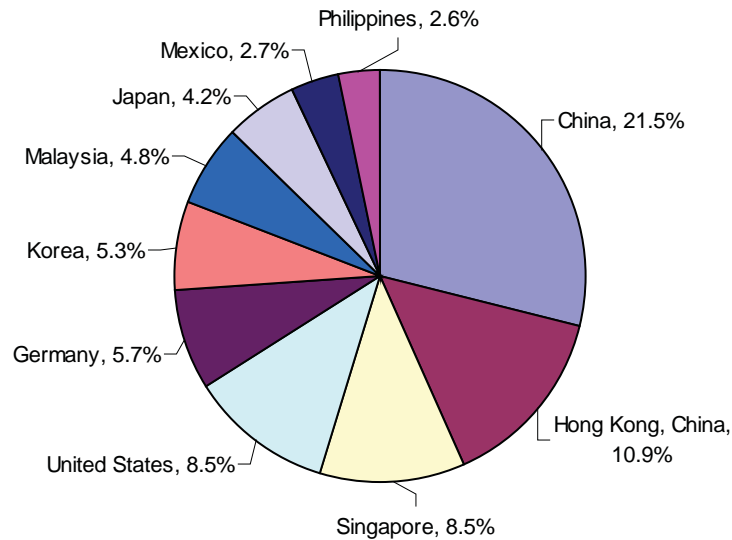
### ***Telecommunications***

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 United States, Germany, and Finland traditionally dominated

<sup>35</sup> China accounted for nearly one-third (32.4 percent) of semiconductor imports in 2008 when Hong Kong is included.

<sup>36</sup> See Yinug 2009 for more details on semiconductor manufacturing stages and increasing global fragmentation of production.

**FIGURE 19** Semiconductor: Top 10 importers, 2008



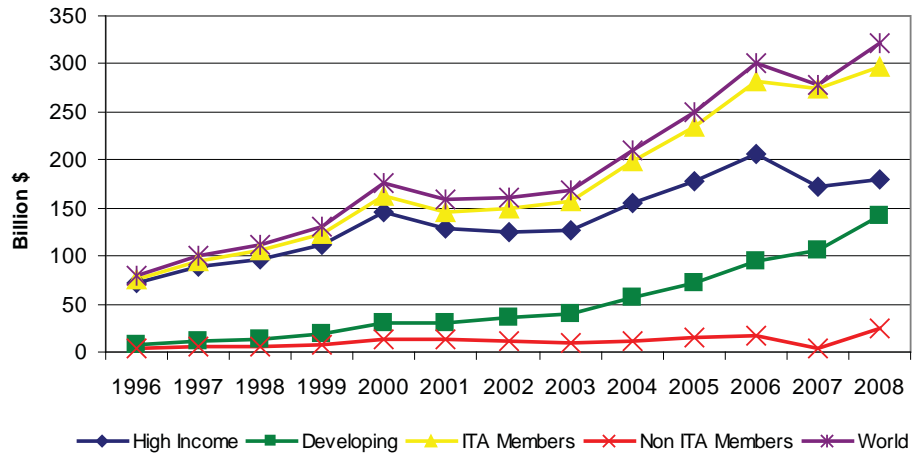
Source: Compiled by USITC staff from UN Comtrade.

telecommunications trade, but a sizeable shift towards developing-country exporters, namely China, occurred after China joined 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).<sup>37</sup> 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), revealing 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.<sup>38</sup>

<sup>37</sup> China and South Korea's exports grew an annualized 35.0 percent and 27.2 percent, respectively during 1996-2008.

