

**THE IMPACT OF  
TRADE LIBERALIZATION  
IN APEC**



**Economic Committee**

**Asia Pacific Economic Cooperation**

**November 1997**

Published by the APEC Secretariat  
438 Alexandra Road  
#14-00 Alexandra Point  
Singapore 119958  
Tel: (65) 276 1880  
Fax: (65) 276 1775  
E-mail: [info@mail.apecsec.org.sg](mailto:info@mail.apecsec.org.sg)  
Website: <http://www.apecsec.org.sg>  
© 1997 APEC Secretariat

APEC #97-EC-01.2  
ISBN981-00-9644-5

## **CONTENTS**

<b>FOREWORD</b>	<b>i</b>
<b>EXECUTIVE SUMMARY</b>	<b>iii</b>
<b>CHAPTER 1</b>	
<b>APEC TRADE LIBERALIZATION AND FACILITATION MEASURES</b>	<b>1</b>
Pre-MAPA Trade Liberalization In APEC	1
Trade Liberalization And Facilitation In MAPA	3
<b>CHAPTER 2</b>	
<b>THEORETICAL FRAMEWORKS AND QUALITATIVE ASSESSMENTS</b>	<b>8</b>
Theoretical And Analytical Framework	8
Qualitative Analysis Of The Effects Of Other Actions	11
<b>CHAPTER 3</b>	
<b>QUANTITATIVE ASSESSMENT OF THE IMPACT OF TRADE LIBERALIZATION AND FACILITATION</b>	<b>13</b>
Model Structure	13
Quantification Of MAPA Measures	15
Simulation And Estimated Impacts	20
<b>CHAPTER 4</b>	
<b>CONCLUSION AND RECOMMENDATIONS</b>	<b>32</b>
Appendix 1 Background And Progress Of The Project	
Appendix 2 Technical Outline Of The GTAP Model	
Appendix 3 Sensitivity Analysis And Alternative Specifications	
Appendix 4 Members Of The Task Force On The Impact Of Trade Liberalization	
Appendix 5 Summary Tables	
Appendix 6 Acronyms And Regional Definitions	

## FOREWORD

Since its establishment by APEC Ministers in Jakarta in November 1994, the Economic Committee has undertaken a broad range of research and analysis in support of APEC's work both on trade and investment liberalization and facilitation and on economic and technical cooperation.

The Committee completed several trade and investment-related analytical projects during the course of 1997. It is intended that this body of work provide analytical support for APEC's continuing, highly important work on trade and investment liberalization and facilitation.

A key component of this package is the present study on *The Impact of Trade Liberalization in APEC*, for which Japan and Singapore took primary responsibility. This study uses computable general equilibrium (CGE) model simulations to assess the impact of APEC's trade and investment liberalization and facilitation measures as set out in the Manila Action Plan for APEC (MAPA). The study concludes that implementation of MAPA by APEC member economies will bring substantial income and trade benefits. It should therefore provide considerable momentum to APEC's ongoing liberalization agenda.

Related Economic Committee projects completed and published this year include studies led by two different teams in Chinese Taipei. One assessed *The Impact of Investment Liberalization in APEC*, which draws on case studies from several APEC economies and sectors to derive lessons about the process of opening investment regimes. The second analyzed *The Impact of Subregionalism on APEC*, which examines in both theoretical and empirical terms the interaction between trade and investment liberalization on a subregional basis through agreements such as NAFTA, AFTA and CER as well as through informal "growth triangles" and more broadly-based liberalization through APEC and the WTO.

In addition, the *1997 APEC Economic Outlook*, prepared under the leadership of Korea, includes in its structural chapter a discussion of the concept of "open regionalism" based on all the studies and provides some supporting evidence, also drawn from CGE model simulations, on comparative benefits of alternative approaches to APEC trade liberalization. This discussion complements the other studies and, indeed, helps pull together some of the common themes. As well, the Outlook provides a broad overview of recent and prospective economic trends in the region which in turn provides some perspective on the context in which the trade and investment policy initiatives are being carried forward.

As an institution that has been created at the dawn of the information age, APEC has pioneered a "virtual" mode of operation. It functions with a very small Secretariat and relies accordingly on the voluntary contributions of the time and energy of experts in member economies to carry out the large majority of its work.

In the case of the present study, particular thanks are due to the Co-chairs of the Economic Committee Task Force on the Impact of Trade Liberalization, Mr. Makoto Nomura of the Economic Planning Agency, Japan; and Dr. Tan Kong Yam of the Ministry of Trade and Industry, Singapore. Thanks are also due to Dr. Kazutomo Abe of Japan's Economic Planning Agency, the principal drafter of the report; to Tom Engle, Program Director at the APEC Secretariat, who has provided logistical and technical support to the Economic Committee in this work and, in particular, taken responsibility for seeing the study through to publication; and to Dan Ciuriak, Coordinator Asia Pacific Research at the Department of Foreign Affairs and International Trade in Canada, who has assisted me in my role as Chair of the Committee and taken particular responsibility for coordinating the incorporation of comments from member economies on drafts of this study and for the final editing of the text.

John M. Curtis  
Chair  
APEC Economic Committee  
Ottawa, November 1997

## EXECUTIVE SUMMARY

The Manila Action Plan for APEC (MAPA), which was agreed by the APEC Ministers at their meeting in Manila in November 1996, set out APEC members' plans to realize the goals established by APEC Economic Leaders in the Bogor Declaration of 1994 and elaborated in the Osaka Action Agenda of 1995. The MAPA is a collective work by all APEC members, consisting of individual action plans, collective action plans and other joint activities. This study assesses the likely economic effects of implementing these measures, using simulations of a Computable General Equilibrium (CGE) model.

The CGE model results are not forecasts. They do, however, indicate the rough order of magnitude of the gains in terms of real incomes and export volumes from "modellable" measures such as tariff cuts and the reduction of border costs through customs streamlining. Dynamic and product-differentiation effects are only partially captured. Moreover, other effects, such as scale economies, could not be incorporated because of model and data constraints. Accordingly, the estimates below are indicative only and probably underestimate the full impacts of implementing MAPA.

The model simulation indicates that the benefits from MAPA will be substantial. The real Gross Domestic Product (GDP) of APEC economies as a whole will be raised by about 0.4 percent, or a permanent increase of US\$69 billion per year in 1995 prices (Table A). The corresponding benefits to the world as a whole will be about 0.2 percent of global output, or US\$71 billion in 1995 prices. By way of comparison, this is roughly equivalent to total global official development assistance in 1995. This impact is also equivalent to one fourth of the full impact of implementation of the Uruguay Round (UR) trade liberalization. (See Chart A).

All APEC members gain, albeit in different magnitudes (Table B). The differences reflect: (i) the relative size of the economies (the larger the economy, the larger the gains in dollar terms); (ii) the degree of liberalization (economies that liberalize the most gain the most); (iii) trade effects, reflecting diversions and expansions of trade; and (iv) the degree of capital deepening caused by the policy shocks when capital accumulation is incorporated in the model (the developing economies generally have favorable conditions). The results indicate that, in percentage terms, all of the developing and newly industrialized economies will gain more than the APEC average of 0.4 percent of GDP, while among the five industrialized APEC members, only New Zealand will exceed the APEC average.

The impact of trade facilitation, such as streamlining of customs procedures, exceeds that of trade liberalization, i.e. tariff reduction. Trade facilitation will create a gain of about 0.26 percent of real GDP to APEC (or about US\$45 billion), while the gain from trade liberalization will be 0.14 percent of real GDP (about US\$23 billion). This outcome reflects the focus placed on facilitation actions by APEC. The introduction of trade facilitation measures requiring new technologies, however, would entail costs, for example of equipment and training, not captured by the model.

While most of the MAPA measures are unilateral and non-discriminatory, the gains to APEC,

amounting to about US\$69 billion, will be much larger than those to non-APEC members, only US\$2 billion. Free rider gains flowing from APEC trade liberalization and facilitation are small and, therefore, should not be a concern. The study also found that early implementation of the trade facilitation measures will contribute to the early realization of the full impacts of MAPA.

The MAPA measures will considerably expand trade. As Chart B illustrates, trade expansion will take place in such a manner that intra-regional trade among the APEC economies will increase the most. The MAPA initiatives will lead to stronger interdependence within the APEC region; however, inter-regional relations will be also deepened.

The GDP gain by APEC from the tariff reductions contained in MAPA will be equivalent to about one-third of the total gains to be realized from full tariff elimination by APEC.

The static benefits of trade liberalization and facilitation are essentially the efficiency gains obtained from reallocation of labor and capital, which usually involves temporary, though occasionally high, adjustment costs. Indeed, the expected impacts yielded by the model may not be fully realized if this adjustment process does not work well. Deregulation and competition policies are therefore important to ensure that market mechanisms function well. Governments can also play a crucial role in reducing the costs of job transition through, for example, provision of training and education.

For a more precise assessment of the impacts of trade policies in APEC, it would be valuable to assemble data on the protection levels of member economies. In addition, it would be beneficial to: (i) develop theoretical frameworks and analytical tools to assess the total impact of APEC initiatives, including investment measures; (ii) undertake follow-up assessment periodically, as action plans are updated; and (iii) enhance the CGE model, develop other types of models, and encourage more participation from APEC members in research activities.

Makoto Nomura, Economic Planning Agency, Japan  
Tan Kong Yam, Ministry of Trade and Industry, Singapore

Co-chairs, Economic Committee Task Force on the Impact of Trade Liberalization

**Table A: Impacts of MAPA are Substantial**

**(1) Impact on APEC**

Initiatives	Gross Domestic Product	
	Percentage Change	Amount <sup>1</sup> (US\$ billions in 1995)
UR Commitments	0.9	140.3
MAPA Total <sup>2</sup>	0.4	68.5
• MAPA Liberalization	(0.1)	(23.1)
• MAPA Facilitation	(0.3)	(45.3)
UR and MAPA <sup>3</sup>	1.3	208.7

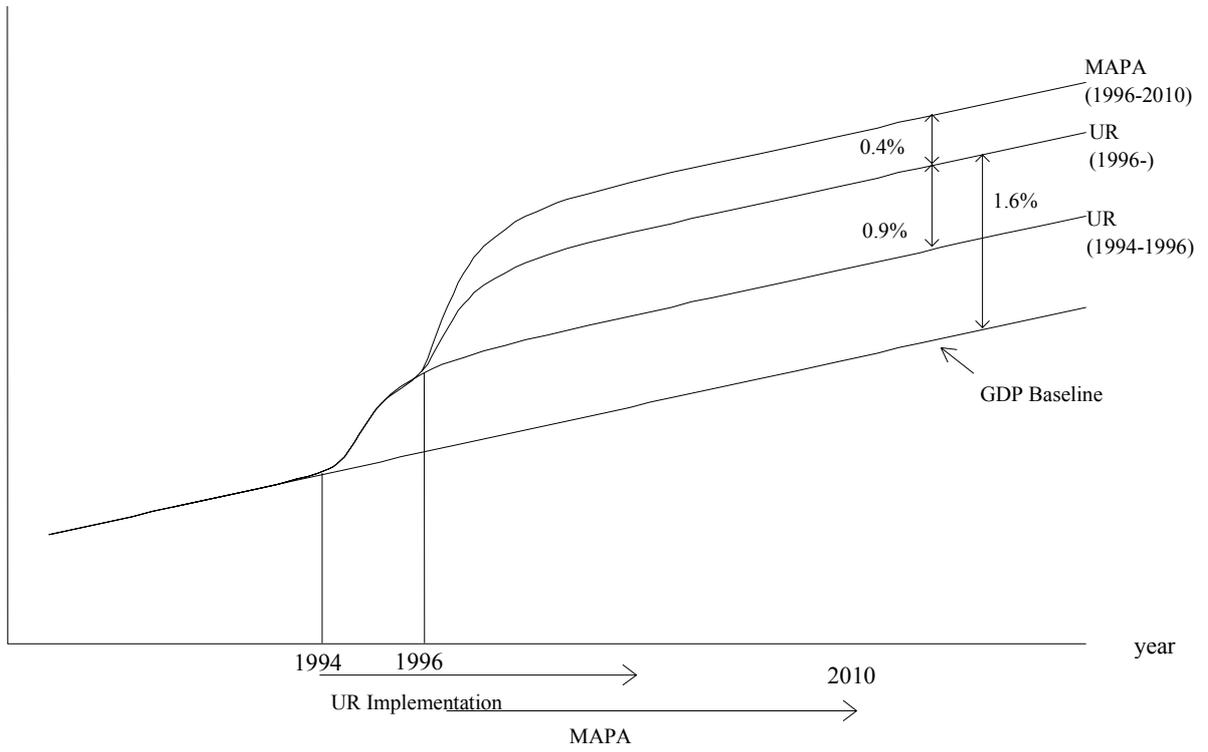
**(2) Impact on the World**

Initiatives	Gross Domestic Product	
	Percentage Change	Amount (US\$ billions in 1995)
UR Commitments	0.8	246.8
MAPA Total	0.2	70.9
• MAPA Liberalization	(0.07)	(24.5)
• MAPA Facilitation	(0.15)	(46.5)
UR and MAPA	1.0	317.8

Notes:

1. Amounts shown in the table are based on the level of nominal GDP of the economies in 1995.
2. MAPA measures include those contained in member economies' individual action plans, collective actions, Osaka Initial Actions and the Information Technology Agreement.
3. "UR and MAPA" is equal to the sum of the impacts of the UR commitments and MAPA (liberalization and facilitation).

**Chart A: Conceptual Illustration of the GDP Effects of UR and MAPA**



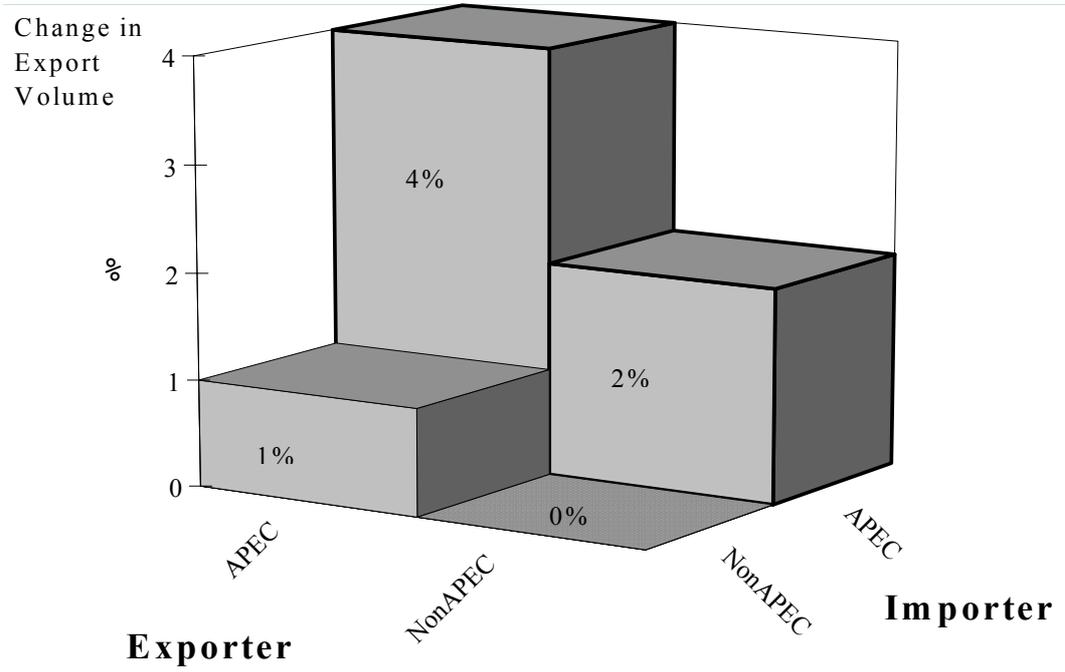
**Table B: All APEC Members Gain from MAPA**

Economies / Regions <sup>1</sup>	Gross Domestic Product	
	Percentage Change	Amount <sup>2</sup> (US\$ billions in 1995)
Australia	0.4	1.8
Canada	0.4	2.0
Chile	4.9	3.3
China	2.1	14.3
Hong Kong, China	0.4	0.6
Indonesia	2.4	4.9
Japan	0.1	7.2
Korea	0.8	3.8
Malaysia	7.4	6.3
Mexico	0.7	1.7
New Zealand	1.3	0.8
Philippines	4.3	3.2
Singapore	1.5	1.2
Chinese Taipei	1.3	3.3
Thailand	3.1	5.2
USA	0.1	8.9
<b>APEC Total</b>	<b>0.4</b>	<b>68.5</b>
Rest of World	0.0	2.4
<b>World MAPA Total</b>	<b>0.2</b>	<b>70.9</b>

Notes:

1. Because of data constraints, Brunei Darussalam and Papua New Guinea could not be specified. See Table 4 in the text for details.
2. Amounts shown are based on the level of nominal GDP of the economies in 1995.

**Chart B: MAPA Reinforces Interdependence in the APEC Region**



## Chapter 1

# APEC TRADE LIBERALIZATION AND FACILITATION MEASURES

At their meeting in Bogor in November 1994, APEC Economic Leaders set a number of specific goals and objectives, including: free and open trade and investment in the Asia-Pacific region no later than 2010 for industrialized economies and 2020 for developing economies; expansion and acceleration of trade and investment facilitation programs; and intensified development cooperation. In Osaka in November 1995, APEC adopted the Osaka Action Agenda (OAA), which has become the template for future APEC work toward the common goals. In November 1996, APEC released the Manila Action Plan for APEC (MAPA), which is the first action plan toward the goals set in the Bogor Declaration and the OAA. MAPA consists of individual action plans (IAPs), collective action plans (CAPs) and other joint activities in various APEC fora. This report examines the impact on trade and real income/welfare in APEC of the measures incorporated in MAPA.

### PRE-MAPA TRADE LIBERALIZATION IN APEC

Before assessing the impact of MAPA, it is helpful to refer to the recent historical context of trade liberalization by APEC members, in particular measures underway before the release of MAPA. The highlights of MAPA are also introduced in this section.

#### *Tariff Reduction Since the Late 1980s*

Rapid progress in APEC trade liberalization has been made since the late 1980s, including significant advances on the multilateral, unilateral and subregional fronts. APEC members implemented unilateral reforms and deregulation programs that resulted in a significant reduction of their overall tariff rates in the 1990s. As a result of these various measures, the unweighted average tariff rate in the APEC region fell from 15.4 percent in 1988 to 9.1 percent in 1996.<sup>1</sup> Among the members, three economies have virtually zero tariffs, and only four economies had tariffs higher than 15 percent in 1996.<sup>2</sup> However, most of the members with the higher tariffs have significantly reduced their tariff rates.

