Assessing APEC Trade Liberalization and Facilitation – 1999 Update

Asia Pacific Economic Cooperation

Economic Committee
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FOREWORD

Since its inception in November 1994, the Economic Committee has remained committed to providing analytical contributions to APEC's priority policy agenda of trade and investment liberalization and facilitation (TILF). Most notably, a study of *The Impact of Trade Liberalization in APEC* in 1997 was the first attempt to quantitatively assess the impact of APEC trade liberalization measures as set out in the Manila Action Plan for APEC (MAPA). The study concluded that the implementation of MAPA would result in substantial income gains and trade expansion in the APEC region. It provided momentum to APEC's ongoing liberalization agenda.

This year's research project, *Assessing APEC Trade Liberalization and Facilitation – 1999 Update*, has updated and expanded the 1997 study. Its aim is to provide an objective basis for considering and promoting trade liberalization and facilitation within APEC. As with the 1997 study, the 1999 study employs a sophisticated analytical tool (computable general equilibrium model) to assess ultimate gains from the trade measures committed to date by APEC economies. In addition, the 1999 study examines the role of competitive markets, the role of the public sector, and the scope for APEC's economic and technical cooperation (ECOTECH) programs.

Japan has led this project in collaboration with Singapore. Other economies have provided useful comments on earlier drafts. Special thanks are due to the project coordinator, Dr. Kazutomo Abe of Japan's Economic Planning Agency. Thanks are also due to Mr. Bradley Crofts, Director (Program) at the APEC Secretariat, for seeing this report through to publication.

Mitsuru Taniuchi

Chair, APEC Economic Committee
Tokyo, September 1999

HIGHLIGHTS

Assessing APEC Trade Liberalization and Facilitation – 1999 Update

APEC Economic Committee

1. APEC Trade Measures Boosts the Region's Income

- APEC trade liberalization and facilitation measures committed to date expand the region's annual income (GDP) by US$75 billion (at 1997 prices), or 0.4% of the region's total GDP.
  Income gains would amount to US$90-105 billion, if various dynamic effects are taken into account.
- The economies that liberalize most gain most.
  All APEC economies gain from trade liberalization and facilitation. The APEC developing economies, including the crisis-affected economies, generally enjoy higher gains.
- Model simulations of tariff elimination indicate that significantly greater income gains could be achieved.
  Annual income gains from tariff elimination amount to US$ 200 billion, or 1.2% of the region's GDP (including the effects of the remaining commitments under the Uruguay Round).

2. Trade Facilitation and Competition Policies – 1999 Policy Context

- Trade facilitation significantly contributes to income gains. The focus of the 1999 APEC process on facilitation is well justified.
  APEC trade facilitation measures committed to date expand the region's income (GDP) by US$46 billion (as noted above, US$75 billion when the effects of both liberalization and facilitation measures are included). If trade facilitation measures are further progressed, income gains could amount to US$64 billion.
- Competitive markets are essential for fully realizing benefits of trade liberalization and facilitation.
  Potential gains from trade measures would not be fully realized, if the mobility of production factors (capital and labor) is limited. It is important to highlight the linkage between domestic competition policies/regulatory reforms and trade liberalization and facilitation.

3. Adjustment Costs and Role of ECOTECH

- Given the significant net benefits of trade liberalization and facilitation, adjustment costs are unlikely to present an adequate reason for delays in opening trade to the world, as long as sound complementary policies are implemented.
- The public sector can play a role in reducing the cost of job transition for affected workers.
  Social safety net could be important in helping the most vulnerable groups adversely affected by liberalization. Policymakers should develop an adequate political strategy in support of liberalization.
- There is the scope for ECOTECH activities, in particular, for human resource development, to address the social safety net issues.

CHAPTER 1

INTRODUCTION

In the past two years, the APEC economies have experienced serious fluctuations due to the economic crisis. This has caused much stronger attention than ever before to the structural problems and long-term growth potential of economies in the region. In APEC, trade liberalization and facilitation were supposed to have been two major pillars of structural reform policies in the economies. Leaders in Kuala Lumpur believed that trade and investment liberalization was one of the cornerstones for renewed and sustainable growth. Leaders have also affirmed their commitment to the Bogor goals of achieving free and open trade and investment and that ongoing and ambitious liberalization is indispensable to the health of APEC economies. It is timely for APEC to conduct studies to examine trade liberalization and facilitation in the context of the linkage to long-run growth, as well as to other structural reforms such as competition policies.