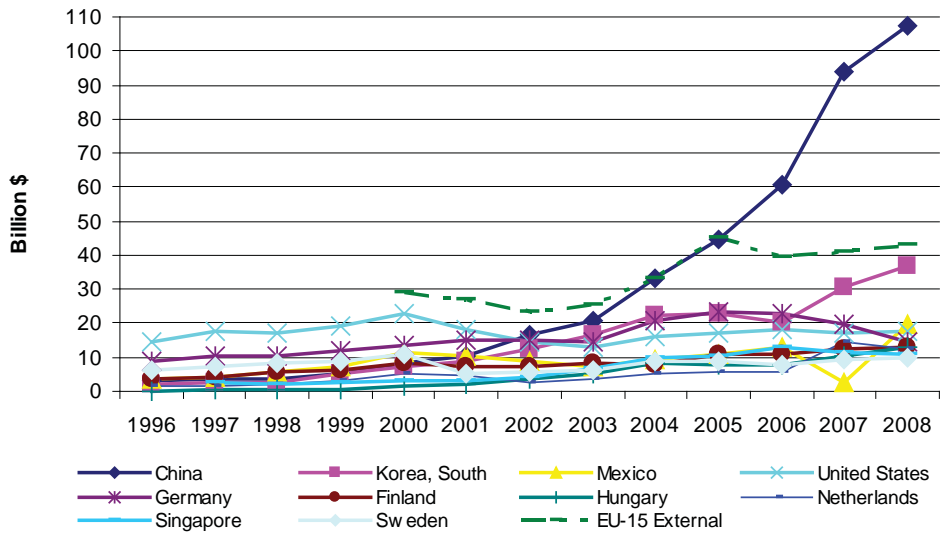
<sup>38</sup> See Luthje 2004 for an illustration of China's role in the global production network of cell phones for a major manufacturer.

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



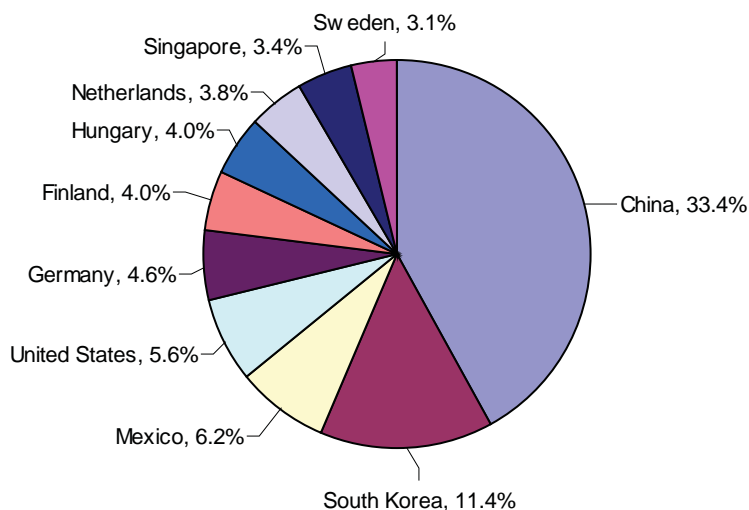
Source: Compiled by USITC staff from UN Comtrade database.

**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

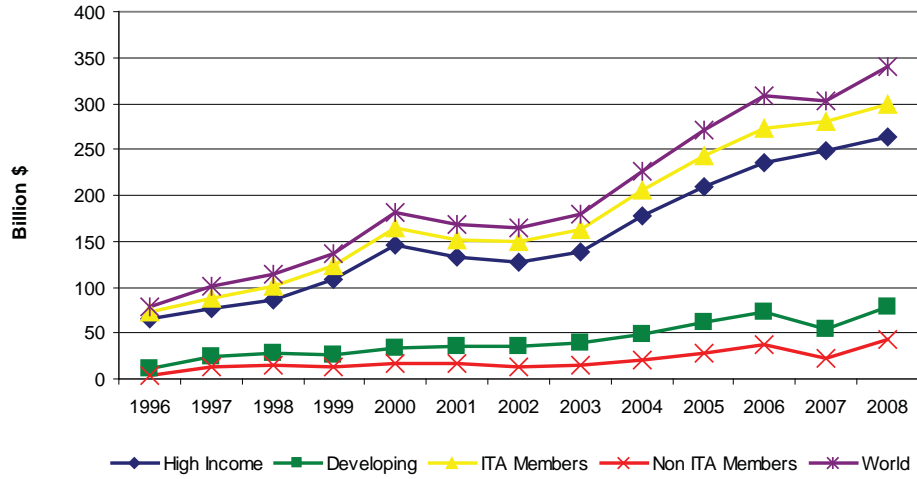


*Source:* Compiled by USITC staff from UN Comtrade database.