The Uruguay Round (UR) of the GATT, which was completed in December 1993, complemented the unilateral tariff reforms. The UR served to bind the applied tariffs that had already been lowered by the unilateral reforms. In the case of industrial products, the percentage of bound tariff lines rose from 78 percent to 99 percent for developed member of the GATT, from 21 to 73 percent for the developing members, and from 73 to 98 percent for transition members. The results provided a substantially higher degree of market security for traders and investors.<sup>3</sup> This was particularly important for the APEC developing economies and NIEs. In several of these APEC members, the number of bound tariff lines was significantly increased, and bound tariff

---

<sup>1</sup> The significant decline in tariff rates in 1996 may have partly reflected the implementation of the downpayments in the Osaka Initiative Actions.

<sup>2</sup> The economies with virtually zero tariffs include: Brunei Darussalam; Hong Kong, China; and Singapore. The four economies with the tariffs higher than 15 percent include: China; Papua New Guinea; the Philippines; and Thailand. Pacific Economic Cooperation Council, "Perspectives on the Manila Action Plan for APEC" (1996), pp. 8-10.

<sup>3</sup> Pacific Economic Cooperation Council, "Milestones in APEC Liberalization: A Map of Market Opening Measures by APEC Economies," (1995), pp. 41-54.

rates were lowered.

### ***Liberalization of Non-Tariff Measures Since the Late 1980s***

Unilateral reforms have brought about a significant decline in the incidence of non-tariff measures (NTMs) on imports by APEC economies since the late 1980s. For APEC as a whole, the incidence of NTMs has been cut nearly in half, declining from nine percent of import coverage in 1988 to five percent in 1996.<sup>4</sup> Some members virtually eliminated some types of non-tariff protection.<sup>5</sup>

Meanwhile, the UR contributed to the removal and reduction of NTMs and subsidies in several important areas. The commitments include: removal of voluntary export restraints (VERs) by the end of 1999; removal of domestic support, export subsidies and VERs in agriculture; phasing out and integration into WTO rules of the bilateral quotas on textiles and garments in three stages over a ten-year period; and expansion of the list of prohibited subsidies in non-agricultural trade to include not only export subsidies but also subsidies on domestic goods considered to distort trade.

### ***Subregional Arrangements***

There are several subregional trading arrangements (SRTAs) within the APEC region, involving 13 APEC members. These arrangements have contributed to the reduction of tariffs and non-tariff measures within the region.<sup>6</sup>

Major examples include the North American Free Trade Agreement (NAFTA), the ASEAN Free Trade Area (AFTA) and the Australia-New Zealand Closer Economic Relations Trade Agreement (CER). With few exceptions, NAFTA will eliminate all tariffs on trade between the parties by January 2003, i.e. within ten years of the date of implementation of NAFTA.<sup>7</sup> In addition, Chile and Mexico established a free trade agreement in January 1992, pursuant to which most products became tariff-free as of 1996. The agreement is being renegotiated for the inclusion of disciplines in services, investment and other areas as well as for the elimination of reciprocal exceptions. Chile and Canada also signed a free trade agreement that includes disciplines in goods, services and investment. Since entry into force of the agreement in July 1997, 92 percent of exports of Chile and 76 percent of exports of Canada are duty-free with the rest to be liberalized in two to six years.

The AFTA has set a schedule to reduce intra-regional tariffs to a range of zero to five percent for industrial products and non-sensitive agricultural products by January 2003. Meanwhile, 87.7 percent of tariff lines will meet this target by 2001. AFTA has also encouraged members to consider accelerating the tariff reduction for the remaining products to the zero to five percent range by 2000. Trade facilitation has also been encouraged, and there has been progress on various fronts, including customs procedures and standards.

The CER eliminated all tariffs, import licensing and quantitative restrictions to trans-Tasman trade as of July 1990. Services trade was broadly liberalized between Australia and New Zealand

---

4 MAPA Highlights.

5 These include Australia, Chile, Indonesia, New Zealand and Singapore.

6 For detailed analysis, see APEC Economic Committee, "The Impact of Subregionalism on APEC," (1997). As noted in that document, the three major SRTAs in the APEC region account for almost 1/3 of intra-APEC trade.

7 In the case of Canada and the United States, by January 1, 1998.

from January 1989.

### ***Osaka Initial Actions***

In November 1995 in Osaka, APEC leaders announced their packages of Osaka Initial Actions to demonstrate their firm commitment to achieve liberalization and facilitation. The packages covered a wide range of measures, including tariff reductions, acceleration of future tariff reductions, and early implementation of the agreements of the World Trade Organization (WTO). Almost all members also announced various deregulation measures, including in areas such as telecommunications, finance, civil aviation, and import procedures. These measures are major achievements for APEC, and some in the package are taken into MAPA.

## **TRADE LIBERALIZATION AND FACILITATION IN MAPA**

### ***Expanded Market Access***

APEC members have reinforced these liberalization trends with MAPA. Table 1 is an excerpt from MAPA Highlights listing some major actions of the members. Five members (Brunei Darussalam; Chile; Hong Kong, China; New Zealand and Singapore) have indicated a target of zero tariffs by 2010/2020. China has announced a schedule of significant reduction from the current high level of 23 percent to around 15 percent by 2000. Two others are implementing and refining their Osaka Initial Actions by providing not only a deadline, but also the timeframe for achieving general tariff reductions.

Individual APEC economies are all well on track in terms of progress toward the Bogor goal. For most APEC members, the combined commitments under the IAPs, Osaka Initial Actions and other unilateral reforms will result in lower average (applied) tariffs than those committed under the UR for the period 1996-2000. These features are clearly shown in a report of the Pacific Economic Cooperation Council (PECC), which includes an analysis of members' individual tracks of tariff reduction in the future (see box).<sup>8</sup>

---

<sup>8</sup> Pacific Economic Cooperation Council, "Perspective on the Manila Action Plan for APEC," 1996, pp. 11-16.

**Table 1: MAPA Highlights -- Tariff Action Plans of APEC Economies**

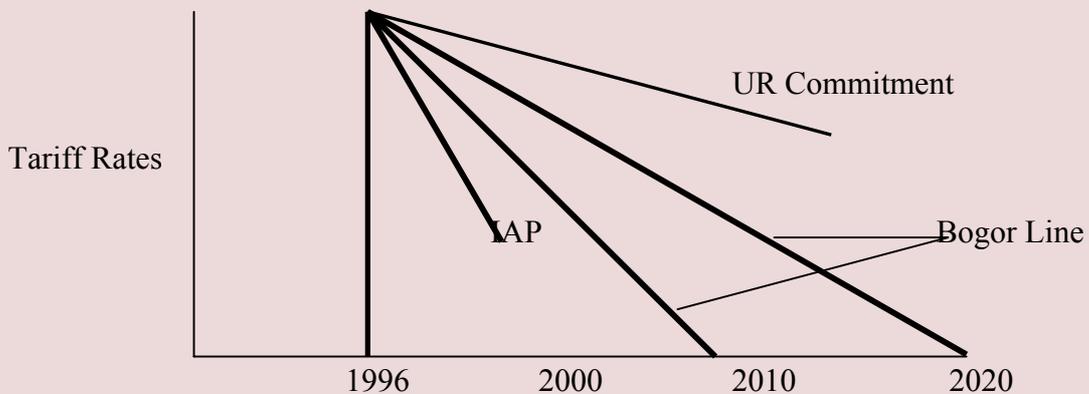
<b>Economy</b>	<b>Actions</b>
Australia	<ul style="list-style-type: none"> <li>Phase down exceptions to the 0-5% general applied tariff to the year 2000, including those on passenger motor vehicles, textiles, clothing and footwear, cheese and vegetables</li> <li>Review by 2000 general applied tariff rate and exceptions, subject to certain conditions</li> </ul>
Brunei	<ul style="list-style-type: none"> <li>Progressively reduce tariffs to zero by 2020, with some exceptions</li> </ul>
Canada	<ul style="list-style-type: none"> <li>Phase down MFN tariff rates on manufacturing inputs on 1,500 lines by 1999</li> <li>Phase down GPT rates by 2004</li> <li>Conclude ITA to eliminate tariffs on information technology products by 2000</li> </ul>
Chile	<ul style="list-style-type: none"> <li>Progressively reduce tariffs to 0% on most products by 2010</li> </ul>
China	<ul style="list-style-type: none"> <li>Reduce simple average tariff to around 15% by 2000</li> </ul>
Hong Kong, China	<ul style="list-style-type: none"> <li>Progressively bind at 0% on all imports by 2010</li> </ul>
Indonesia	<ul style="list-style-type: none"> <li>Eliminate surcharges and reduce tariffs to a maximum of 5% and 10% by 2003</li> </ul>
Japan	<ul style="list-style-type: none"> <li>Expand Tariff Elimination Initiative on pharmaceuticals by 2000</li> <li>Conclude ITA to eliminate tariffs on information technology products by 2000</li> </ul>
Korea	<ul style="list-style-type: none"> <li>Eliminate tariffs on ships from 1997</li> <li>Consider revising tariff concession schedule</li> </ul>
Malaysia	<ul style="list-style-type: none"> <li>Reduce/abolish import duties on certain items, including canned food, dental &amp; medical supplies, cosmetics, paper products and printed paper in 1997</li> <li>Continue with unilateral tariff reductions under annual budget exercise</li> </ul>
Mexico	<ul style="list-style-type: none"> <li>Reduce tariffs on information technology products as part of ITA under negotiations starting 1999</li> </ul>
New Zealand	<ul style="list-style-type: none"> <li>All imports duty-free by 2010</li> </ul>
Papua New Guinea	<ul style="list-style-type: none"> <li>Reduce to 5% tariff on basic steel, aluminum, capital equipment, machinery, basic chemicals. Chemical agricultural inputs by 1997</li> <li>Revise standard rates, with a view to progressive reduction by 2000</li> </ul>
Philippines	<ul style="list-style-type: none"> <li>Progressively reduce to targeted uniform rate of 5%, except sensitive agricultural products by 2004</li> </ul>
Singapore	<ul style="list-style-type: none"> <li>Progressively bind tariffs at 0% by 2010</li> </ul>
Chinese Taipei	<ul style="list-style-type: none"> <li>Progressively reduce average tariffs to around 6%, with about 65% at 5% or below, by 2010; review the possibility of deepening the reduction</li> </ul>
Thailand	<ul style="list-style-type: none"> <li>Regularly review import duties with a view to reducing domestic protection</li> <li>Review possibility of revising tariff concession schedule</li> </ul>
USA	<ul style="list-style-type: none"> <li>Proposed negotiations towards zero tariff under ITA by 2000</li> </ul>

Source: MAPA Highlights (APEC, 1996)

### Tracking Tariff Reductions

The PECC report contains a chart of “the IAP trends” that indicate the future tariff rates committed to in the IAPs. The IAP lines reflect unilateral measures and Osaka Initial Actions, as well as IAP commitments. The chart also includes “the indicative Bogor tracks (Bogor Line)” which are simply declining trend lines connecting the point representing the tariff rate in 1996 or 2000 with the zero tariff point in 2010/2020. The report calls some economies “champions.” They are the economies: (i) which already have low tariffs and are near the indicative Bogor target of zero as of 1996, namely Brunei, Singapore, and Hong Kong, China; or (ii) which have committed to extensive tariff reduction so that their IAP lines are below the Bogor trend line, namely Chile, China, Indonesia, and the Philippines.

#### Conceptual Framework of “Champions”



The methodology in the PECC report is straightforward and easily identifies which economies are champions. The analysis, however, does not show the magnitudes of the effects on the world and regional economies that the commitments will cause. This gives a rationale to the present project, which aims quantitatively to assess the economic impact.

In addition to tariff reduction, all members will individually address NTMs by way of review, reduction, or elimination of non-WTO-consistent measures. The action plans, together with Osaka Initial Actions, indicate that eight APEC members outline specific steps for time-bound actions to reduce NTMs. Moreover, MAPA includes several important items in services trade liberalization: in particular, the explicit statement of support for the WTO negotiating processes on services trade liberalization, and the adoption of sets of APEC principles for the development of open markets, by the Bogor timeframe, for energy services and telecommunications.

### Information Technology Agreement

The commitments on the Information Technology Agreement (ITA) were another achievement of APEC in 1996. The 1996 Ministerial Meeting and APEC Economic Leaders Meeting gave crucial momentum to conclude the ITA.<sup>9</sup> The political impact of the leaders’ decision provides the rationale to treat the ITA as an achievement of APEC. The “Ministerial Declaration on Trade

<sup>9</sup> The leaders’ declaration summed it up as follows: “Recognizing the importance of information technology in the 21<sup>st</sup> century, APEC leaders called for the conclusion of an information technology agreement by the WTO Ministerial Conference that would eliminate substantially tariffs by the year 2000, recognizing the need for flexibility as negotiations in Geneva proceed.”

in Information Technology Products” was agreed at the Singapore WTO Ministerial Conference in December 1996. Negotiations on implementation of the ITA were completed in March 1997.

Under this agreement, more than 40 members of the WTO will eliminate tariffs on information technology products, including computer hardware and software, semi-conductors and integrated circuits, and other related products. The following APEC members participated in the agreement as of June 1997: Australia; Canada; Hong Kong, China; Indonesia; Japan; Korea; Malaysia; New Zealand; the Philippines; Singapore; Chinese Taipei; Thailand; and the United States of America. Members undertook to complete the elimination of the tariffs by the year 2000; in the case of some developing economies, the agreed date for some products was no later than 2005.

### ***Trade Facilitation Measures***

The objective of trade facilitation measures is to reduce the cost of doing business by liberalizing trade, eliminating unnecessary administrative burdens, and bringing down technical barriers to trade through the use of new technologies and/or cost-effective processes. More specifically, these measures include: (i) the move toward a paperless and harmonized customs system; and (ii) conclusion of a mutual recognition arrangement on conformity assessment for standards and alignment with international standards.<sup>10</sup>

For customs procedures, APEC will work to reduce transaction costs arising from complex administrative requirements with the intention of moving to a paperless system, and to operate simplified, harmonized, efficient, and transparent customs rules and procedures throughout the region.

In addition, in MAPA, members agreed to reduce the cost of compliance with diverse standards and technical regulations imposed by 18 APEC economies. Standards are necessary to safeguard consumer health and safety and to protect the environment. Nonetheless, these diverse standards and technical regulations along with the corresponding testing procedures for compliance can effectively limit market access by preventing economies of scale, raising production and/or testing costs and increasing the possibility of products being rejected at the customs border of the importing economy. Trade facilitation may also include the measures to facilitate the mobility of business people, and those related to rules of origin.

There was further progress in the area of the trade facilitation in the APEC process in 1997. In the Trade Ministers Meeting in Montreal in May, members reaffirmed the importance of trade and investment facilitation to lowering the costs of doing business and agreed to intensify efforts in priority areas in 1997, including simplification of customs procedures, effective implementation of intellectual property rights commitments, harmonization of customs valuation, facilitation of comprehensive trade in services, and enhancing the environment for investments. The Subcommittee on Customs Procedures has drafted a work plan, to which members have committed their close cooperation.

---

<sup>10</sup> For a fuller description of these measures, see MAPA Highlights (APEC, 1996).

### *Deregulation and Other Actions*

MAPA contains measures in a wide variety of areas other than tariffs, NTMs, services trade liberalization, and the trade facilitation measures described above. These areas include government procurement, intellectual property rights, dispute mediation and competition policy. In particular, MAPA addresses the need to:<sup>11</sup>

- create greater transparency in government procurement;
- build effective intellectual property rights regimes, and to agree on adopting the principles of border control in the WTO TRIPs Agreement by 2000;
- promote effective dispute mediation mechanisms for disputes between firms and those between firms and governments;
- identify the best practices in regulatory reform and establish cooperation arrangements on competition policy; and
- build an open and efficient infrastructure sector through the development of principles and best practices, and expand cooperation between the public and private sectors.

---

<sup>11</sup> See MAPA Highlights (APEC, 1996).

## Chapter 2

# THEORETICAL FRAMEWORKS AND QUALITATIVE ASSESSMENTS

The common analytical framework underpinning empirical studies using CGE models is classical trade theory. In this chapter, this theoretical framework is first introduced to provide a clear background to the CGE methodology. The economic gains of trade liberalization and facilitation are discussed, and some of the recent developments in model expansion are introduced. The possible economic effects of actions other than trade liberalization and facilitation measures are analyzed quantitatively. These include deregulation and competition policies, intellectual property rights, and dispute mediation, etc.

### THEORETICAL AND ANALYTICAL FRAMEWORK

Trade theory suggests that trade liberalization and facilitation actions will stimulate international trade, investment, and production; that improving market access will result in the more efficient use of resources; and that world income, as well as world trade, will be larger than it would have been without the liberalization and facilitation.

#### *Trade Theory Framework*

Comparative advantage -- associated with the work of Ricardo and Heckscher-Ohlin -- explains the causes of trade and the gains from trade on the basis of the relative differences between economies in factor endowments. By specializing in products that suit local conditions, and trading these for other goods that are produced comparatively greater efficiency in other economies, each economy will have a higher real income than in the absence of trade. This is the basic motivation behind trade and an explanation for the broad pattern of trade in the world economy.

In the framework, tariffs and non-tariff measures are considered to be distortions in the markets that impede trade and cause trade and welfare losses to the economies. Trade liberalization and facilitation measures are therefore understood as the removal and/or reduction of economic distortions. Such measures reduce import barriers, which lowers import prices to the domestic market and increases imports. Cheaper imports, in turn, lead to lower production costs for other domestic industries. Relocation of labor and capital to other, more efficient sectors concurrently takes place from the formerly protected sectors. The improved competitiveness of the export goods industries increases the exports of the economy. If it is assumed that trade accounts tend to be balanced in the long run, which is the standard assumption in the theoretical framework, the exports of the economy will increase until balanced trade is eventually recovered.

#### *Imperfect Substitution and the Armington Approach*

The basic framework, however, does not explain the full complexity of observed trade patterns, such as intra-industry trade. To capture these complexities, recourse is necessary to other theories developed in the field of the economics of industrial organization.<sup>12</sup> In fact, in the Asia-Pacific region, intra-industry trade, or two-way trade in the same product category, represents a

---

<sup>12</sup> The principal reference on this topic is Elhanan Helpman and Paul Krugman, "Market Structure and Foreign Trade"(1985).

substantial share of total trade. Intra-industry trade involves both final consumption goods and intermediate and capital goods. An approach to this phenomenon is to introduce imperfect substitution among the goods in the same category. Researchers often adopt the “Armington” structure which assumes that products within the same product category but originating in different economies are imperfect substitutes.<sup>13</sup> For example, automobiles produced in one economy are treated differently from the automobiles produced in another economy. This expansion of the framework, compared to the case of perfect substitution, will dampen the effect of the response of buyers to changes in the relative prices of competing goods from different economies. The Armington assumption is consistent with perfect competition.