The report of the Economic Committee project – *The Impact of Trade Liberalization in APEC* (1997 Project) – was published in 1997, and was the first attempt to quantitatively assess benefits of the APEC actions on trade liberalization and facilitation, using a Computable General Equilibrium (CGE) model. The 1997 project modeled the impact of measures largely included in the Manila Action Plans for APEC (MAPA), representing only a part of the liberalization further to be implemented under the Bogar commitments. The 1997 project estimated that the Manila Action Plan for APEC (MAPA) in 1996 would increase the gross domestic product (GDP) of APEC economies as a whole by 0.4 percent, or a permanent increase of US$69 billion per year. This substantial benefit is roughly equivalent to the total amount of global official development assistance. In November 1997 in Vancouver, the findings of the project contributed to APEC Ministers' reaffirming their strong belief that continued trade and investment liberalization and facilitation is essential to economic growth and equitable development in the region.

The 1997 report recommended further improving the methodology, analysis and database of the study. The recommended improvement of methodology and analysis included an introduction of the dynamic effects of liberalization, based on the endogenous growth theory, and more careful attention to adjustment costs, as well as the improvement of the CGE modeling techniques. The 1997 report also pointed out the importance of looking further into the inter-linkage between trade and investment, especially the impact of trade liberalization on direct investment. It becomes increasingly important now to examine the dynamic issues, especially after the economic crisis.

APEC action plans, including MAPA in 1996, have been "moving targets", to be improved, revised, and updated every year. Additional measures have come forward every year since 1997, reflecting the updated Individual Action Plans. In addition, in its process in 1999, APEC has put a stronger focus on trade facilitation in supporting and reinforcing liberalization. Trade facilitation, together with tariff reduction, is oriented toward more workable markets with lower trade costs, and accordingly ensures a solid base for growth. Deeper analyses on the trade facilitation would be timely, in particular in 1999.

Finally, APEC Senior Officials in Wellington identified potential linkages between the

work of the Economic Committee and prospective policy dialogues. Timely study on policy related issues would surely reinforce the recent endeavors in APEC.

With that background, this study updates, refines and expands the analysis of the 1997 Project. While the major objective is maintained as quantitatively assessing the impact of trade liberalization in APEC, the scope is significantly widened. Following the introduction, this report is divided into four chapters. Chapter 2, covers the updating and refining of the estimates of the impact of trade liberalization and facilitation in APEC. Using an updated CGE model, the study assesses the Individual Action Plans (IAPs) up to 1998, and Collective Action Plans (CAPs). Estimations of tariff elimination and full trade facilitation will be made by using an updated CGE model. Limitations of the model simulation and some factors which cannot be covered by the model will be examined.

Chapter 3, focuses on dynamic aspects of trade liberalization. The dynamics and adjustment processes in economies are looked into in more detail than in the 1997 study. An econometric regression analysis is adopted to estimate a growth function. Dynamic aspects, such as the effects of openness of the economy on the long-term growth through more active domestic investment, promoting competition, and attracting direct investment inflows together with technology transfer are discussed. Attention is paid to the adjustment process and costs caused by trade liberalization, drawing on the literature. Discussion of the costs and benefits will add to the realism of the study, as well as shed light on the active role of public sectors in mitigating the costs and facilitating the movement of resources.

CHAPTER 2

UPDATE OF MODEL ESTIMATE

The 1997 Project, *The Impact of Trade Liberalization in APEC*, was the first attempt to quantitatively assess the benefits of APEC action plans to liberalize and facilitate trade, using simulations in a Computable General Equilibrium (CGE) model. The 1997 Project found that the benefits from the Manila Action Plan in APEC (MAPA) in 1996 would be substantial. The simulation indicated that 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. The impact is equivalent to one fourth of the full impact of implementation of the Uruguay Round (UR) trade liberalization. All APEC members gain, albeit in different magnitudes. The impact of trade facilitation activities in MAPA, such as the streamlining of customs procedures, exceeds that of trade liberalization, i.e. tariff reduction. This reflects the fact that most of the liberalization required to achieve free trade and investment was not reflected in the MAPA. While most of the MAPA measures were unilateral and non-discriminatory, the gains to APEC economies will be much larger than those to non-APEC members. Thus, free-rider gains flowing from APEC trade liberalization and facilitation are small, and therefore, should not be a concern.

In November 1997 in Vancouver, the findings above contributed to APEC Ministers' reaffirming their strong belief that continued trade and investment liberalization and facilitation is essential to economic growth and equitable development in the region. They noted that studies undertaken within APEC's Economic Committee (the 1997 Project and other related studies by the Committee), confirmed that timely implementation of commitments made by member economies under the Manila Action Plan for APEC would significantly increase trade and output in the APEC region and in the world more generally.

Two years have now passed since the publication of the former study. Several new demands have arisen on updating the existing CGE component of the 1997 study. New members joined APEC at the Ministerial Meeting in Kuala Lumpur in November 1998. Broader membership should increase the total benefits of trade liberalization in APEC. Observing the commitment to continuous improvement of Individual Action Plans (IAPs), the members updated their own IAPs twice in 1997 and 1998, after MAPA was published. It would be desirable to update the existing CGE estimate on the impact of revised IAPs on each individual member economy including the new members. It would be also desirable for the estimates to reflect the progress in Collective Action Plans (CAPs) in APEC, including trade facilitation actions.