Led by developed countries, ITA members' 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 23). 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 a group of four EU members (Germany, United Kingdom, the Netherlands, and France) remained leading telecommunications importers during the period examined, accounting respectively for 20.4 percent and 16.8 percent of 2008 imports, 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.<sup>39</sup>

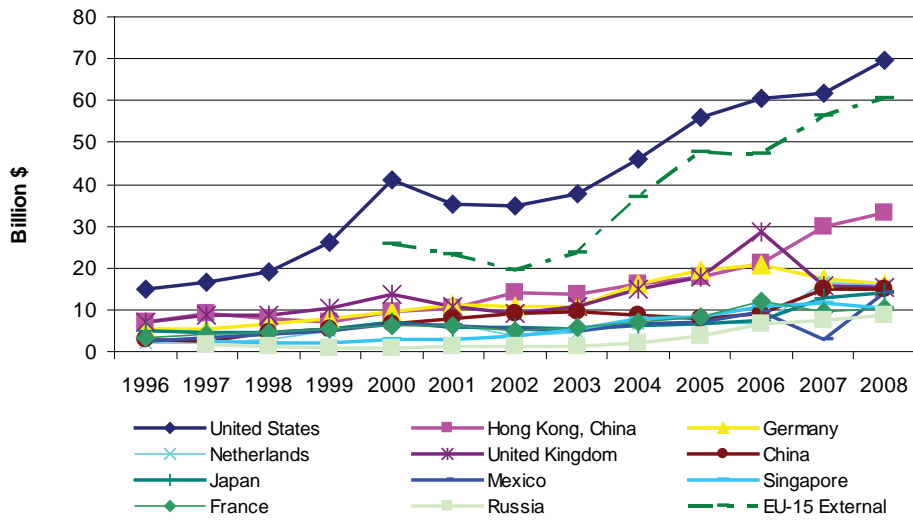
<sup>39</sup> Worldwide broadband wireless subscriptions surged from 20.5 million to 32.5 million between 2001 and 2008 and wireless subscriptions increased to 3.1 billion from 0.8 billion during the same period (TIA 2008).

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



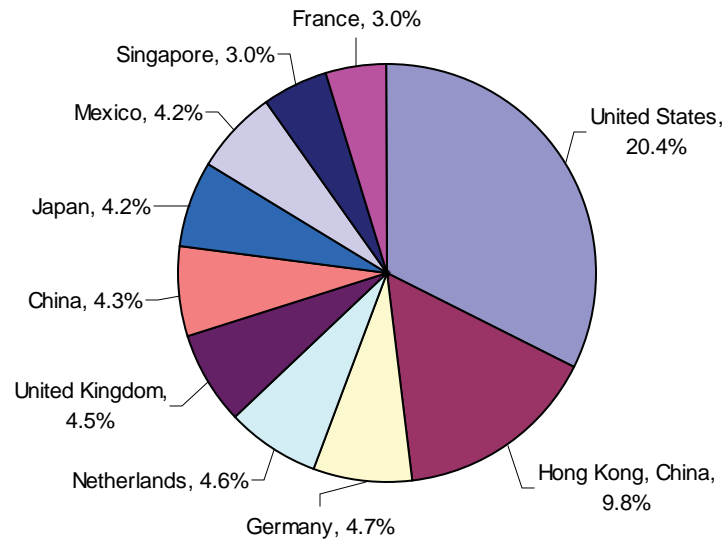
Source: Compiled by USITC staff from UN Comtrade database.

**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 of 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, however, suggests that the ITA has enhanced 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

**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 have likely helped to limit 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 changes made in 2007.<sup>a</sup> Further, data that isolate other duty-free mechanisms outside the ITA encompassing IT products was generally not available. Because the majority 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, the analysis 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 the recent global economic slowdown significantly affected values of world trade, and by extension, ITA products.

**Limited empirical analysis**

A review of prior work 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 from other WTO members by 14 percent under if it joined the ITA. (Bora and Liu 2006, 1, 14).<sup>b, c</sup> On the other hand, 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 join the ITA and postulated that recent growth of IT trade was not closely correlated to ITA tariff reductions. (Continued on page 148.)

(Continued from page 147.) 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 IT diffusion in developing countries showed that certain non-ITA countries have achieved greater success than many ITA member countries.<sup>d</sup>

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.

<sup>a</sup> According to the WTO, the 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 of 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.

<sup>b</sup> Bora and Liu (2006) conclude that a country's ITA imports would be 7 percent higher if it were an ITA member and the exporter is a non-ITA member of the WTO 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 baseline.