### ***Scale Economies and Imperfect Competition***

Other than imperfect substitution, experts in CGE modeling have tried to incorporate various features into the standard model to make it more realistic. One of the recent endeavors is the introduction of scale economies and imperfect competition. Scale economies provide a basis for trade other than comparative advantage. If economies specialize in different products and trade with each other, they can exploit economies of scale in production. There are two types of scale economies: the industry-wide, “external” type related to the aggregate output level of the industry, and the firm-specific, “internal” one related to individual firms’ output levels.<sup>14</sup>

A famous example of the first type is the computer industry in Silicon Valley. This type of scale economy is compatible with the assumption of perfect competition. It has been reported that this specification enlarges the real income effect of trade liberalization by 20 to 30 percent when empirically estimated scale parameters are used.

The second type is usually combined with the assumption of monopolistic competition and has drawn more attention from researchers recently. Under the framework, preferences are much less sensitive to geographic location of the production than are the Armington models, and therefore demand is more sensitive to changes in relative prices between different products in the same product category. As a result, models with scale economies and imperfect competition tend to yield stronger trade effects following trade liberalization. In spite of various merits of the expanded framework, the specification of perfect competition was adopted in the present study, mainly because of the instability of the results of model simulation with imperfect competition.

### ***Non-Tariff and Trade Facilitation Measures***

While MAPA includes few concrete items, a salient feature of the UR commitments is the reduction of non-tariff measures. In line with the standard analyses of these kind of measures, an effort has been made to calculate “tariff equivalents” to the trade impediments. The reduction of non-tariff measures can then be treated as equivalent to the reduction of hypothetical tariffs. The liberalization measures, therefore, will stimulate imports, and provide income and welfare gains.

Trade facilitation, on the other hand, mainly aims to reduce trade costs. Intuitively, the implementation of cost-reducing measures is similar to a downward shift in the supply schedule of imports. In turn, this effect can be captured in a model through an equivalent improvement in productivity of the international transportation sector. The effects, therefore, are larger than those

---

<sup>13</sup> Paul S. Armington, “A Theory of Demand for Products Distinguished by Place of Production,” *International Monetary Fund Staff Papers* vol. 16, No.1, 1969, pp. 159-178 .

<sup>14</sup> Joseph Francois, Bradley McDonald and Hakan Nordstrom, ”A User’s Guide to Uruguay Round Assessments,” *Staff Working Paper RD-96-003*, World Trade Organization (1996).

of simple tariff reduction by the amount of productivity gain in the sector.<sup>15</sup>

### ***Investment Liberalization***

Some recent studies have tried to incorporate the liberalization of direct investment into CGE models. While the modeling work is in the development stage, the CGE model could be used to estimate the impact of a very wide range of trade and investment policies if this endeavor is successful. Had it been possible to include investment in the model, the effects of investment liberalization measures would lead to increased efficiency and have positive income effects.<sup>16</sup> It is, however, not very clear whether the investment liberalization would lead to positive trade effects, because direct investment may substitute for existing trade flows.<sup>17</sup> Unfortunately, this project could not incorporate direct investment into the model because of data constraints. However, it would be desirable to incorporate investment effects in future studies of this nature, to the extent possible.<sup>18</sup>

### ***Dynamic Effects of Trade Liberalization***

The theoretical framework above covers only a part of the possible gains from trade liberalization associated with the efficiency improvements from the reduction of distortions. Many possible dynamic effects that would go well beyond these gains are not, however, taken into account. Recent applied research on trade liberalization has stressed the importance of dynamic scale economies and the pro-competitive effects of trade liberalization, especially in the context of regional trade arrangements.

Trade liberalization and integration of markets dynamically enhances competition, promotes a more rational international specialization of production, and enhances the international transmission of innovation and knowledge. Expanded markets can also mean expanded returns to, and hence incentives for, innovation. Moreover, trade liberalization can create a healthier environment for savings and investment. These effects can, in turn, have important medium-run and long-run implications for the process of economic development and growth.<sup>19</sup> A number of empirical works have identified significant trade/growth relations in various contexts.

This study builds in an income-investment linkage to capture some of the dynamic effects of trade liberalization. Initially, the economy is assumed to be on a steady-state path where investment and savings equal capital depreciation. The increase in income caused from trade liberalization measures stimulates savings and investment. The increase in investment, in turn, contributes to the accumulation of capital stock, and causes a further increase in income through more capital

---

15 Another approach is possible to assess trade facilitation. Some facilitation measures would directly address trade impediments that are “quasi-tariff.” The facilitation measures, in this case, are equivalent to simply reducing the tariff equivalents and involve no productivity gains. See Kazutomo Abe, “Economic Effects of Selected Trade Facilitation Measures in APEC Manila Action Plan” (1997), submitted to the Expert Seminar on the Impact of APEC Trade Liberalization, Tokyo, March 1997.

16 Peter A. Petri, “Foreign Direct Investment in a Computable General Equilibrium Framework” (1997), Conference paper, Making APEC Work: Economic Challenge and Policy Alternatives.

17 Michihiro Oyama, “A Direct Investment and International Trade”, (1997)

18 The project “The Impact of Investment Liberalization in APEC,” APEC Economic Committee (1997), draws on case studies of the effects of investment liberalization in several member economies.

19 1995 APEC Economic Outlook, illustrating the deepening of interdependence in the region, listed the possible routes from trade liberalization to growth. Deepening interdependence strengthens growth by: (i) providing a strong incentive to mobilize inputs and to improve their quality; (ii) expanding potential markets by allowing the attainment of economies of scale, enabling goods to be made at lower costs; (iii) providing an incentive to increase the efficiency of management through the increased pressure of competition; and (iv) providing an incentive to enhance technological innovation.

inputs.<sup>20</sup> In the new equilibrium, the economy is on another steady-state path with a larger capital stock. This expansion of the model magnifies the static impact on income and trade volume, although it must be stressed that this method reflects only part of the dynamic effects indicated above that can be expected over the medium term

### ***Adjustment Costs***

Reflecting the fact that the model simulations provide a comparison between two steady states, the discussion above tends to ignore the existence of adjustment costs. Reallocating resources to more productive uses, however, usually involves temporary adjustment costs. For example, trade liberalization will affect domestic protected sectors, displacing some workers.<sup>21</sup> Governments can play a crucial role in reducing the costs of job transition required by the shift of production. One key ingredient is education. Workers with higher level of education are usually better able to make the transition from one job to another. The public sector can also play a direct role in facilitating job transition, including provision of a job training system. A final role of the public sector is providing temporary unemployment insurance as a safety net.

Concern is also sometimes expressed that trade liberalization will increase imports in the short run and aggravate the trade balance of the liberalizing economy. Trade liberalization, by promoting a reallocation of resources within an economy promotes two-way trade and does not have any *a priori* implications for the trade balance, even in the short run. However, to the extent that trade balance positions might widen rather than narrow in the first instance in particular cases, any such impacts would not be permanent but would tend to be reversed as various adjustment mechanisms come into play. Protection distorts resource allocation, causing a loss that takes place continuously and indefinitely; macroeconomic policies, which would not distort markets, are thus a better alternative for pursuing external balance.<sup>22</sup>

## **QUALITATIVE ANALYSIS OF THE EFFECTS OF OTHER ACTIONS**

### ***Deregulation and Competition Policies***

Deregulation, or regulatory reform, has become an important component of economic policy in both developed and developing economies and is likely to play an increasingly important role in the further economic integration of the APEC region. Competition policies serve the same ultimate objectives as regulatory reforms and are an important complement to regulatory reforms to ensure that competitive conditions prevail in an industry following implementation of reforms. In the international dimension, deregulation and competition policies help ensure that the gains of trade liberalization are fully realized. In this sense, deregulation and competition policies are important complements to the trade liberalization process.

---

20 Joseph Francois, Bradley J. McDonald and Haken Nordstrom (1996), "Liberalization and Capital Accumulation in the GTAP Model," and Joseph Francois *et. al.*, "A User's Guide to Uruguay Round Assessments."

21 These short-run costs, however, do not provide a convincing justification for maintaining trade barriers. In almost all cases, such protection merely shifts resources between sectors, while reducing overall efficiency. Protecting specific sectors inevitably distorts market signals and imposes higher costs on other domestic industries and domestic consumers. For a fuller discussion, see APEC Economic Committee, "1996 APEC Economic Outlook" (1996), section 2.4 and a box article in the section. The section also discusses the possible environmental impacts of trade liberalization.

22 For example, see Barry J. Eichengreen, "Dynamic Mode of Tariffs and Employment under Flexible Exchange Rates," *Journal of International Economics*, vol.11, 1981, pp. 341-359.

One OECD study lists five ways in which inefficiency arises from inappropriate regulations.<sup>23</sup> First, firms have less incentive to economize on resources. This can take the form of over-investment in capital or employing excess labor. Second, lack of competition can bring excess rents to inefficient sectors, implying that profits and wages are higher than they would be under competitive conditions. Third, regulations on service and product type can prevent firms from taking advantage of economies of scale, and especially scope, in networking. Fourth, regulations can impose high administrative costs on governments, firms, and consumers. Finally, there is increasing evidence against the view that firms enjoying significant market power plough back excess profits into higher rates of R&D and innovation

The OECD study estimates that the recommended regulatory reforms, by addressing all these inefficiencies, could increase GDP by one to six percent in selected OECD industrialized economies, including APEC members Japan and the United States. These output gains derive from an increase in productivity, which directly increases an economy's potential output and indirectly stimulates capital accumulation as well as international trade and investment. Trade and investment liberalization and deregulation/competition policies can thus serve as two major pillars of economic policy to improve efficiency, incomes and living standards.<sup>24</sup>

By and large, the model employed here could not capture the effects of regulatory reform in MAPA. Therefore in this way too the model probably underestimates the impact of APEC's reform commitments. Recalling the discussion of the modeling of trade facilitation measures, regulatory reforms in the sectors related to international trade which directly address business costs for exports and imports could be captured in much the same way as were the trade facilitation effects. However, this would be only a small portion of the overall impacts on economic growth of regulatory reforms.

### ***Increasing Transparency and Reducing Risk***

Many of the policy measures in MAPA aim to increase transparency and reduce risk in economic activities. Such items include government procurement, intellectual property rights and dispute mediation. Ensuring transparency in government procurement should increase market opportunities for both domestic and foreign suppliers. Protection of intellectual property rights is crucial to enable firms to recover their investment in research and development, and thus to encourage them to invest and to share technology through licensing and other arrangements. Meanwhile, an effective and transparent system of dispute mediation is part of the foundation of an environment conducive to business. While both of these are thus important areas of MAPA, measures relating to them also could not be captured by the quantitative methodology employed here.

---

<sup>23</sup> OECD, "The Economy-wide Effects of Regulatory Reform," (1996).

<sup>24</sup> "The Impact of Investment Liberalization in APEC", APEC Economic Committee (1997), provides case studies which show that investment liberalization contributed to the improvement of economic efficiency.

## Chapter 3

# QUANTITATIVE ASSESSMENT OF THE IMPACT OF TRADE LIBERALIZATION AND FACILITATION

Many empirical studies have been conducted on the impact of trade liberalization.<sup>25</sup> While most have studied the impact of the Uruguay Round, recent studies have focused on the effects of regional trade arrangements and a few have examined APEC trade liberalization.<sup>26</sup>

The computable general equilibrium (CGE) model is a handy instrument for assessing the impact of trade liberalization and is widely used in these studies. In this chapter, the model structure is first introduced. Some details are explained about administering shocks to the model from the liberalization measures. Tariff reductions are the major shocks. Simulation results are then presented. Emphasis is placed on the economic interpretation of the result. Model robustness is checked by the sensitivity analysis in this section and in Appendix 3.

### MODEL STRUCTURE

#### *The CGE Model*

The CGE model<sup>27</sup> in essence is an application of neoclassical theory and, in its international trade dimension, of classical trade theory. A CGE model consists of equations that represent demand and supply conditions of the sectors of the economies. The sectors are explicitly linked together in value-added chains from primary goods, through higher stages of processing, to the final assembly of consumption goods for households and governments.

The sectors in the model are linked through various economy-wide constraints. For example, because firms in different sectors compete for a limited supply of labor, capital and land, an expansion in one sector will be accompanied by a contraction in another sector, except when the expansion is the result of resource accumulation or technological improvements that economize on the use of resources. Reflecting the nature of the classical framework, competition and resource allocation are adjusted through the flexible movement of prices. Unemployment rates are assumed to be constant, as the model reflects the changes between two equilibrium states in each of which the unemployment rate would be at its “natural” level.

Because the main interest of the project is in international trade, the CGE model used here includes multiple economies and allows for linkage between economies. While a change in one part of the world economy, in principle, has repercussions throughout the world economy, the effects normally are greatest in the sector and economy where policy change or shocks are initiated. The effects then spread through linkages to adjacent sectors at home and into the markets of trading partners.

#### *GTAP Structure and Model Enhancement*

---

<sup>25</sup> Joseph Francois *et. al.*, “A User’s Guide to Uruguay Round Assessments.”

<sup>26</sup> Philippa Dee, Chris Geisler and Greg Watts, “The Impact of APEC’s Free Trade Commitment,” *Staff Information Paper*, Australian Industry Commission (1996).

<sup>27</sup> The explanation in this sub-section benefits from General Agreement on Tariffs and Trade, “The Results of the Uruguay Round of Multilateral Trade Negotiations” (1994).

The GTAP model used for this project provides model equations as well as a complete data set.<sup>28</sup> Standard and classical assumptions are adopted, except that the modelers have tried to incorporate recent developments in trade theory into the model structure. Model parameters are empirically estimated, and various economic variables, such as income, employment, and trade, are taken from authorized sources. In this project, data on regions and sectors are aggregated, and the actual simulation model consists of 14 sectors and 19 regions. All APEC economies, except for Brunei and Papua New Guinea, are individually disaggregated (see Appendix 2 for details on the GTAP model).<sup>29</sup> The data set incorporates a minor modification of the base data set for Hong Kong, China.<sup>30</sup>

After several simulation trials, the specification adopted as the standard version assumed perfect competition and constant returns to scale technologies, and incorporated a medium-term income-savings-investment linkage to capture dynamic effects.<sup>31</sup>

Constant returns to scale and perfect competition were assumed in order to retain model stability. Efforts were made to enhance the model structure to address the scale economies and imperfect competition. Two approaches were tested to incorporate the increasing returns to scale: one with industry-wide national scale economies, and the other with firm-specific scale economies. However, no stable result could be obtained, especially when the impacts on individual sectors of individual economies were examined. This result is perhaps due to the high regional and sectoral disaggregation of the model, i.e. 19 regions in 14 sectors.

Meanwhile, the dynamic specification was selected as the standard because it is likely to be closer to reality; however, the simulation results of a static specification are also shown as a basis for comparison. As indicated above, estimated impacts under the dynamic version tend to be larger than those of the static version.

The GTAP by default adopts the framework of product differentiation by region of origin.<sup>32</sup> In this framework, each bilateral trade flow can be subject to a unique tariff rate. This Armington assumption considerably facilitates the model manipulations while incorporating product differentiation and keeping the perfect competition assumption. GTAP uses the Armington elasticities, which are empirically estimated. While some studies use different values of the elasticities, the original values are used here to maintain comparability. The larger the Armington elasticities, the larger the effects of the trade liberalization. Estimates with other values of the elasticities are presented in Appendix 3 for a sensitivity analysis.

The GTAP model has two options that allow researchers to select whether or not investment can be globally allocated across the regions. Under one option, investment may move across regions to equalize the rates of return on capital across the regions. In this case the trade balances of the economies become endogenous. Under the other option, where investment is assumed to stay

---

28 GTAP database Version 3.0, which consists of 37 goods and services in 30 regions.

29 Those economies could not be individually disaggregated because of data constraints.

30 The original dataset of Hong Kong, China includes a negative savings rate that perhaps reflects an underestimate of re-exports or investment and overestimate of consumption. Based on the actual figures in 1992, some of the government consumption has been moved to investment, which amounts to 33 percent of GDP, as the minimum amendment.

31 Under the dynamic effect, the initial increase in income from trade liberalization stimulates savings and investment, allowing capital accumulation. At the new equilibrium, the economies stay on the steady-state path where investment equals depreciation

32 Armington introduced the expanded framework of international trade, incorporating the differentiation of traded goods. Armington, "A Theory of Demand for Products Distinguished by Place of Production."

within its own region, investment is determined such that the regional composition of capital stocks does not change, i.e., the regional and global net investment move together. In this case, the trade balance is exogenously fixed to maintain the investment-savings balance. While the model specification with the cross-border allocation of investment tends to yield different estimates of the gains to individual economies, the global gain as a whole would be similar to the specification without cross-border allocation of investment.<sup>33</sup> The model with the investment allocation yielded somewhat unstable results; accordingly, this study adopted the model specification without cross-border allocation of investment.

## QUANTIFICATION OF MAPA MEASURES

### *Methodology*

The measures that economies implement under MAPA are the shocks to be applied to the model. Generally, a model simulation requires a pair of inputs: the baseline data and the controlled data reflecting the impacts of the shocks. Each data set is fed to a model and, based on each input, the model feeds back an output, for example income, exports, and production. The final result, i.e. the impact of the shocks, is obtained by taking the differences between the two hypothetical model outputs.

In the case of APEC trade liberalization, the exogenous shocks to the model are the changes in the protection levels, calculated from the tariff lines on a sector-by-sector basis. While this project is aimed at evaluating the net economic impact of MAPA, the UR commitments are concurrently implemented during the period 1996-2005. If implemented in parallel, the effects of the UR commitments and the measures in MAPA that are “beyond” the UR commitments (i.e., the “UR-plus” measures) are brought out.

Three input data sets are therefore calculated: (i) the baseline data set which assumes neither the UR commitments nor the “UR plus” measures of MAPA; (ii) the first controlled data set, reflecting the UR commitments only; and (iii) the second controlled data set, reflecting both the UR and the “UR plus” measures of MAPA. The MAPA measures in this paragraph include those in IAPs, CAPs, Osaka Initial Actions, and the Information Technology Agreement (ITA). The GTAP database conveniently contains ready-made data sets for the baseline and the first controlled set. The simulation in this project used the ready-made data set after some updates and revisions to correct errors.

The following additional guidelines are adopted for the construction of model inputs;

- i ) tariff rates of the sectors are calculated from each bilateral tariff line by means of aggregation of bilateral import weights in 1992;
- ii ) tariff data are calculated at two reference points, the years 2000 and 2010. At each point, the baseline data set and the controlled data sets are calculated;
- iii ) tariff reductions reflecting the ITA are included in the “UR plus” measures, as long as the economies committed to join the agreements at the WTO Singapore Ministerial Conference in December 1996 or later. All tariff rates of information technology products in ITA-participating economies are to be reduced to zero in accordance with the agreement; and
- iv ) despite the Bogor Declaration, tariff rates of the industrialized economies are not set at zero in 2010, unless their own IAPs clearly specified so.

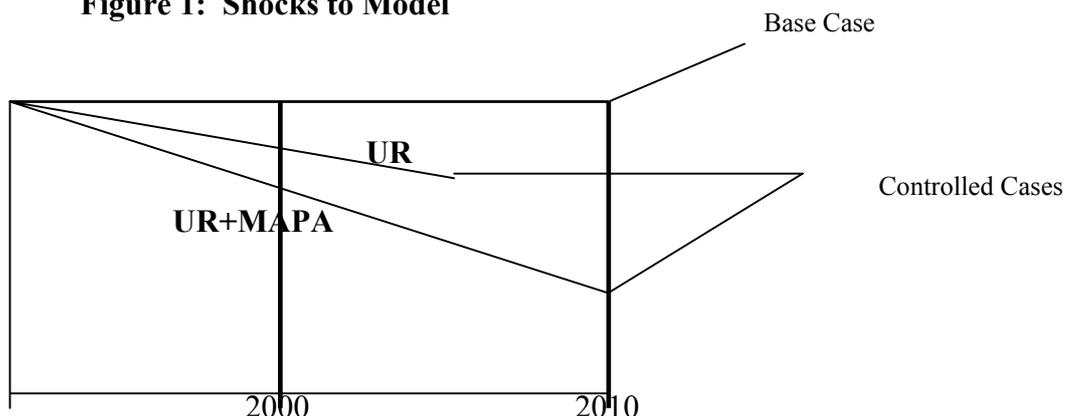
Figure 1 illustrates schematically the protection data calculations, and Table 2 summarizes the

---

<sup>33</sup> This reflects the fact that this version of the GTAP model only allows the reallocation of the amount of the world investment to the regions.

quantification according to the guidelines.

**Figure 1: Shocks to Model**



***Issues for the Calculations***

The guidelines above raise several technical issues. Regarding the first, there are several alternatives for the weights used to calculate average tariff rates. The GTAP database uses bilateral import weights, which this project adopted mainly because of the availability of the data and to maintain consistency with the model calibration. Regarding the second guideline, the reference years 2000 and 2010 are selected as those specified in the MAPA. For the third guideline, the IAPs of some economies do not clearly commit them to the ITA, but if they committed to joining it at the WTO conference at Singapore, the commitments have been included in the inputs.

Some of the descriptions in IAPs do not contain sufficient information to obtain precise figures. Owing to the lack of a standard format in the initial IAPs, their contents are not strictly comparable to each other. While some member economies did provide additional, detailed information, it was often necessary to make working assumptions and estimates to fill information gaps.

**Table 2: Major IAP “UR Plus” Tariff Reductions**

<b>Economy</b>	<b>Tariff Reduction: Items</b>	<b>2000</b>	<b>2010</b>
Australia	<ul style="list-style-type: none"> <li>max. 5% except for below: passenger motor vehicles textile clothing and footwear certain vegetables</li> <li>ITA<sup>1</sup></li> </ul>	current rates (0 - 5%) 15 % 10-25 % 5 %(1998) 0 %	-- -- -- -- 0 %
Brunei Darussalam	<ul style="list-style-type: none"> <li>progressive liberalization towards zero tariff to 2020</li> </ul>	80% of total tariff lines bound at 8%	2% of total tariff lines bound at 5%
Canada	<ul style="list-style-type: none"> <li>manufacturing inputs (MFN tariff rates)</li> <li>all original equipment automotive parts and articles</li> <li>reduction in GPT rates</li> <li>ITA<sup>1</sup></li> </ul>	? % for 714 items in 1999 0 % (on 1996)  ? 0% 0 %	? % for 64 items in 2004  0 %  ? % 0 %
Chile	<ul style="list-style-type: none"> <li>almost all products</li> </ul>	8%	0%
China	<ul style="list-style-type: none"> <li>simple average tariff</li> </ul>	around 15%	further reduction
Hong Kong, China	<ul style="list-style-type: none"> <li>bind tariff at 0% on all imports</li> <li>ITA<sup>1</sup></li> </ul>	about 55% of imports are bound at 0% 0 %	0 %  0 %
Indonesia	<ul style="list-style-type: none"> <li>items with surcharges and tariffs of 20 % or less in 1995 (except automotive parts)</li> <li>items with surcharges and tariffs of more than 20% in 1995 (except automotive parts)</li> <li>chemicals and metal products</li> <li>ITA<sup>1</sup></li> </ul>	max. 5% by 2000  0 - 20% in 1998  -- --	max. 5 % by 2003  max. 10 % by 2003  max. 10 % by 2003 0 % by 2005
Japan	<ul style="list-style-type: none"> <li>expand Tariff Elimination Initiative on pharmaceuticals by 2000</li> <li>ITA</li> </ul>	--  0%	--  0%
Korea	<ul style="list-style-type: none"> <li>ships from 1997</li> <li>ITA<sup>1</sup></li> </ul>	0% (from 1997) --	0 % 0 % by 2004
Malaysia	<ul style="list-style-type: none"> <li>ITA<sup>1</sup></li> </ul>	--	0% by 2005
Mexico	<ul style="list-style-type: none"> <li>elimination of tariffs on certain electronic components, and computers equipment</li> </ul>	--	--
New Zealand	<ul style="list-style-type: none"> <li>all imports</li> <li>pharmaceutical products</li> <li>ITA<sup>1</sup></li> </ul>	appx. 3% simple average tariff 0 % (from July 1997) 0%	duty free  0% 0%
Papua New Guinea	<ul style="list-style-type: none"> <li>reduce to 5% tariff on basic steel, aluminum, capital equipment, machinery, basic chemicals. Chemical agricultural inputs by 1997</li> </ul>	--	By 2006 bound at 30% for nonagricultural products
Philippines	<ul style="list-style-type: none"> <li>all imports, except sensitive agricultural products</li> </ul>	7.81% simple average applied tariff except sensitive agricultural products	uniform rate of 5%, except sensitive agricultural products by 2004
Singapore	<ul style="list-style-type: none"> <li>progressive binding of tariffs at 0% by 2010</li> <li>ITA<sup>1</sup></li> </ul>	--  0%	0 %  0%
Chinese Taipei	<ul style="list-style-type: none"> <li>average tariffs</li> <li>ITA<sup>1</sup></li> </ul>	around 7.9% average nominal tariff rates and applied rate of 5% or lower on about 50% of tariff lines --	around 6% average nominal tariff rates and applied rate of 5% or lower on about 65% of tariff lines 0 % by 2002
Thailand	<ul style="list-style-type: none"> <li>ITA<sup>1</sup></li> </ul>	--	0% by 2005
USA	<ul style="list-style-type: none"> <li>ITA</li> </ul>	0%	0 %

1. Not included in IAP. Committed at the 1996 WTO Ministerial Conference or thereafter.

## *APEC Trade Facilitation*

Table 3 summarizes the limited references on empirical estimates of the impact of trade facilitation: the Cecchini Study on intra-EC trade facilitation; the UNCTAD study; and a study by the Australian Industry Commission (IC95).

The Cecchini study identified potential gains of about 1.6-1.7 percent of total intra-EC trade value for administrative costs to firms, which is a direct cost saving.<sup>34</sup> This is smaller than those in the UNCTAD study, since it covers more narrowly defined trade facilitation measures that address direct costs reduction.<sup>35</sup> But if lost business opportunities are taken into account, the cost savings would be approximately 5 percent of the total import)

The UNCTAD report noted that the costs of trade transactions are 7-10 percent of total trade value<sup>36</sup>. The report states that, once the recommendations by UNCTAD are fulfilled, “achieving total annual savings equivalent to quarter of the total value of procedures is a realistic objective that we shall strive to reach by the turn of the century.” This could represent close to US\$100 billion per year, i.e. 2-3 percent of total import value. The UNCTAD recommendations are largely comparable to undertakings in the OAA, which influenced MAPA.

The Australian Industry Commission made an extensive analysis of APEC trade facilitation, as well as trade liberalization.<sup>37</sup> This study adopted 5 percent and 10 percent reductions of total trade value for the impact of the facilitation measures in the OAA. The figures are empirically based on a series of research papers of UNCTAD<sup>38</sup> and the Cecchini Report.<sup>39</sup> The IC95 report adopted a five percent cost reduction for the completion of Bogor Declaration, since it covered some actions on facilitation of investment flows.

---

34 Paolo Cecchini *et.al.* “The European Challenge 1992” (1988), pp. 8-15.

35 One estimate suggests that the total cost of rules of origin is in the range of 3 to 5 percent of the value of the traded products. The costs consist of administrative costs and efficiency losses to industry, which significantly overlap the direct administrative costs of customs procedures. While this adopts a rather different approach, it would support our estimate of the direct costs. See the discussion in Sherry M. Stephenson, “The Economic Impact of Rules of Origin in the Asia-Pacific Region,” *Paper submitted to PECC Trade Policy Forum IX in Seoul, Korea* (1996).

36 UNCTAD, “Columbus Ministerial Declaration on Trade Efficiency,” Preamble.

37 Dee *et al.*, “The Impact of APEC’s Free Trade Commitment,” Industry Commission of Australia.

38 UNCTAD, “Columbus Ministerial Declaration on Trade Efficiency,” (1994).

39 The Committee of European Communities conducted extensive studies on the EC market integration, including Paolo Cecchini with Michael Catinat and Alexis Jacquemin, “The European Challenge 1992” (1988); and “The Economics of 1992,” *European Economy*, No.35, March 1988.

**Table 3: Reference Summary of Cost Savings from Trade Facilitation**

Source	Scope	Impact	Note
Commission of the European Communities "Cecchini Report" and other related studies (1988)	Intra-EC Trade Customs Procedures  Removing barriers affecting overall production (protective public procurement, divergent technical standards and other restrictions)	1.6-1.7% of total intra-EC trade value for administrative costs to firms. (approximately 5% if lost business opportunities are included.)  2.0-2.4% of GDP in the area	Surveyed by extensive interviews of firms in the area.  Assessed by welfare gain approach
UNCTAD "Columbus Ministerial Declaration on Trade Efficiency" (1994)	Trade Efficiency Measures: · Banking and Insurance · Customs · Business Information · Transport · Telecommunication	Costs of trade transactions are 7-10% of the total trade value.  Trade efficiency measures would result in the reduction of the costs above by 25% or by up to US\$100 billion annually by 2000. This means cost saving of 2-3% of prices of arrived goods.	Recommended measures are largely comparable to Osaka Action Agenda.
Australia Industry Commission "The Impact of APEC's Free Trade Commitment" (IC95) (1995)	Facilitation measures in the Osaka Action Agenda · Direct cost savings from administration and delays associated with customs controls and some limited action on facilitation · Direct cost savings from above plus a more extensive set of facilitation measures.	5% of total trade value  10% of total trade value	The figures are used for inputs of CGE model.

Based on the above, it appears that the range of two to three percent of total import value is a consensus of the potential direct cost savings from various trade facilitation measures. This project uses one percent of import prices for the direct cost savings from trade facilitation for the newly industrializing economies of Korea, Chinese Taipei and Singapore, and two percent for the other developing economies. These estimates are on the conservative side, in the range of about half the consensus estimates. This conservative approach is prudent when the wide variety of APEC members is taken into account.

### ***MAPA Non-tariff and Other Measures***

Evaluating non-tariff measures is a daunting task. MAPA measures include the reduction of NTMs related to quotas and other quantitative restrictions, export controls, and licensing. As most of the products covered under the measures appear to be nonagricultural products, newly constructed protection data sets would be required to make quantitatively assessments of the effect of the measures. Under the present stage of the development of the database, it was impossible for the project teams to construct such a database, and the project could not accommodate a simulation of the effects. In this way, too, the study probably underestimates the impacts of full implementation of MAPA.

## SIMULATION AND ESTIMATED IMPACTS

The CGE model simulations measure the likely trade and real income effects from implementation of MAPA. The trade effects represent the changes in the volume of merchandise exports and/or imports. The real income effects mean that the liberalization creates larger incomes than would occur without the liberalization. The income gain may be alternatively referred to as “production gain” or “welfare gain.” This effect is presented in real terms. In this study, the term “income gain” will be used because it is the most frequently used.

### *Nature of the Estimates of the Simulation*

It is a usual reservation that the estimates derived from the simulation are not forecasts per se. The income gains and trade increases should be considered to mean that the variables will be higher than they otherwise would have been if the liberalization had not taken place. The IC95 report well describes the situation, as follows:

The liberalization and facilitation measures will be phased in over time, and it will also take time for each APEC economy to adjust to the changes. During this phasing and adjustment period, a myriad of other changes will also affect each economy. These other changes are not taken into account in the current analysis. The model results should be seen as providing an indication, at some future time after all the phasing and adjustment has taken place, of how large the difference would be, compared with the alternative situation at the same point in time, had the liberalization not taken place.<sup>40</sup>

The estimates are intended to indicate the rough order of magnitude of the trade and income gains that can be expected from trade liberalization and facilitation. As has been noted, the estimates may ignore important parts of MAPA and UR packages.<sup>41</sup> Many dynamic effects are simply ignored. In addition, by the year 2010, the economic structure of the world is likely to have changed considerably from that of the 1992 benchmark economy on which the estimates for 2010 are based. For example, China has recently grown faster than other APEC economies and its share of total APEC GDP has increased. As the income and trade effects involving China are large in percentage terms, the APEC-wide impact would have been larger if 1996 had been taken as the base year.<sup>42</sup> Furthermore, APEC action plans, including MAPA, are “moving targets” that will be improved, revised, and updated every year. Additional measures may come forward every year.

As with other CGE studies, the estimates are quite sensitive to the underlying assumptions and specifications. This also underscores the reservation that the estimates indicate a rough order of magnitude. This report also includes a sensitivity analysis in the next section and Appendix 3 to avoid quoting a single number for the estimate.

---

40 Dee *et al.*, “The Impact of APEC’s Free Trade Commitment,” pp. 4-5.

41 GATT, “The Results of the Uruguay Round of Multilateral Trade Negotiations.”

42 See Economic Research Institute, Economic Planning Agency, Japan, “The Future of China and the Economy of Asia Pacific Region” (1997) for the impact of trade liberalization in China based on the year 2000.

### *Simulation Assumptions*

The model estimates the effects of trade measures, mainly tariff reduction and trade facilitation, in MAPA. Two controlled cases in 2000 and 2010 are simulated against the baseline in the respective years: (i) full implementation of UR measures; and (ii) UR plus MAPA.<sup>43</sup> The net effect of MAPA is theoretically obtained by subtracting the former from the latter. However, the following issues arise in presenting the net effects of MAPA:

- The contributions of members that already have low tariffs under the UR tend to be ignored in the net effects of MAPA; and
- The contributions of the members that were not contracting parties of the GATT would be exaggerated in the MAPA estimates.

### *Trade Effects*

Table 4 summarizes the estimated trade effects in 2010. Since the specification with cross-border allocation of investment is not adopted, the trade balance of each economy remains constant. The rates of changes in the volume of merchandise exports approximate the magnitude of the trade effects. The simulation indicates that the UR commitments will increase the volume of merchandise exports of APEC economies and the world by about 9.1 percent and 7.3 percent, respectively. If MAPA commitments are also implemented, the figures will be about 12.1 percent and 9.1 percent. Therefore, the net effects of MAPA on the exports from APEC and the world would be approximately 3.0 percentage points and 1.8 percentage points, respectively. MAPA will increase the UR trade effects by approximately one-third in APEC.

The estimate of the trade effect of the UR on world exports, about a 9 percent increase, while generally consistent with those of other studies, is nonetheless on the modest side because: (i) the model assumes perfect competition, and (ii) the base case of our simulation assumes the protection level in 1996, which is later than other studies, so some of the UR commitments would have already been implemented.<sup>44</sup> The estimates are therefore considered to be within the range of the plausible figures for the trade effects of MAPA. It is likely that the estimated impacts of MAPA would be larger if the specification of imperfect/monopolistic competition could be adopted.

---

<sup>43</sup> As indicated above, “UR plus MAPA” means the tariff reduction in MAPA, the trade facilitation in MAPA, and ITA commitments, in addition to the UR commitments.

<sup>44</sup> The GATT studies reported that the trade effects of the UR commitments fall in the range of 6-24 percent, depending on the specifications. If the cases assuming monopolistic competition are excluded, the range is 6-10 percent.

**Table 4: Trade Effects of MAPA –  
Estimated Change in Merchandise Export Volume in 2010  
(Percent)**

**(1) Impact on APEC**

Initiatives	Dynamic Version	(Memorandum) Static Version
UR Commitments	9.1	8.6
MAPA Total	3.0	2.1
(MAPA Liberalization)	(1.1)	(0.9)
(MAPA Facilitation)	(1.9)	(1.3)
UR and MAPA	12.1	10.7

**(1) Impact on the World**

Initiatives	Dynamic Version	(Memorandum) Static Version
UR Commitments	7.3	6.7
MAPA Total	1.8	1.4
(MAPA Liberalization)	(0.6)	(0.5)
(MAPA Facilitation)	(1.3)	(0.9)
UR and MAPA	9.1	8.0

Notes:

1. The dynamic version of the model assumes constant returns to scale and perfect competition and allows capital accumulation through the income-investment linkage.
2. The static version in the Memorandum item assumes constant returns to scale and perfect competition without capital accumulation.
3. “MAPA” covers individual action plans, collective actions, Osaka Initial Actions, and the Information Technology Agreement.
4. “UR and MAPA” is the sum of the impacts from the UR commitments and MAPA (liberalization and facilitation).

As explained above, simulations of MAPA are also performed for the reference year of 2000. If trade facilitation is excluded and only the trade liberalization is covered, there is very little difference between the net effects of MAPA in 2000 and 2010 (see Table 1 in Appendix 5). The difference will be about 0.35 percentage points for APEC and 0.2 percentage points for the world. In other words, by the year 2000, APEC will have already implemented about 80 percent of the tariff reduction measures undertaken in MAPA and enjoyed most of the associated gain. This also implies that, if implementation of the trade facilitation measures is expedited, economies would enjoy a substantial proportion of the total effects of MAPA in the early 2000s.

Table 5 summarizes the trade effect for each member economy. All of the APEC economies studied will enjoy an increase in trade volume. The model specification is likely to yield modest estimates, so the actual impact may be even larger. The estimated increases are much larger in the developing economies of APEC than in the industrialized economies. Furthermore, the economies that have undertaken more liberalization in MAPA tend to enjoy larger export increases, e.g. Chile, China, and the Philippines.