<sup>c</sup> Mann and Liu (2007) conclude, based on a review of the empirical literature that ITA participation results in increased bilateral trade.

<sup>d</sup> Joseph and Parayil (2006) used a Network Readiness Index, household IT spending, and measures of telephone usage, among others, to assess ICT diffusion.

*Source:* Compiled by USITC staff from UN Comtrade database.



and Poon 2006, 388).<sup>40</sup> Further, the ITA is often credited as a catalyst for rapid growth in technological advancements and technology diffusion beyond that which would have otherwise occurred (AEA 2008, 2; Slaughter 2003, 26). While considerable discussion and analysis are still needed 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 12 years demonstrate elimination of tariffs on ITA products contributed importantly to these developments in global IT trade.

## Conclusions

During the 12 years after the Declaration stated the ITA's objectives of increased trade and technology diffusion through tariff elimination for many IT goods, remarkable growth in ITA trade 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 the Internet bubble and the advent of the current global economic downturn. Primarily a domain of developed countries at its inception, the ITA greatly expanded the number of developing countries and, in turn, enhanced IT trade for those countries. WTO member participation in the Agreement more than doubled between 1996 and 2008, 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 their expanding membership, developing-country members' ITA trade has increased substantially, in terms of both volume and share. Developing countries now represent more than one-third of ITA trade,

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<sup>40</sup> 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 and Poon 2006).

with growth rates frequently outpacing those of their developed-country counterparts. The robust expansion of ITA trade by developing countries is most evident in Asia, with China consistently a dominant force. Already a strong trader in ITA products, China's ascension to its current position as a leading exporter and importer accelerated in conjunction with implementation of its WTO and ITA obligations. Although China's role is the most prominent, other developing countries, including other Asian countries, also 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 the composition of ITA products' trade, was the expanded share of trade in computers and telecommunications products as a percentage of total ITA trade. However, strong growth in imports and exports for all ITA products occurred, with the most significant growth in telecommunications products, office equipment, and semiconductors, paralleling the increasing fragmentation of global production networks for all IT products. The shift in global production and trade patterns is most striking in computers and telecommunications products, where China and South Korea alone have displaced the United States, Japan, and several European countries as the leading producers and exporters.

In conclusion, remarkable growth in global trade of ITA products and appreciably expanding participation in these trade flows by developing countries, with a significant shift to Asia, has occurred in the wake of tariff liberalization under the ITA.

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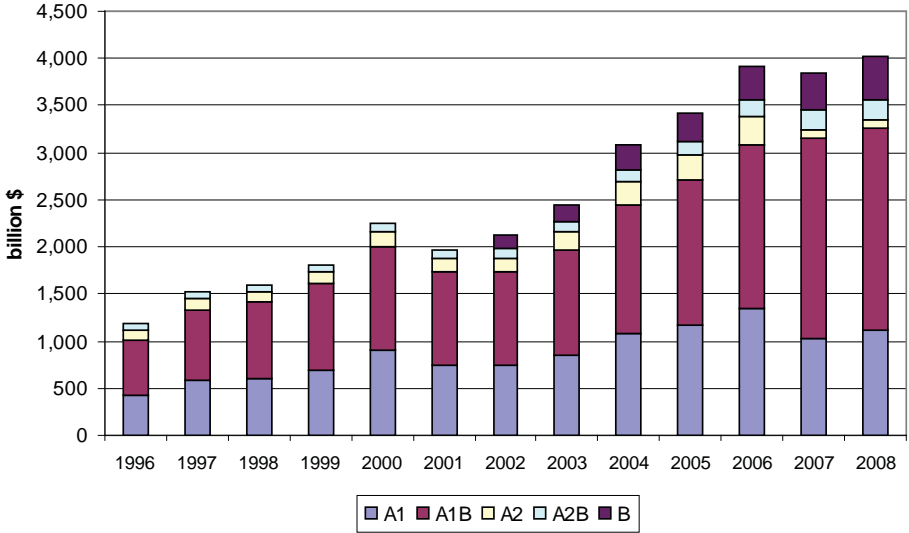
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# Appendix A

**FIGURE APPENDIX A.1** ITA total trade by attachment, 1996-2008



Source: Compiled by USITC staff from UN Comtrade database.