**Table 5: Trade Effects of MAPA -**

**Estimated Change in Merchandise Export Volume of APEC Economies in 2010  
(Percent)**

Economies	Dynamic Version	(Memorandum) Static Version
Australia	2.0	1.6
Canada	1.7	1.4
Chile	12.0	7.0
China	9.6	8.1
Hong Kong, China	1.6	1.0
Indonesia	3.7	1.1
Japan	1.1	0.9
Korea	3.0	2.2
Malaysia	8.9	1.9
Mexico	2.6	1.8
New Zealand	4.2	3.2
Philippines	22.1	17.6
Singapore	4.4	2.5
Chinese Taipei	3.8	2.8
Thailand	5.1	1.8
USA	1.9	1.7
APEC Total	3.0	2.1
Rest of World	0.6	0.5
World Total	1.8	1.4

See notes at Table 4.

Trade liberalization and facilitation in an economy will stimulate imports, which will in turn lead to an increase in exports through cost reduction. This effect may be referred to as the trade creation effect. The trade partners of the initially liberalizing economy will also enjoy the positive impact of increasing trade. Table 5 above indicates that the all regions, both within and outside APEC, will gain from the trade creation effect.

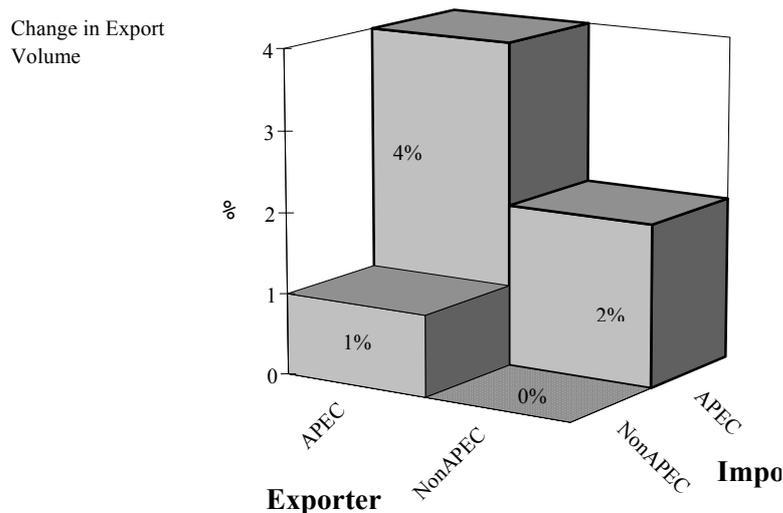
However, trade diversion for other economies and third parties may also arise. The increase in exports of the initially liberalizing economy may negatively affect the exports of other economies with competing export sectors. The trade diversion effect may also influence regional trade patterns between APEC as a group and non-APEC economies.<sup>45</sup>

MAPA trade liberalization is, in principle, on a unilateral and non-discriminatory basis. Therefore, significant trade diversion, i.e. the shift of trade flows from the inter-regional one (between APEC and non-APEC) to the intra-regional one (within APEC), would not be expected. Indeed, Figure 2 shows increases in exports in the cases of: (i) intra-APEC: (ii) from non-APEC to APEC and (iii) from APEC to non-APEC. However, intra-APEC trade increases by a much

<sup>45</sup> See APEC Economic Committee, "The Impact of Subregionalism on APEC," (1997). This study includes the estimates of trade and income effects of MAPA on ASEAN, NAFTA and CER, using the versions of the model used by the present study.

larger rate than inter-regional trade. This may reflect two factors. One is that the degrees of trade-weighted effective tariff reduction under MAPA are slightly different as between intra-APEC trade and the imports of APEC from non-APEC. The former is 0.86 percentage points, while the latter is 0.67 percentage points, reflecting that the level of tariffs in intra-APEC trade in the base case is somewhat higher than the latter. This may give slight advantage to the intra-APEC trade over the exports from non-APEC to APEC. The other factor is that, because the tariff reductions in MAPA are implemented collectively, some APEC economies may concurrently improve their competitive edge in their export industries through cost reduction, and will compete with and win against some exports from non-APEC to APEC.

**Figure 2 : Trade Expansion Resulting from MAPA in 2010**



Trade volume between non-APEC economies will remain about the same as it would have been in the absence of MAPA. This is because some of the trade flows within non-APEC economies will be diverted to APEC, perhaps because the exports to APEC will give non-APEC more benefit and imports from APEC will be cheaper. In conclusion, liberalization will lead to stronger interdependence among the APEC region, while inter-regional trade relations will also deepen.

### ***Effects on Real Income***

Trade liberalization and facilitation create gains in real income, which come from efficiency improvements. Real income and production are higher than they would have been without the liberalization and facilitation. In the dynamic version, the initial efficiency improvement induces capital accumulation that creates further increases in real income. The income gains in terms of money are usually smaller than those of trade effects.<sup>46</sup>

The model yields estimates of the percentage change in real income relative to the 1992 benchmark level. The effects can be also expressed in terms of the money amount of the GDP in some reference year. For the purposes of this report, the value of the GDP gains is expressed in 1995 US\$.

Table 6 summarizes the income effects of the UR and MAPA in 2010 in terms of both percentage changes and 1995 US dollars. The UR commitments will create annual income gains at the level of about 0.9 percent of GDP to the APEC members and 0.8 percent to the world economy. Implementation of MAPA commitments will further increase the gains to the level of 1.3 percent

<sup>46</sup> GATT, “The Results of the Uruguay Round of Multilateral Trade Negotiations” (1994), p. 27 presents the following example: “It is important to be clear that a \$1 billion increase in exports is not equivalent to a \$1 billion increase in income. To produce additional exports, resources must be used which could otherwise have been used to produce goods and services for domestic residents. If these resources would have produced \$900 million in such domestic goods and services, the true net income gain is the \$100 million difference between the value of those ‘foregone’ domestic goods and services and the \$1 billion in goods and services that can be purchased in the world market with the additional foreign exchange earnings.”

for APEC members, and 1.0 percent to the world economy. The net gains of MAPA to APEC, 0.4 percentage points, amount to more than 40 percent of the impact of the remaining portion of the UR which had not been implemented as of 1996. If the net impact of MAPA to APEC is compared with that of the UR from 1994, MAPA will create around one-fourth of the full impact of the UR.

**Table 6: Estimated Change in Real Income in 2010**

**(1) Impact to APEC**

Initiatives	Dynamic Version		(Memorandum) Static Version
	Percentage Change (GDP)	Amount ( billion US\$ in 1995)	Percentage Change (GDP)
UR Commitments	0.9	140.3	0.25
MAPA Total	0.4	68.5	0.07
(MAPA Liberalization)	(0.1)	(23.1)	(0.03)
(MAPA Facilitation)	(0.3)	(45.3)	(0.04)
UR and MAPA	1.3	208.7	0.3

**(2) Impact to the World**

Initiatives	Dynamic Version		(Memorandum) Static Version
	Percentage Change (GDP)	Amount ( billion US\$ in 1995)	Percentage Change (GDP)
UR Commitments	0.8	246.8	0.2
MAPA Total	0.2	70.9	0.04
(MAPA Liberalization)	(0.07)	(24.5)	(0.02)
(MAPA Facilitation)	(0.15)	(46.5)	(0.02)
UR and MAPA	1.0	317.8	0.3

See notes at Table 4.

The estimated impact of the UR to the world (0.8 percent of GDP) is generally comparable to those of the existing studies. The study's estimates lie in the mid-range of the various estimates, including those with imperfect competition.<sup>47</sup> As noted, our estimates of the trade effects are on the modest side of the existing estimates. Our dynamic assumption may result in larger estimates for the real income effects but only modestly larger ones for the trade effects: the ratios of dynamic estimates over the static estimates in terms of percentage changes are about 3.5 for the real income effects but 1.1 for the trade effects. Models with monopolistic competition tend to identify comparable effects for income but significantly larger effects for trade. According to a GATT study, the ratios are 2.8 for the real income effects and 2.7 for the trade effects. The dynamic model may therefore somewhat understate the trade effects, while indicating mid-range estimates of the real income effects.

Reflecting the nature of the CGE model, the simulations cover only part of the dynamic effects of trade liberalization. There is, however, a wide range of studies adopting econometric estimation of growth functions. Under this approach, the estimated real income effects may be larger in the long run, because the growth studies capture a wider range of dynamic gains than the CGE models.<sup>48</sup>

The trade facilitation measures in MAPA are estimated to have a larger impact than the modellable trade liberalization measures contained therein. The introduction of trade facilitation measures requiring new technologies would entail one-time costs and expenses for equipment and training which cannot be reflected in these estimates.

As is the case with the trade effects, there is little difference between the net income gains of MAPA between 2000 and 2010. If only trade liberalization is taken, it can be expected that about 90 percent of the total impact to be experienced by 2010 will be felt by 2000. Expediting trade facilitation, therefore, is the key for the early realization of the total effects of MAPA.

Since most liberalization and facilitation measures in MAPA are unilateral and non-discriminatory, there might be concern that much of the income gain would flow to non-APEC economies. The simulation shows that this would not be the case. APEC's income will increase by a much higher rate than that of non-APEC, which is negligible. Free-rider gains flow out from APEC only to a very small extent. As shown in Table 7, the spill-over of the income gain to non-APEC will be only \$2.4 billion, while the gain to APEC will be \$68.5 billion. Members, therefore, need not have significant concerns about long-run free-rider gains from implementation of MAPA.

### ***Geographical Distribution of Real Income Effects***

Table 7 also presents the real income effects on individual economies. The percentages range from 0.1 to 7.4. The income gains in terms of money amounts in Table 7 are obtained by multiplying the percentage changes by the level of GDPs of the economies in 1995.

**Table 7: Income Effects of MAPA –**

---

<sup>47</sup> The estimates of the existing studies with various specification range between 0.2 percent and 1.4 percent. It should be noted that our estimated effects are calculated against the protection level in 1996, while other existing studies use the year 1992 as the base.

<sup>48</sup> See Lee "International Trade Distortions and Long Run Economic Growth" (1993), IMF Staff Paper vol. 40 No.2, pp. 299-328. If the estimated parameters are applied to MAPA trade liberalization and facilitation, the per capita real annual growth rate of APEC will increase by 0.1 percentage points.

## Estimated Real Income Effects on APEC Economies in 2010

Economies/ Regions	Dynamic Version		(Memorandum) Static Version
	Percentage Change (GDP)	Amount (1995 US\$ billions)	Percentage Change (GDP)
Australia	0.4	1.8	0.1
Canada	0.4	2.0	0.0
Chile	4.9	3.3	0.4
China	2.1	14.3	0.8
Hong Kong, China	0.4	0.6	-0.0
Indonesia	2.4	4.9	0.1
Japan	0.1	7.2	0.0
Korea	0.8	3.8	0.2
Malaysia	7.4	6.3	0.5
Mexico	0.7	1.7	0.1
New Zealand	1.3	0.8	0.3
Philippines	4.3	3.2	1.3
Singapore	1.5	1.2	-0.1
Chinese Taipei	1.3	3.3	0.1
Thailand	3.1	5.2	0.3
USA	0.1	8.9	0.0
<b>APEC Total</b>	<b>0.4</b>	<b>68.5</b>	<b>0.1</b>
Rest of World	0.0	2.4	0.0
<b>World MAPA Total</b>	<b>0.2</b>	<b>70.9</b>	<b>0.0</b>

See notes at Table 4.

The estimated income gains in terms of US dollars are different among the APEC economies. Differences reflect the following factors:

- (i) *The relative magnitudes of the economies* (the larger the economy, the larger the absolute dollar gain);
- (ii) *The degree of liberalization undertaken* (economies that liberalize the most gain the most).<sup>49</sup> Hence the comparatively large positive impact of MAPA on Chile and the Philippines. If combined with the UR, the income gains in terms of percentage are more evenly allocated among the members;
- (iii) *The expected interactions of domestic and foreign economies.* In some cases, the liberalization of one economy would involve a reduction of the income in other economies, because the liberalization of an economy might cause a deterioration in the terms of trade of other economies. However, in the estimates of the impacts of MAPA, there will be no loser in APEC; and

<sup>49</sup> Existing studies on the impact of the UR concluded that there was a strong relationship between liberalization and estimated welfare gains in individual economies. See Francois, et. al (1996).

(iv) *The degree of capital deepening caused by the policy shocks.* The dynamic version model tends to magnify the income effects more so when the tariff reduction and trade facilitation are capital friendly, i.e. the measures shift the economy toward more capital intensive production, and when the saving rates are higher. Generally, the developing economies display these conditions.

There is a significant difference in income gains between groups of economies in terms of development stages. The developing economies in APEC will enjoy a gain of 2.3 percent, and Asian NIES 1.0 percent, while the industrialized economies in APEC will obtain 0.2 percent. This result may be mainly due to the second and fourth factors above.

### ***Impacts on the Sectors***

Because the simulation requires bold assumptions on the model inputs, such as the across-the-board tariff reductions assumed in the cases of China and Chinese Taipei, it is prudent to avoid drawing any definite conclusions on the detailed sectoral impacts. It is possible, however, to provide some aggregated results. Table 8 presents the trade and real income (or production) effects of MAPA by sector on all APEC economies under the dynamic version model in 2010.

**Table 8: Impact of MAPA on APEC by Sector in 2010**

<b>Commodity</b>	<b>Production (Percent Change)</b>	<b>Export Volume (Percent Change)</b>
Agriculture	0.3	1.4
Mining	0.6	3.2
Processed Food	0.2	2.0
Textiles	0.7	8.1
Chemicals	0.5	3.2
Metals	0.4	4.1
Transportation Equipment	0.4	3.0
Machinery & Equipment	0.7	3.4
Other Manufacturing	0.4	3.1
Energy, Gas and Water	0.3	-0.8
Construction	0.7	0.8
Transportation	0.2	0.3
Private Service	0.3	0.6
Public Service	0.2	1.0
Total	0.4	4.2

In the dynamic version, MAPA will increase production in all manufacturing and service sectors. In the static version, in sectors such as food and beverages, chemicals, metals and transportation, MAPA will have a negative impacts on production through the change in relative prices in domestic markets (see Appendix 5). The income effects in the dynamic version, which are amplified by the accumulation of capital stock, outweigh these negative impacts. The increase in production is the highest in textiles, machinery and equipment, and construction. The export volume will increase in all sectors except energy. The increase in textile exports is especially notable.

### ***Sensitivity Analysis and Alternative Specifications***

The simulation results are sensitive to the model specifications, as is illustrated in the difference between the dynamic and static models. The estimates are also sensitive to the values of parameters in the equations of the model. It is, therefore, important to undertake a sensitivity analysis to verify the realism of the model and thus the plausibility of the estimates.

Appendix 3 contains a sensitivity analysis on the Armington parameters. These results provide considerable confidence in the robustness of the model. The change in the Armington parameter may proportionally change the estimated effects: to the APEC total, for example, a one percent change in the Armington parameter brings a one percent change in the trade effect and a half percent change in the real income effect.

In improving on the basic version model of constant returns of scale and perfect competition, an alternative specification is to model the dynamic effects of trade liberalization directly through trade-productivity linkages. This can be achieved by incorporating equations for generating positive externalities through both export expansion and the importation of new capital goods. Appendix 3 also provides details on this exercise. The overall simulation results are broadly consistent with the liberalization component of the results from the dynamic version model in Tables 4 and 5. This outcome also provides greater confidence in the robustness of the model results as well as the plausibility of the estimated impact effect of MAPA liberalization on the APEC economies.

### ***Comparison to Tariff Elimination***

To illustrate the magnitude of the total effects of MAPA trade liberalization, the simulation results may be compared against the effects of full tariff elimination in APEC, as simulated in the *1997 APEC Economic Outlook*. This study undertakes CGE model simulations of different scenarios of trade liberalization, using the same GTAP database and CGE model structure to analyze the impact of “open regionalism.” Five cases are presented: preferential trade liberalization, unconditional MFN-based trade liberalization, conditional trade liberalization with the EU reciprocating, conditional liberalization with rest of the world reciprocating, and global trade liberalization. For the comparison with the estimates in this study, the case of unconditional trade liberalization, which assumes APEC members extend 100 percent tariff reductions to both members and non-members, is the most realistic and suitable.

The specific model used in the *Economic Outlook* is generally consistent with the dynamic version used here; both yield estimates of real income effects around the mid-range of the existing studies. The model simulation estimates the income gain to APEC from full tariff elimination by APEC members at about 1.3 percent of GDP, or US\$202 billion in 1995 prices. This effect, however, includes the impact of UR commitments, estimated at 0.9 percent of GDP, or US\$140 billion. Therefore, the net income gain from APEC tariff elimination would be almost 0.4 percent of GDP, or US\$62 billion. Taking this net real income effect as the denominator, tariff reduction via MAPA has achieved around one-third of the goal of full tariff elimination.

It must be recalled, however, that trade and investment liberalization in APEC would include other components, such as reduction of NTMs, services liberalization, and investment liberalization. The above figure, US\$62 billion in 1995 prices, covers only tariff elimination. Based on rough comparison, full implementation of the APEC free trade and investment agenda would probably have an impact about seven times greater than the gains from trade liberalization

and facilitation already committed in MAPA.<sup>50</sup>

---

<sup>50</sup> According to the IC 95 report, full implementation of the Bogor Declaration, including the reduction of tariff and NTMs, services liberalization, investment liberalization, and full trade facilitation, would raise GDP by 2.8 percent in APEC. The IC95 model yields estimates about the same as those from the standard dynamic model for the areas studied. Comparing this figure with the present study's estimate of the impact from MAPA (0.4 percent of GDP), the potential gain from Bogor would amount to seven times the total impact of trade liberalization and facilitation in MAPA.

## Chapter 4

### CONCLUSION AND RECOMMENDATIONS

The trade liberalization and facilitation measures undertaken in MAPA will increase, in the medium and long run, the production of APEC economies through more efficient resource allocation. They will also expand both exports and imports by lowering import costs through the reduction of barriers and lowering costs for the export sectors through increased efficiency. This will result in higher real incomes of the economies on a permanent basis. Since the reallocation of labor and capital may involve temporary adjustment costs, governments can play a crucial role in facilitating the realization of the gains from trade by reducing the costs for the job transition through, for example, provisions of training and education.

The estimates emerging from the CGE model are not forecasts. The income gains and trade increases should be considered to mean that the variables will be higher than they otherwise would have been if the measures had not been implemented. The estimates are intended to indicate the rough order of magnitude of the income and trade gains expected from trade liberalization and facilitation. Reflecting the basic nature of the CGE model, many of dynamic effects could not be captured and in this sense, the impacts may be underestimated. On the other hand, since the adopted model specification assumes perfect competition, the expected impacts may not be fully realized if the expected adjustment process does not work well. This underlines the importance of deregulation and competition policies to ensure that markets function properly.

The model simulations indicate that the benefits from MAPA would be substantial. MAPA trade liberalization and facilitation would increase the GDP of APEC economies as a whole by about 0.4 percent in real terms, or US\$69 billion in 1995 prices. To the world as a whole, the benefit will be about 0.2 percent, or US\$71 billion. MAPA's impacts is equivalent to about one fourth of the full impact of the UR trade liberalization and more than 40 percent of the impact of the remaining portion of the UR which had not been implemented as of 1996.

Four other conclusions are noteworthy. First, the differences of impacts among the APEC economies reflect the relative size of the economies, the degree of liberalization undertaken, and the expected interaction among the economies. Second, although the measures in MAPA are non-discriminatory and unilateral, there is little spill-over of welfare gains to non-APEC economies and thus little cause for concern about free-rider gains flowing from MAPA. Third, the estimated impact of trade facilitation under MAPA outweighs the impact of the modellable aspects of liberalization under MAPA. While the introduction of trade facilitation requiring new technologies would entail costs and expenses, these are one-time whereas the gains are permanent. Finally, early implementation of the facilitation measures would lead to early realization of the total effects of MAPA.

#### *Recommendations for Further Research*

In implementing this project, the research teams from Japan and Singapore faced several data constraints. While GTAP prepared a comprehensive data set, the base year was 1992. Only limited updates to the data were possible, mainly because of unavailability of the data. In particular, protection data, including tariff and non-tariff measures, are very hard to collect and update. While such an exercise might touch on some sensitive issues, it would be valuable to assemble the data for a more up-to-date assessment of the impacts of trade policies.

The research teams also have the following recommendations:

- Liberalization affects not only trade, but also investment, yet the CGE model simulation cannot accommodate the direct effects of investment liberalization. A theoretical framework and analytical tools to assess the total impact of APEC initiatives, including the investment measures, needs to be developed.
- MAPA is only the first statement of APEC's plans for reaching the Bogor goals. Action plans are to be continuously updated and improved. It is therefore important to undertake periodic follow-up assessments of the expected impacts as the IAPs and CAPs are revised.
- CGE model development for APEC is still in a preliminary stage. Substantial inputs are required to improve the model specifications and simulation techniques. Model enhancement would include incorporating scale economies and imperfect competition. It would also be beneficial to develop an econometric growth model to assess the impact of trade liberalization. While the Japan and Singapore teams implemented this project in coordination with the Korean team preparing the *1997 Economic Outlook*, it would be desirable for many other economies to get involved in the research exercise.

## Appendix 1

### BACKGROUND AND PROGRESS OF THE PROJECT

At their meeting in Bogor in November 1994, APEC Economic Leaders set a number of specific goals and objectives, including: free and open trade and investment in the Asia-Pacific region by 2010 for industrialized economies and 2020 for developing economies; expansion and acceleration of trade and investment facilitation programs; and intensified economic and technical cooperation. In Osaka in November 1995, APEC adopted the Osaka Action Agenda (OAA), which has become the template for future APEC work toward the common goals.

The OAA includes a collective action commitment “to review and analyze the impact of trade liberalization in the Asia-Pacific region.”<sup>1</sup> This task was assigned to the Economic Committee, which established a Task Force on the Impact of Trade Liberalization in February 1996 to carry out the present project. Japan and Singapore volunteered as co-chairs of the Task Force. The Task Force held three meetings in 1996 and 1997, as well as an Expert Seminar in March 1997. The Task Force discussed the objectives and scope of the project, analytical methods, data collection and the draft of the report.

The immediate objective of the project is to examine the benefits of trade liberalization and facilitation in the Asia-Pacific region. More specifically, the project focuses on the economic impacts of trade liberalization and facilitation actions undertaken in the Manila Action Plan for APEC (MAPA).

Another important objective of the project is to establish an analytical tool for assessing APEC trade liberalization and facilitation measures. All APEC members will have access to the analytical tools used in the project, including the economic models, their data, and the theoretical framework. Indeed, the 1997 Economic Outlook shares the same model as this project for its analysis, and other APEC research projects have also utilized similar analytical frameworks. Once the project is completed, the data collected in this project from the member economies will be open to all member economies, unless the copyright of the Global Trade Analysis Project (GTAP) prevents this.

A major component of the project is a model-based quantitative analysis. A computable general equilibrium (CGE) framework is adopted for this purpose. The CGE framework provides a handy tool for assessing the economic effects of trade liberalization and facilitation.<sup>2</sup> Some measures of APEC, however, are not rigorously manageable by any models. Such measures would include those related to most non-tariff measures, services liberalization, competition policy, intellectual property rights, government procurement, deregulation, and dispute mediation. Where feasible, theoretical discussion is offered in this report for some of the measures on their possible economic effects.

While this project is independent, it serves as a component in a package of research projects on APEC trade and investment liberalization and facilitation being completed under Economic

---

<sup>1</sup> Asia Pacific Economic Cooperation, “Osaka Action Agenda,” Part One: Liberalization and Facilitation, Section C: Actions in Specific Areas, 15. Information Gathering and Analysis (Groundwork).

<sup>2</sup> A number of studies have adopted the CGE framework, including those of the General Agreement on Tariffs and Trade (GATT), the World Bank, and the Organization for Economic Cooperation and Development (OECD).

Committee supervision in 1997. The package consists of four projects: the *1997 APEC Economic Outlook* (by Korea), *The Impact of Subregionalism on APEC* (by Chinese Taipei), *The Impact of Investment Liberalization in APEC* (by Chinese Taipei), and the present project. The project organizers have closely coordinated with each other, exchanged and used each other's achievements, and made cross-references.

The scope of the project has been discussed in the Task Force and Economic Committee meetings. The Committee decided that this project should make use of the hypothetical assumptions of the *Economic Outlook* by Korea to avoid any overlaps and contradictions between the two projects. The major focus of the *1997 Economic Outlook* is on the economic implications of "open regionalism" in APEC, and the Korean team carried out CGE simulations of various scenarios of full trade liberalization. The research teams of Korea, Japan and Singapore have fully coordinated with each other to make the assumptions, model specifications and simulation work consistent and comparable. The coordination enabled this Project to make a cross-reference to the impact of full trade liberalization based on cases from the *Economic Outlook*, which were developed with similar analytical tools.

## PROJECT MEETINGS

February 1996 -- Economic Committee Meeting in Manila, the Philippines  
*Decided to establish the Task Force on the Impact of Trade Liberalization*

August 1996 -- First Meeting of the Task Force on the Impact of Trade Liberalization in Davao, the Philippines  
*Discussed the outline of the project with particular emphasis on the property of the Global Trade Analysis Project*

October 1996 -- Economic Committee Meeting in Manila, the Philippines  
*Submitted Interim Report from Co-chairs of the Task Force*

March 1997 -- Expert Seminar on the Impact of Trade Liberalization in Tokyo, Japan  
*Discussed the technical aspects of modeling with experts from APEC member economies and international organizations*

May 1997 -- Second Meeting of the Task Force on the Impact of Trade Liberalization in Quebec, Canada  
*Discussed the draft final report*

August 1997 -- Economic Committee Meeting in St. John's, Canada  
*Discussed and finalized the revised draft final report*

October 1997 -- Economic Outlook Symposium in Seoul, Republic of Korea  
*Presented findings to experts from member economies and PECC.*

November 1997 -- APEC Ministerial Meeting in Vancouver, Canada  
*Submitted the final report (anticipated)*

## Appendix 2

### TECHNICAL OUTLINE OF THE GTAP MODEL

The CGE model simulations in this study were carried out on the basis of the standard Global Trade Analysis Project (GTAP) model with its Version 3.0 database. The data and structure of the model, including equations and parameters, are presented here. For additional details, see “Global Trade Analysis: Modeling and Applications (1996),” edited by T. W. Hertel.

#### DATA

The GTAP database consists of bilateral trade, transport, and protection data characterizing economic linkages among regions, together with individual and country input-output databases that account for intersectoral linkages within each region.

##### *Trade Data*

The trade data upon which the GTAP data base is built originate from United Nations D-series trade statistics. COMTRADE (COMmodity TRADE) is the registered name of the database maintained by the UN Statistics Office. This database is one of the most complete and exhaustive in terms of commodity and country coverage, but because of the large size of the database, its reliability is questionable. Efforts have been made by the United Nations to fill the data gaps and balance the bilateral trade and transport matrices. The bilateral flows are also used to determine the pattern of trade in nonfactor services. The reconciliation method adjusts reported values based on “relative” biases for bilateral transaction. For almost all the reporting countries there are only slight changes in the total reported values. There are cases of severe underreporting or nonreporting in some countries. In most of these cases, the partners’ reported trade was used, after adjusting for the international transport margins.

##### *Protection Data*

The support and protection data (SPD) are expressed in the form of ad valorem equivalent, tariff, and nontariff barrier, and they draw heavily on information submitted to the GATT in connection with the Uruguay Round (UR) negotiations. These protection data are broadly indicative of the level of protection prevailing prior to the UR. The best-quality data in the SPD are those relating to tariffs. There remains considerable bilateral variation in the applied tariff rates, aggregated over all merchandise trade. Nontariff information is most complete in the cases of agriculture and textiles/apparel. Antidumping duties are incorporated for Canada, the European Union and the United States. Also, the export restraining effects of EU price undertakings are included. However, the SPD are not comprehensive. Other trade measures, despite their importance, are very difficult to quantify in a useful way. Protection of and support to the service sector are especially difficult to quantify, and it is the only sector that is wholly neglected. It was thought better to do a solid job of incorporating tariff and selected nontariff information and leave other policy measures aside for the time being, given the dubious information content of the latter.

##### *Input-Output Data*

The basic input-output (IO) data provide information about the individual regional economies. Some of these were obtained from the Australian Industry Committee (IC), while others were contributed by members of the GTAP network. For the six composite regions in the database, no

IO information is available, but representative combinations of the known tables are used to obtain estimated IO tables. Because the IO tables making up the regional databases refer not to 1992, but rather to the latest available year, they will have to be updated to conform to 1992 trade and macroeconomic data. It should be noted that the largest economies are relatively less reliant on trade, while trade flows are far larger than GDP in the several small trading economies. These economies present special problems for the database because of prevalence of re-exports. The original dataset of Hong Kong, China includes a negative saving rate, which perhaps reflects an underestimate of re-exports or investment and an overestimate of consumption. Based on the actual figures in 1992, some of the government consumption has been moved to investment, which amounts to 33 percent of GDP, as the minimum amendment.

## **MODEL**

To operationalize the large database, a standard, multiregion, applied general equilibrium modeling framework has been developed. Distinguishing features include: the treatment of private household behavior, international trade and transport activity, and global savings/investment relationships.

### ***Aggregation***

The GTAP database consists of the 37 disaggregated sectors and 30 countries/regions, which are aggregated to the appropriate versions for simulations. In this study, regions are aggregated into 19 areas, and 16 areas are allocated to APEC economies. The APEC member economies are disaggregated individually where data are available (data for Brunei and Papua New Guinea are not available). Fourteen commodities are aggregated following the standard classification in the national accounts, considering the importance of industries/commodities. See Table 2-1.

### ***Model Structure***

The GTAP model is a computable general equilibrium model that depicts the behavior of households, governments, and global sectors across each region in the world. It is composed of regional models linked through international trade. Prices and quantities are simultaneously determined in factor markets and commodity markets by the accounting relationships, the equilibrium conditions specified by the behavior of economic agents, and the structure of international trade. The model includes three factors of production: labor, capital, and land. Labor and capital are used by all industries, but land is used only in agricultural sectors. Capital and intermediate inputs are traded, while labor and land are not traded between regions.

#### **i. Firm Behavior**

The GTAP model assumes that firms use constant returns to scale technology, and minimize the cost of inputs, given a level of output and technology. Firms' behavior depends largely on the assumptions of separability in the production structure. Firms are assumed to combine a bundle of intermediate inputs in fixed proportion with a bundle of primary factors. The demand for each intermediate input is also assumed to vary in fixed proportion with the level of output. That is, the production function in the GTAP model has a Leontief structure. This production structure yields demand equations for a bundle of primary factors and each intermediate input. In determining the demand for primary factors, the Constant Elasticity of Substitution (CES) functional forms is assumed. The CES production function yields the demand equations for each primary factor, and the price of value-added in industry  $j$  in region  $r$  evaluated at firms. Firms purchase intermediate inputs, some of which are produced domestically, and some of which are imported. Domestic and imported intermediate inputs are substituted according to a constant

elasticity of substitution. Similarly, a constant elasticity of substitution is assumed to capture the degree of substitutability between imports from different sources. The two-level CES functional form yields the demand functions.

#### ii. Household Behavior

Regional household behavior is governed by an aggregate utility function specified over composite private consumption, composite government consumption, and savings. The other feature of regional households utility function is the use of an index of current government expenditures as a proxy for the welfare derived from the government's provision of public goods and services to private household in the region. The GTAP model employs a special case of the Stone-Geary utility function, in which all subsistence quantities are equal to zero. The share of private household expenditures, government expenditures, and savings are constant in total income. Once the changes in real government spending has been determined, this spending has been allocated across composite goods and aggregate demand for the composite is allocated between imports and domestic products under the assumption of constant elasticity of substitution. Private household demand has a non-homothetic nature. The allocation of private household expenditures across commodities is based on the constant difference of elasticity (CDE) expenditure functions.

#### iii. Global Banking Sector and Savings/Investment

The GTAP model introduces two global sectors. One is the global transportation sector described below. The other is the global banking sector. The global banking sector intermediates between global savings and investment. It creates a composite of investment goods, based on a portfolio of net regional investment, and offers this to regional households to satisfy their savings demand. Therefore, all savers face a common price for this saving commodity. A consistency check on the accounting relationships involves separately computing the supply of the composite investment goods and the demand for aggregate savings. If all other markets are in equilibrium, all firms earn zero profit, and all households undergo budget constraints, then global investment must equal global savings by virtue of Walras' Law.

#### iv. Global Transportation

The global transportation sector provides the services that account for the difference between fob and cif values for a particular commodity shipped along a specific route. Summing up all routes and commodities gives the total demand for international transport services. The supply of these services is provided by individual regional economy, which export them to the global transport sector. In the GTAP model, transportation services are provided via the Cobb-Douglas production function. Lacking the data that link exports of transport services with specific routes, the services are combined into a single composite of international transport goods. Then, the percentage change equation for the composite price index given the demands for inputs to the shipping industry is derived under the Cobb-Douglas assumption. The GTAP model assumes that the composite of international shipping services is employed in fixed proportion with the volume of a particular good shipped along a particular route.

## PARAMETERS

There are four types of behavior parameters in the GTAP: elasticities of substitution (in both consumption and production), transformation elasticities that determine the degree of mobility of primary factors across sectors, the flexibilities of regional investment allocation, and consumer

demand elasticities.

First, the SALTER project engaged in an extensive review of the literature and some original empirical work to specify values for substitution elasticities on a commodity-specific, region-generic basis. The Armington parameters are reported in Table 2-2. The first column describes the ease of substitution between the domestic goods and the composite import, by commodity. As such, it governs the composite import demand elasticity. The second column determines the ease of substitution among imports from different sources. In the SALTER parameter file, this is equal to twice the value of the first one. The elasticities of substitution in the value-added aggregates for each sector are also reported in the third column of Table 2-2. The overall elasticity of substitution among primary factors determines the ability of the economy to alter its output mix in response to changes in relative commodity prices. These parameters also play an important role in determining the sectoral supply response, in the presence of sector-specific and sluggish factors of production. Elasticity of substitution in primary production is relatively small and the greatest degree of substitutability arises in the trade and transport sector. For a sensitivity analysis on the Armington parameters, see Appendix 3.

Second, within each region, the model distinguishes between primary factors that are perfectly mobile across productive sectors and those factors that are sluggish. In an experiment with sluggish endowment commodities, it is important to determine how much of a disparity in relative sectoral returns can be sustained over the simulation period. This disparity is governed by the elasticity of transformation.

Third, there is another set of “mobility” parameters that determine the flexibility of regional investment. It is possible to choose some regions where investment is quite sensitive to the changing rate of return, and others where this is not the case.

Fourth, the parameters that describe demand behavior in initial equilibrium for the representative private household are region-specific. Consumer behavior in GTAP is based on the constant difference elasticity (CDE) expenditure function, which is most naturally calibrated to income and own-price elasticities of demand.

**Table 2-1: Regional and Commodity Aggregation****Economies/Regions**

<b>AGGREGATION</b>	<b>(NAME)</b>	<b>In GTAP Model</b>
1. AUSTRALIA	(AUS)	Australia
2. NEW ZEALAND	(NZL)	New Zealand
3. JAPAN	(JPN)	Japan
4. INDONESIA	(IDN)	Indonesia
5. MALAYSIA	(MYS)	Malaysia
6. THE PHILIPPINES	(PHL)	the Philippines
7. THAILAND	(THA)	Thailand
8. CHINA	(CHN)	China
9. REPUBLIC OF KOREA	(KOR)	Republic of Korea
10. SINGAPORE	(SGP)	Singapore
11. HONG KONG, CHINA	(HKG)	Hong Kong
12. CHINESE TAIPEI	(CTP)	Chinese Taipei
13. UNITED STATES OF AMERICA	(USA)	United States of America
14. CANADA	(CAN)	Canada
15. MEXICO	(MEX)	Mexico
16. CHILE	(CHL)	Chile
17. LATIN AMERICA	(LTN)	Central America & Caribbean, Argentina, Brazil, Rest of South America
18. WESTERN EUROPE	(WEU)	European Union 12, Austria-Finland & Sweden, European Free Trade Area
19. REST OF THE WORLD	(ROW)	India, Rest of South Asia, Central European Associates, Former Soviet Union, Middle East & North Africa, Sub Saharan Africa, Rest of World

Note: Brunei and Papua New Guinea are not included in the database.

**Commodities/Industries**

<b>AGGREGATION</b>	<b>(NAME)</b>	<b>In GTAP Model</b>
1. AGRICULTURE, FORESTRY & FISHERY	(AGR)	paddy rice, wheat, grains, non grain crops, wool, other livestock, forestry, fishery
2. MINING	(MNG)	coal, oil, gas, other minerals
3. FOOD & BEVERAGES	(PFD)	processed rice, meat products, milk products, other food products, beverages & tobacco
4. TEXTILES	(TXL)	textiles & apparel
5. CHEMICALS	(CHM)	petroleum & coal products, chemicals rubbers & plastics, nonmetallic mineral products
6. METALS	(MTL)	primary ferrous metals, non ferrous metals, fabricated metal products
7. TRANSPORT EQUIPMENT	(TRN)	transport equipment
8. MACHINERY & EQUIPMENT	(OME)	machinery & other equipment
9. OTHER MANUFACTURING	(OMF)	leather etc., lumber & wood, pulp paper etc., other manufacturing
10. ELECTRICITY, GAS & WATER	(EGW)	electricity-gas & water supply
11. CONSTRUCTION	(CNS)	construction
12. TRADE & TRANSPORT	(T_T)	trade & transport
13. OTHER SERVICES (PRIV.)	(OSP)	other services (private), ownership of dwellings
14. OTHER SERVICES (GOVT.)	(OSG)	other services (government)

Source: GTAP database, Version 3.0

**Table 2-2: Substitution Elasticities**

	1	2	3
AGR	2.49	4.73	0.56
MNG	2.80	5.60	1.12
PFD	2.38	4.77	1.12
TXL	3.15	6.54	1.26
CHM	2.03	3.96	1.26
MTL	2.80	5.60	1.26
TRN	5.20	10.40	1.26
OME	2.80	5.60	1.26
OMF	2.43	5.63	1.26
EGW	2.80	5.60	1.26
CNS	1.90	3.80	1.40
T_T	1.90	3.80	1.68
OSP	1.90	3.80	1.26
OSG	1.90	3.80	1.26

Notes:

1. Armington substitution elasticity between domestic and composite import goods.
2. Armington substitution elasticity among import goods by source.
3. Substitution elasticity of primary factors (land, labor and capital).

## Appendix 3

### SENSITIVITY ANALYSIS AND ALTERNATIVE SPECIFICATIONS

#### *Sensitivity Analysis on Armington Parameters*

A sensitivity analysis attempts to find how simulation results depend on the assumed parameter values. In this Appendix, the Armington parameters are systematically changed to trace how they would change the outcomes.

Armington parameters are key elasticities in the model to determine to what degree the imports and domestically produced commodities are substitutable. Under the assumption of perfect substitution, import and domestic prices would converge to a unique price, while the regime that involves imperfect competition can permit the existence of two or more prices for one commodity category. A modeling technique developed by Armington (1969) is based on the idea that two or more prices for one commodity can exist not because of the functional particularities, but depending on the sources of origin of the goods.

The method applied here is to change the bundle of Armington parameters by 25 percent higher and lower than those of the standard case. Then, the responsiveness of the key variables is checked to evaluate the robustness of the simulation results. Armington values are tabulated in Table 3-1. The UR plus MAPA in 2010 is used for the common trade shock. Simulation results are tabulated in Tables 3-2 and 3-3. Both dynamic and static versions are checked, and observed variables are real export volume and real GDP.

As for the effect on export volumes, it is found that, for almost all the economies, the effect in terms of percentage will change proportionally to the percentage changes in Armington parameters. Table 3-3 presents the deviations of the estimated real exports caused by the changes of Armington parameters, either 25 percent higher or lower than the standard values. In the dynamic version, the deviations in the economies lie in the range of -41 percent to -17 percent with the 25 percent lower parameters, and 13 percent to 34 percent with the 25 percent higher parameters. The differences of the deviations among the economies are mainly due to the difference of the composite share of each commodity across the region. If a region specialized in a commodity that is relatively substitutable compared with other commodities, exports may change more drastically. For APEC total, the deviation is -26 percent with lowered parameters, and 23 percent with higher parameters.

As for real GDP effects, both the dynamic and static versions show that the effects would be almost linear to the parameter changes in each economy. As is shown in Table 3-5, the deviations are different among the economies, ranging from -64 percent to 0 percent with lower parameters, and from 20 percent to 1 percent with higher parameters, in the dynamic version. In the static version, the changes appear to depend on the commodity share in trade and trade dependency ratio. In the dynamic version, as the difference between the static and dynamic versions is whether capital accumulation exists or not, one should focus on the linkage between the trade shock and capital accumulation, as well as the common factors of the static version. For APEC total, the deviations are -13 percent with the lower parameters and 9 percent with the higher parameters in the dynamic version. It is somewhat surprising that the deviations in the static

version are larger, ranging from -23 percent with the lower parameters to 24 percent with higher parameters.

More precisely, some technical points should be noted here. First of all, the solution method may affect the simulation results. In this test, the 5 steps euler method is applied. Approximation of non-linear equation by 5 steps might be rough compared to that of Grugg method. Simulation results are expected to be more moderate with this specification.

Secondly, some small industries in small regions may be distorted in the process of calculation of the changes. It is not clear at this stage, however, whether a property of the software, linearization of non-linear equations, may distort the results of some variables with small initial values. Further inquiry is required on this issue.

In conclusion, the sensitivity analysis above provides us with considerable comfort in the robustness of the model. It should also be taken into account that the change in the Armington parameter may proportionally change the estimated effects: to APEC total for example, for one percent change in the Armington parameter, one percent change in the trade effect and a half percent change in the income effect.

**Table 3-1: Armington Parameters**

	Values of ESUBD			Values of ESUBM		
	Lower by 25%	Standard	Higher by 25%	Lower by 25%	Standard	Higher by 25%
AGR	1.864	2.486	3.107	3.728	4.732	6.214
MNG	2.100	2.800	3.500	4.200	5.600	7.000
PFD	1.784	2.379	2.974	3.569	4.770	5.948
TXL	2.359	3.146	3.932	4.719	6.540	7.864
CHM	1.521	2.028	2.534	3.041	3.959	5.069
MTL	2.100	2.800	3.500	4.200	5.600	7.000
TRN	3.900	5.200	6.500	7.800	10.400	13.000
OME	2.100	2.800	3.500	4.200	5.600	7.000
OMF	1.822	2.430	3.037	3.645	5.634	6.075
EGW	2.100	2.800	3.500	4.200	5.600	7.000
CNS	1.425	1.900	2.375	2.850	3.800	4.750
T_T	1.425	1.900	2.375	2.850	3.800	4.750
OSP	1.425	1.900	2.375	2.850	3.800	4.750
OSG	1.425	1.900	2.375	2.850	3.800	4.750

Notes:

ESUBD: elasticity of substitution between domestically produced commodities and composite-imported commodities.

ESUBM: elasticity of substitution among imported commodities by their sources.

ESUBM is set as double size of ESUBD.

Standard values are employed in GTAP version 3.0 data set.

See Table 2-1 in Appendix 2 for abbreviations.

**Table 3-2: Change in Real Exports (Percent)**

Economy	Dynamic Lower by 25%	Dynamic Standard	Dynamic Higher by 25%	Static Lower by 25%	Static Standard	Static Higher by 25%
AUS	1.564	2.005	2.427	1.243	1.623	2.014
CAN	1.264	1.743	2.238	0.932	1.403	1.889
CHL	9.775	11.954	13.971	5.480	6.979	8.513
CHN	7.230	9.553	11.784	5.919	8.073	10.171
HKG	1.031	1.593	2.130	0.507	1.037	1.551
IDN	3.008	3.709	4.266	0.664	1.120	1.562
JPN	0.692	1.074	1.437	0.577	0.904	1.232
KOR	2.243	2.969	3.702	1.523	2.178	2.848
MYS	6.273	8.871	10.676	1.332	1.893	2.453
MEX	1.961	2.617	3.223	1.169	1.824	2.436
NZL	3.295	4.226	5.114	2.508	3.168	3.861
PHL	17.427	22.106	26.847	13.142	17.626	22.155
SGP	2.601	4.384	5.004	2.052	2.492	2.957
CTP	3.062	3.824	4.547	2.076	2.757	3.433
THA	4.194	5.061	5.724	1.310	1.811	2.305
USA	1.426	1.933	2.423	1.244	1.689	2.149
APEC Total	2.209	2.991	3.678	1.547	2.144	2.745
APEC Industrial Economies	1.191	1.655	2.105	1.000	1.409	1.829
APEC Developing Economies	5.834	7.625	9.209	3.470	4.780	6.065
East Asia NIES	2.407	3.382	4.054	1.675	2.266	2.864
LTN	0.496	0.586	0.669	0.498	0.557	0.626
WEU	0.578	0.646	0.705	0.562	0.586	0.626
ROW	0.361	0.377	0.383	0.401	0.406	0.418
WORLD	1.405	1.842	2.225	1.057	1.381	1.713

Notes:

1. See Table 1 in Appendix 2 for abbreviations.
2. See Table 3-1 in this Appendix for the parameters set in each case.

**Table 3-3. Deviations of Real Export Volume**

Economy	Dynamic Lower by 25%	Dynamic Higher by 25%	Static Lower by 25%	Static Higher by 25%
AUS	-21.995	21.047	-23.413	24.091
CAN	-27.481	28.399	-33.571	34.640
CHL	-18.228	16.873	-21.479	21.980
CHN	-24.317	23.354	-26.682	25.988
HKG	-35.279	33.710	-51.109	49.566
IDN	-18.900	15.018	-40.714	39.464
JPN	-35.568	33.799	-36.173	36.283
KOR	-24.453	24.688	-30.073	30.762
MYS	-29.286	20.347	-29.635	29.583
MEX	-25.067	23.156	-35.910	33.553
NZL	-22.030	21.013	-20.833	21.875
PHL	-21.166	21.447	-25.440	25.695
SGP	-40.671	14.142	-17.657	18.660
CTP	-19.927	18.907	-24.701	24.519
THA	-17.131	13.100	-27.664	27.278
USA	-26.229	25.349	-26.347	27.235
APEC Total	-26.153	22.944	-27.875	28.027
APEC Industrial Economies	-28.049	27.206	-29.028	29.739
APEC Devel'g Economies	-23.493	20.770	-27.411	26.881
East Asia NIES	-28.819	19.877	-26.076	26.369
LTN	-15.358	14.164	-10.592	12.388
WEU	-10.526	9.133	-4.096	6.826
ROW	-4.244	1.592	-1.232	2.956
WORLD	-23.665	20.934	-23.440	24.166

1. Deviation rate = ( Each Case - Standard Case ) / Standard Case \* 100

2. MEX(Mexico) shows that a larger Armington makes trade volume smaller, while trade volume is larger with larger Armington in all other regions. Further research would be required to find out the reasons.

**Table 3-4: Change in Gross Domestic Product (Percent)**

Economy	Dynamic Lower by 25%	Dynamic Standard	Dynamic Higher by 25%	Static Lower by 25%	Static Standard	Static Higher by 25%
AUS	0.35	0.39	0.43	0.08	0.11	0.13
CAN	0.34	0.35	0.36	0.03	0.04	0.04
CHL	4.06	4.93	5.55	0.28	0.37	0.45
CHN	1.69	2.07	2.39	0.61	0.82	1.02
HKG	0.42	0.42	0.43	-0.02	-0.02	-0.02
IDN	2.18	2.44	2.56	0.09	0.11	0.13
JPN	0.14	0.14	0.14	0.02	0.02	0.03
KOR	0.76	0.84	0.92	0.15	0.19	0.23
MYS	5.21	7.37	8.72	0.39	0.48	0.58
MEX	0.68	0.69	0.71	0.04	0.05	0.06
NZL	0.97	1.31	1.58	0.21	0.28	0.34
PHL	3.65	4.27	4.83	0.88	1.27	1.64
SGP	0.52	1.46	1.53	-0.05	-0.07	-0.09
TWN	1.13	1.25	1.36	0.11	0.14	0.17
THA	2.68	3.11	3.37	0.28	0.34	0.40
USA	0.12	0.12	0.13	0.01	0.01	0.02
APEC Total	0.34	0.39	0.43	0.05	0.07	0.08
APEC Industrial Economies	0.15	0.15	0.16	0.02	0.02	0.03
APEC Devel'g Economies	1.93	2.33	2.62	0.33	0.45	0.55
East Asia NIES	0.82	0.97	1.05	0.10	0.13	0.16
LTN	0.00	0.01	0.01	0.01	0.01	0.01
WEU	0.02	0.03	0.03	0.00	0.00	0.00
ROW	-0.01	-0.01	-0.01	0.01	0.01	0.01
WORLD	0.19	0.22	0.24	0.03	0.04	0.05

1. See Table 1 in Appendix 2 for abbreviations.
2. See Table 1 in this Appendix for the parameters set in each case.

**Table 3-5. Deviations in Real GDP(Percent)**

Economy	Dynamic Lower by 25%	Dynamic Higher by 25%	Static Lower by 25%	Static Higher by 25%
AUS	-11.253	8.951	-20.952	20.000
CAN	-2.312	3.179	-13.158	15.789
CHL	-17.617	12.563	-23.913	23.098
CHN	-18.629	15.541	-26.039	24.572
HKG	0.000	1.422	-15.789	10.526
IDN	-10.541	5.127	-19.048	20.952
JPN	0.000	2.128	-19.048	23.810
KOR	-9.547	9.905	-20.541	22.162
MYS	-29.273	18.258	-18.919	19.543
MEX	-2.453	2.309	-20.408	22.449
NZL	-26.180	20.244	-25.000	22.500
PHL	-14.513	13.224	-30.830	29.960
SGP	-64.330	4.811	-35.211	30.986
TWN	-10.207	8.134	-20.833	20.833
THA	-13.849	8.567	-17.456	17.456
USA	-5.691	5.691	-28.571	28.571
APEC Total	-12.607	9.296	-23.920	23.948
APEC Industrial Economies	-4.530	4.956	-22.578	24.204
APEC Devel'g Economies	-17.122	12.257	-25.149	24.231
East Asia NIES	-14.746	8.195	-20.206	21.562
LTN	-83.333	50.000	-20.000	30.000
WEU	-21.429	17.857	-50.000	100.000
ROW	0.000	0.000	0.000	20.000
WORLD	-13.110	9.746	-24.055	25.401

\*\*\* MEX(Mexico) shows non-linear relation between real GDP and size of Armington in static model while that of dynamic is nominal

### *Alternative Specifications*

The model adapted three different channels of trade-productivity links.<sup>1</sup> The first channel links sectoral productivity to sectoral imports of intermediate and capital goods so that the extent of the productivity increase depends on the share of intermediates in production. The second channel is the externality associated with sectoral export performance, i.e. higher export growth translates into increased domestic productivity. The third channel involves the externality associated with aggregate exports, whereby increased exports make physical capital more productive, an effect embodied in the capital stock in the production process. Each of the three relationships operates through a simple elasticity equation. For example, an export productivity elasticity of 0.15 for industrial sector exports means that a 10 percent rise in real exports would result in a 1.5 percent increase in total factor productivity in that sector.

Empirically, for MAPA simulations, the model used the Lewis, Robinson, and Wang<sup>2</sup> estimates which are partly based on de Melo and Robinson<sup>51</sup> in their analysis of the Korean growth performance.

In addition, in modeling import demands, the model is modified by the common practice of using the highly restrictive constant elasticity of substitution function for imports aggregation equation. Following Deaton, the model adopted the Almost Ideal Demand System (AIDS) specification.

<sup>1</sup>See Lewis J.D., Robinson S., and Wang Z., "Beyond the Uruguay Round: The Implications of an Asian Free Trade Area," World Bank (1995).

<sup>51</sup> Jaime De Melo and Sherman Robinson, "Productivity and Externalities: Models of Export-led Growth," Journal of International Trade and Economic Development, vol.1,no.1(1992),pp41-68.

This specification allows import expenditure elasticities to be different from unity as well as the more realistic situation of allowing cross-country substitution elasticities to vary for different pairs of countries.<sup>52</sup> In general, this specification generates more realistic trade volume and terms-of-trade effects when analyzing the economic impact of regional trade liberalization.

---

<sup>52</sup> Angus Deaton and John Muelbauer, "Economics and Consumer Behavior"(1980).

## Appendix 4

### MEMBERS OF THE TASK FORCE ON THE IMPACT OF TRADE LIBERALIZATION

#### *Task Force Co- Chairs*

Mr. Makoto Nomura, Economic Planning Agency, Japan

Dr. Tan Kong Yam, Ministry of Trade and Industry, Singapore

#### *EC Chair's Office*

Dr. John Curtis

Mr. Dan Ciuriak

#### *Participants from Member Economies*

<b>Economy</b>	<b>Name</b>	<b>Affiliation</b>
Australia	Ms. Christine Archer	The Treasury
Canada	Mr. Someshwar Rao	Industry Canada
China	Mr. Chen Wenjing	Ministry of Foreign Trade & Economic Coop'n
Chile	Mr. Robert Paiva	Ministry of Economy
Hong Kong, China	Mr. K. Y. Tang	Government Economist
Indonesia	Dr. Bambang Kusumanto	Ministry of Finance
Japan	Mr. Takashi Shinozuka	Ministry of Foreign Affairs
	Mr. Seiji Hagiwara	Ministry of International Trade and Industry
	Dr. Kazutomo Abe	Economic Planning Agency
Korea	Dr. Oh Jong Nam	Ministry of Finance and Economy
	Dr. Kim Sang Kyom	Korea Institute for Int'l Economic Policy
Malaysia	Mr. Sakeri Abdul Kadir	Ministry of Finance
Mexico	Mr. Jose Carlos Barona	Ministry of Foreign Affairs
New Zealand	Mr. Andrew Sweet	The Treasury
	Mr. Chris Nixon	New Zealand Institute of Economic Research
Philippines	Ms. Margarita Songco	National Economic Development Authority
Chinese Taipei	Dr. Hu Chun Tien	Academia Sinica
Thailand	Mr. Somchai Sujjapongse	Ministry of Finance
United States	Dr. William Donnelly	U.S. International Trade Commission
	Dr. Christopher Taylor	U.S. International Trade Commission

#### *APEC Secretariat*

Mr. Tom Engle

***Resource Persons in the Expert Seminar***

Dr. Joseph Francois, Professor, Erasmus University

Dr. Dominique van der Mensbrugghe, OECD

Dr. Ulrich Reincke, World Bank

***Research Team***

**JAPAN**

Dr. Kanemi Ban, Economic Research Institute, Economic Planning Agency and  
University of Osaka

Dr Shujiro Urata, Economic Research Institute, Economic Planning Agency and  
Waseda University

Dr. Fukunari Kimura, Economic Research Institute, Economic Planning Agency and  
Keio University

Dr. Ken'ichi Kawasaki, Economic Research Institute, Economic Planning Agency

Dr. Shinji Yoshioka, Economic Research Institute, Economic Planning Agency

Dr Masahiko Tsutsumi, Economic Research Institute, Economic Planning Agency

Dr. Hidekatsu Asada, Economic Planning Agency

Dr. Kazuyoshi Nakata, Economic Research Institute, Economic Planning Agency

Dr. Masayuki Sawada, Economic Research Institute, Economic Planning Agency

Dr. Yoshiaki Igarashi, Economic Research Institute, Economic Planning Agency

Dr. Hiroshi Ono, Economic Research Institute, Economic Planning Agency

Dr. Rie Ashizawa, Economic Planning Agency

**SINGAPORE**

Dr. Toh Mun Heng, National University of Singapore

## Appendix 5

Table 5-1. Impact of MAPA<sup>1</sup> on Welfare and Trade

Version 1 (Static simulation)

Version 2 (Static simulation)

Region	2000		2010	
	GDP	Export	GDP	Export
Australia	0.11	1.68	0.11	1.62
Canada	0.04	1.41	0.04	1.40
Chile	0.13	0.55	0.37	6.98
China	0.82	7.72	0.82	8.07
Hong Kong, China	-0.02	1.10	-0.02	1.04
Indonesia	0.10	0.81	0.11	1.12
Japan	0.02	0.90	0.02	0.90
Korea	0.14	1.57	0.19	2.18
Malaysia	0.45	1.50	0.48	1.89
Mexico	0.05	1.84	0.05	1.82
New Zealand	0.17	1.84	0.28	3.17
Philippines	1.07	12.58	1.27	17.63
Singapore	0.07	1.55	-0.07	2.49
Chinese Taipei	0.12	1.96	0.14	2.76
Thailand	0.30	1.47	0.34	1.81
United States	0.01	1.71	0.01	1.69
Latin America	0.01	0.54	0.01	0.56
West Europe	0.00	0.57	0.00	0.59
ROW	0.01	0.41	0.01	0.41

Region	2000		2010	
	GDP	Export	GDP	Export
Australia	0.39	2.05	0.39	2.01
Canada	0.34	1.75	0.35	1.74
Chile	1.82	2.27	4.93	11.95
China	2.07	9.17	2.07	9.55
Hong Kong, China	0.43	1.67	0.42	1.59
Indonesia	1.96	2.83	2.44	3.71
Japan	0.13	1.06	0.14	1.07
Korea	0.64	2.17	0.84	2.97
Malaysia	6.94	8.03	7.37	8.87
Mexico	0.70	2.65	0.69	2.62
New Zealand	1.14	2.82	1.31	4.23
Philippines	3.51	16.08	4.27	22.11
Singapore	1.34	3.13	1.46	4.38
Chinese Taipei	1.12	2.90	1.25	3.82
Thailand	2.58	4.11	3.11	5.06
United States	0.12	1.94	0.12	1.93
Latin America	0.00	0.55	0.01	0.59
West Europe	0.02	0.61	0.03	0.65
ROW	0.00	0.39	-0.01	0.38

APEC	0.06	1.90	0.07	2.14
Industrialized Economies <sup>2</sup>	0.02	1.41	0.02	1.41
Developing Economies <sup>3</sup>	0.42	4.02	0.45	4.78
East Asian NIEs <sup>4</sup>	0.11	1.61	0.13	2.27
ASEAN <sup>5</sup>	0.34	2.18	0.37	3.07
NAFTA <sup>6</sup>	0.02	1.66	0.02	1.65
CER	0.11	1.71	0.13	1.93
World	0.03	1.25	0.04	1.38

APEC	0.36	2.64	0.39	2.99
Industrialized Economies <sup>2</sup>	0.15	1.64	0.15	1.65
Developing Economies <sup>3</sup>	2.05	6.45	2.33	7.63
East Asian NIEs <sup>4</sup>	0.82	2.56	0.97	3.38
ASEAN <sup>5</sup>	3.08	5.28	3.56	6.66
NAFTA <sup>6</sup>	0.17	1.95	0.17	1.95
CER	0.48	2.20	0.50	2.44
World	0.20	1.65	0.22	1.84

Note:

1. "MAPA" includes the trade liberalization and facilitation measures in MAPA (not including UR commitment)
2. APEC Industrialized Economies consist of Australia; Canada; Japan; New Zealand; and United States
3. APEC Developing Economies consist of Chile; China; Indonesia; Malaysia; Mexico; Philippines; and Thailand
4. East Asia NIEs consists of Hong Kong, China; Korea; Singapore; and Chinese Taipei
5. ASEAN consists of Indonesia; Malaysia; Philippines; Singapore; Chinese Taipei; and Thailand
6. NAFTA consists of Canada; Mexico; and United States

**Table 5-2. Impact of MAPA<sup>1</sup> on Directions of Trade**

Dynamic

Exporter	Importer	2000	2010
WORLD	WORLD	1.65	1.84
ALL APEC	WORLD	2.64	2.99
APEC Industrialized Economies	APEC Industrialized Economies	1.75	1.69
	APEC Developing Economies	5.26	5.70
	East Asia NIES	2.16	1.99
	Non-APEC	0.13	0.15
APEC Developing Economies	APEC Industrialized Economies	6.34	7.35
	APEC Developing Economies	12.06	14.31
	East Asia NIES	8.06	8.88
	Non-APEC	4.91	6.33
East Asia NIES	APEC Industrialized Economies	1.31	1.39
	APEC Developing Economies	9.57	11.06
	East Asia NIES	1.84	5.11
	Non-APEC	0.25	0.74

Static

Exporter	Importer	2000	2010
WORLD	WORLD	1.25	1.38
ALL APEC	WORLD	1.90	2.14
APEC Industrialized Economies	APEC Industrialized Economies	1.62	1.58
	APEC Developing Economies	3.85	4.09
	East Asia NIES	1.77	1.52
	Non-APEC	0.25	0.29
APEC Developing Economies	APEC Industrialized Economies	4.31	5.00
	APEC Developing Economies	6.92	8.28
	East Asia NIES	4.85	5.32
	Non-APEC	2.67	3.61
East Asia NIES	APEC Industrialized Economies	0.85	0.84
	APEC Developing Economies	6.80	7.91
	East Asia NIES	0.92	3.98
	Non-APEC	-0.26	0.11

Exporter	Importer	2000	2010
ALL APEC	ALL APEC	3.58	3.96
ALL APEC	NON-APEC	0.89	1.19
NON-APEC	ALL APEC	1.98	2.19
NON-APEC	NON-APEC	-0.24	-0.32
ASEAN	ASEAN	9.04	11.23
ASEAN	NON-ASEAN	4.55	5.77
NON-ASEAN	ASEAN	4.50	5.38
NON-ASEAN	Non-ASEAN	1.22	1.29
NAFTA	NAFTA	2.43	2.40
NAFTA	Non-NAFTA	1.67	1.68
NON-NAFTA	NAFTA	2.10	2.19
NON-NAFTA	NON-NAFTA	1.41	1.71
CER	CER	-1.26	-3.26
CER	Non-CER	2.50	2.93
NON-CER	CER	2.56	2.89
NON-CER	Non-CER	1.62	1.81

Exporter	Importer	2000	2010
ALL APEC	ALL APEC	2.63	2.88
ALL APEC	NON-APEC	0.55	0.78
NON-APEC	ALL APEC	1.75	1.91
NON-APEC	NON-APEC	-0.16	-0.23
ASEAN	ASEAN	3.56	5.11
ASEAN	NON-ASEAN	1.91	2.68
NON-ASEAN	ASEAN	2.52	3.07
NON-ASEAN	Non-ASEAN	1.10	1.16
NAFTA	NAFTA	2.02	2.00
NAFTA	Non-NAFTA	1.45	1.43
NON-NAFTA	NAFTA	1.83	1.88
NON-NAFTA	Non-NAFTA	0.94	1.15
CER	CER	-2.04	-4.05
CER	Non-CER	2.03	2.44
NON-CER	CER	2.10	2.41
NON-CER	Non-CER	1.22	1.35

(NOTE)

1. "MAPA" includes the trade liberalization and facilitation measures in MAPA (not including UR commitment).
2. See Table 1 for regional aggregation
3. All regional figures are weighted average of individual figures.

Table 5-3. Impact of MAPA<sup>1</sup> on APEC Factor Usage

Dynamic

2000 (Percentage change)		
Industry	Labor	Capital
AGR	0.09	0.83
MNG	-0.59	1.14
PFD	-0.20	0.50
TXL	-0.42	1.08
CHM	-0.03	0.77
MTL	-0.07	0.70
TRN	0.14	0.80
OME	0.04	0.83
OMF	-0.07	0.80
EGW	-0.10	0.45
CNS	0.30	0.99
T_T	-0.13	0.91
OSP	-0.02	0.50
OSG	0.11	1.10

2010 (Percentage change)		
Industry	Labor	Capital
AGR	0.10	0.93
MNG	-0.60	1.33
PFD	-0.21	0.56
TXL	-0.46	1.35
CHM	-0.05	0.84
MTL	-0.06	0.85
TRN	0.08	0.85
OME	0.09	0.93
OMF	-0.07	0.88
EGW	-0.11	0.49
CNS	0.32	1.10
T_T	-0.13	1.02
OSP	-0.02	0.54
OSG	0.11	1.16

Static

2000 (Percentage change)		
Industry	Labor	Capital
AGR	-0.19	-0.09
MNG	-0.49	-0.47
PFD	0.00	0.01
TXL	-0.26	-0.06
CHM	0.04	0.01
MTL	-0.12	-0.13
TRN	0.08	0.03
OME	-0.02	0.08
OMF	-0.01	0.02
EGW	0.03	0.03
CNS	0.16	0.16
T_T	-0.08	-0.09
OSP	0.05	0.04
OSG	0.06	0.11

2010 (Percentage change)		
Industry	Labor	Capital
AGR	-0.20	-0.09
MNG	-0.50	-0.48
PFD	0.01	0.00
TXL	-0.27	-0.03
CHM	0.02	0.00
MTL	-0.11	-0.10
TRN	0.01	0.01
OME	0.02	0.13
OMF	-0.01	0.02
EGW	0.03	0.03
CNS	0.17	0.18
T_T	-0.07	-0.10
OSP	0.05	0.04
OSG	0.05	0.10

Notes:

1. "MAPA" includes the trade liberalization and facilitation measures in MAPA (not including UR commitment).

AGR	Agriculture, Forestry and Fishery	OME	Machinery and Equipment
MNG	Mining	OMF	Other Manufacturing
PFD	Food and Beverages	EGW	Energy, Water, and Gas
TXL	Textile	CNS	Construction
CHM	Chemicals	T_T	Trade and Transport
MTL	Metals	OSP	Other Services (Private)
TRN	Transport Equipment	OSG	Other Services (Government)

**Table 5-4. Impact of MAPA <sup>1</sup> on Production**

Dynamic					(percentage change)
2000	Output		Export Volume		
	Labor intensive <sup>2</sup>	Capital Intensive <sup>2</sup>	Labor intensive <sup>2</sup>	Capital Intensive <sup>2</sup>	
APEC Industrialized Economies	-0.11	0.15	2.35	1.79	
APEC Developing Economies	1.67	2.20	9.52	8.38	
East Asia NIEs	0.75	1.39	2.34	3.57	
World	0.10	0.30	2.43	2.08	

Dynamic					(percentage change)
2000	Output		Export Volume		
	Labor intensive <sup>2</sup>	Capital Intensive <sup>2</sup>	Labor intensive <sup>2</sup>	Capital Intensive <sup>2</sup>	
APEC Industrialized Economies	-0.12	0.14	2.59	1.76	
APEC Developing Economies	2.16	2.57	11.93	9.56	
East Asia NIEs	0.68	1.82	2.21	4.93	
World	0.12	0.33	2.83	2.32	

Dynamic					(percentage change)
2000	Output		Export Volume		
	Labor intensive <sup>2</sup>	Capital Intensive <sup>2</sup>	Labor intensive <sup>2</sup>	Capital Intensive <sup>2</sup>	
APEC Industrialized Economies	-0.15	0.00	2.25	1.53	
APEC Developing Economies	0.52	-0.12	7.98	5.62	
East Asia NIEs	0.33	0.40	1.87	2.39	
World	-0.03	0.07	2.11	1.60	

Dynamic					(percentage change)
2000	Output		Export Volume		
	Labor intensive <sup>2</sup>	Capital Intensive <sup>2</sup>	Labor intensive <sup>2</sup>	Capital Intensive <sup>2</sup>	
APEC Industrialized Economies	-0.16	-0.02	2.50	1.47	
APEC Developing Economies	0.76	-0.02	9.86	6.42	
East Asia NIEs	0.19	0.64	1.68	3.54	
World	-0.03	0.07	2.43	1.77	

Note:

1. "MAPA" includes the trade liberalization and facilitation measures in MAPA (not including UR commitment).
2. Labour Intensive Products includes Food and Beverages (PFD) and Textiles (TXL).  
Capital Intensive Products includes Chemicals (CHM), Metals (MTL), Transport Equipment (TRN), Machinery and Equipment (OME) and Other Manufacturing (OMF).
3. See the Note of table 1 for regional aggregate.

**Table 5-5-(1). Import of MAPA<sup>1</sup> on World Output and Export by Commodities**

DYNAMIC			STATIC						(Percentage Change)		
(Percentage Change)											
2000 COMMODITY	OUTPUT	EXPORT VOLUME	2010 COMMODITY	OUTPUT	EXPORT VOLUME	2000 COMMODITY	OUTPUT	EXPORT VOLUME	2010 COMMODITY	OUTPUT	EXPORT VOLUME
AGR	0.19	1.17	AGR	0.21	1.22	AGR	0.00	0.97	AGR	0.00	1.00
MNG	0.18	0.97	MNG	0.21	1.07	MNG	0.02	0.64	MNG	0.03	0.68
PFD	0.12	1.17	PFD	0.13	1.21	PFD	0.02	0.96	PFD	0.01	0.97
TXL	0.05	3.35	TXL	0.09	4.00	TXL	-0.12	2.95	TXL	-0.11	3.49
CHM	0.28	1.66	CHM	0.31	1.85	CHM	0.05	1.26	CHM	0.05	1.39
MTL	0.29	2.36	MTL	0.32	2.67	MTL	0.05	1.79	MTL	0.06	2.01
TRN	0.28	2.20	TRN	0.33	2.49	TRN	0.07	1.85	TRN	0.09	2.09
OME	0.40	2.24	OME	0.45	2.52	OME	0.12	1.64	OME	0.14	1.85
OMF	0.20	1.85	OMF	0.22	1.95	OMF	0.04	1.49	OMF	0.03	1.54
EGW	0.18	-0.26	EGW	0.20	-0.25	EGW	0.03	-0.36	EGW	0.02	-0.35
CNS	0.37	0.28	CNS	0.40	0.30	CNS	0.11	0.05	CNS	0.12	0.06
T_T	0.04	0.25	T_T	0.06	0.28	T_T	-0.12	0.03	T_T	-0.12	0.02
OSP	0.17	0.38	OSP	0.19	0.41	OSP	0.03	0.08	OSP	0.03	0.07
OSG	0.11	1.49	OSG	0.11	1.57	OSG	0.04	0.51	OSG	0.03	0.50

**Table 5-5-(2). Import of MAPA<sup>1</sup> on APEC Output and Export by Commodities**

DYNAMIC			STATIC						(Percentage Change)		
(Percentage Change)											
2000 COMMODITY	OUTPUT	EXPORT VOLUME	2010 COMMODITY	OUTPUT	EXPORT VOLUME	2000 COMMODITY	OUTPUT	EXPORT VOLUME	2010 COMMODITY	OUTPUT	EXPORT VOLUME
AGR	0.28	1.28	AGR	0.32	1.36	AGR	-0.07	1.23	AGR	-0.07	1.30
MNG	0.45	2.76	MNG	0.56	3.16	MNG	-0.50	0.51	MNG	-0.51	0.62
PFD	0.21	1.81	PFD	0.23	1.96	PFD	-0.01	1.36	PFD	-0.01	1.44
TXL	0.51	6.88	TXL	0.68	8.14	TXL	0.07	6.05	TXL	0.15	6.99
CHM	0.44	2.87	CHM	0.47	3.15	CHM	0.00	2.01	CHM	-0.01	2.18
MTL	0.31	3.34	MTL	0.38	4.05	MTL	-0.14	2.27	MTL	-0.12	2.75
TRN	0.39	2.78	TRN	0.42	3.02	TRN	0.05	2.36	TRN	0.05	2.55
OME	0.55	2.98	OME	0.65	3.44	OME	0.11	2.17	OME	0.16	2.53
OMF	0.37	2.94	OMF	0.40	3.11	OMF	0.04	2.28	OMF	0.04	2.35
EGW	0.30	-0.95	EGW	0.33	-0.78	EGW	0.03	-0.99	EGW	0.03	-1.02
CNS	0.62	0.64	CNS	0.68	0.79	CNS	0.20	0.34	CNS	0.21	0.26
T_T	0.21	0.24	T_T	0.24	0.31	T_T	-0.08	-0.22	T_T	-0.08	-0.24
OSP	0.28	0.54	OSP	0.30	0.62	OSP	0.05	-0.05	OSP	0.04	-0.06
OSG	0.20	0.90	OSG	0.20	0.96	OSG	0.07	0.43	OSG	0.06	-0.44

Notes:

1. "MAPA" includes the trade liberalization and facilitation measures in MAPA (not including UR commitment)
2. See Table 6. For commodity Aggregation

## Appendix 6

### ACRONYMS

AFTA	-	ASEAN Free Trade Area Arrangement
AIDS	-	Almost Identical Demand System
APEC	-	Asia-Pacific Economic Cooperation
CAPs	-	Collective Action Plans
CER	-	Closer Economic Relations Agreement
CES	-	Constant Elasticity of Substitution
CGE	-	Computable General Equilibrium
GATT	-	General Agreement on Tariffs and Trade
GDP	-	Gross Domestic Product
GTAP	-	Global Trade Analysis Project
IAPs	-	Individual Action Plans
ITA	-	Information Technology Agreements
MAPA	-	Manila Action Plan for APEC
MFA	-	Multifiber Arrangement
NAFTA	-	North American Free Trade Agreement
NTMs	-	Non-Tariff Measures
OAA	-	Osaka Action Agenda
OECD	-	Organization for Economic Cooperation and Development
PECC	-	Pacific Economic Cooperation Council
PSEs	-	Producer Subsidy Equivalents
R&D	-	Research and Development
STRAs	-	SubRegional Trading Arrangements
UR	-	Uruguay Round
VERs	-	Voluntary Export Restraints
WTO	-	World Trade Organization

## **REGIONAL NOTATION AND CLASSIFICATION**

### **APEC Industrialized Economies:**

- Australia
- Canada
- Japan
- New Zealand
- United States of America

### **APEC Newly Industrialized Economies (NIEs):**

- Hong Kong, China
- Korea
- Chinese Taipei
- Singapore

### **APEC Developing Economies:**

- Chile
- China
- Indonesia
- Malaysia
- Mexico
- Philippines
- Thailand

### **Latin America:**

- Central America
- Caribbean
- South America

### **Western Europe:**

- European Free Trade Area (European Union 15 plus other EFTA members)

### **Rest of the World:**

- All regions not otherwise classified

Note: In Table B of the Executive Summary, Table 5 and Table 7, “Rest of the World” includes Latin America and Western Europe.