There has been a significant improvement in the modeling tools. Most notably, the database of the CGE Model used in the 1997 study has been totally updated. The new database, based on 1995 trade data, reflects more recent trade and industrial structures in the world. In the context of APEC, this updating will provide us with pictures which reflect the rapid growth of Asian economies in early 1990s.

Chapter 2 contains the study to update the estimates of the CGE model on the benefits of APEC trade liberalization and facilitation. First, the simulation model structure, together with the theoretical background, is briefly presented. A review follows, on the revision of

IAPs and CAPs since 1996. The revisions are quantified into simulation inputs, which are fed in to the updated CGE model. Then the simulation results are analyzed, together with clarifications of the nature and limitation of the estimates, and their implications. Finally, a simulation is made of the impacts of tariff elimination and full trade facilitation.

ANALYTICAL FRAMEWORKS

Trade Theory Framework and Its Expansion

The common analytical framework underpinning empirical studies using CGE models is the classical trade theory. The 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. Comparative advantage theory–associated with the work of Ricardo and Heckscher-Ohlin–explains the origins of trade and the gains from trade on the basis of the relative differences in factor endowments between economies. By specializing in goods that suit local conditions, and trading these for other goods that are produced with comparatively greater efficiency in other economies, each economy will have a higher real income than if there were no trade. This is the basic motivation behind trade and an explanation for the broad pattern of trade in the world economy.

In this trade 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, lowering import prices to the domestic market and increasing imports. Cheaper imports, in turn, lead to lower production costs for some domestic industries. At the same time, labor and capital move from formerly protected sectors to more efficient sectors of the economy. 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.

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.[1] In fact, in the Asia-Pacific region, intra-industry trade, or two-way trade in the same product category, represents a 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" term which assumes that products within the same product category but originating in different economies are imperfect substitutes.[2] 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

1 The principal reference on this topic is Helpman, E. and Krugman, P., *Market Structure and Foreign Trade* (1985).

2 Armington, P.S., "A Theory of Demand for Products Distinguished by Place of Production," *International Monetary Fund Staff Papers vol. 16, No.1*, 1969, pp. 159-178 .

perfect substitution, will dampen the effect of the buyers' responses to changes in the relative prices of competing goods from different economies. The Armington assumption is consistent with perfect competition.

Computable General Equilibrium Model

To date, many empirical studies have been conducted to estimate the impact of the Bogor goal of free and open trade and investment as well as the gains from the outcomes of the Uruguay Round.[3] most of which used CGE models. The CGE model in essence is an application of neoclassical theory and, in its international trade dimension, of the classical trade theory.[4] A CGE model consists of equations that represent the demand and supply conditions of the sectors of the economies. The sectors in the model 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.

The CGE model in its international versions 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 the policy change or shocks are initiated. The effects then spread through linkages to adjacent sectors at home and into the markets of trading partners.

The 1997 Project adopted a CGE model of Global Trade Analysis Project (GTAP), which provided generic model equations as well as a complete data set. The GTAP model adopted standard and classical assumptions, while the model assumes an Armington approach and constant elasticity of substitution in both household and firms behaviors.[5] Model parameters were empirically estimated, and various economic variables, such as income, employment and trade, are taken from authorized data sources.

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3 Francois, J. et. al., "A User's Guide to Uruguay Round Assessments." and Scollay, R. and Gilbert, J., "Measuring the Gains from APEC Trade Liberalization: An Overview of CGE Assessments," submitted to the *APEC Study Center Consortium*, Auckland, NZ, June 1999.

4 The explanation in this sub-section benefits from, "The Results of the Uruguay Round of Multilateral Trade Negotiations", *General Agreement on Tariffs and Trade* (1994).

5 For detail, see Hertel, T. eds., *Global Trade Analysis: Modeling and Applications*, (1996), Cambridge University Press.

While the 1997 Project used GTAP database version 3, it was updated and the revision released in December 1998 as version 4. The updated database includes new features as follows:

- The base year for the database is now 1995. 1992 was used version 3.
- The version 4 database significantly expands its sectoral classifications and regional coverage.
- Considerable numbers of regional input-output tables have been updated in version 4.

With this update, the simulation may better reflect the rapid development in early 1990s in Asian economies. This is particularly important for any trade policy assessment in APEC region.

APEC ACTIONS UPDATED AND QUANTIFICATION OF APEC MEASURES

Rapid progress in APEC trade liberalization has been made since the late 1980s, including significant advance 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. The Uruguay Round of the GATT, which was completed in December 1993, complemented the unilateral tariff reforms. The UR served to bind the applied tariff that had already been lowered by the unilateral reforms. Following the adoption of the Bogor Declaration, APEC leaders announced their package of Osaka Action Agenda (OAA) in November 1995, which provided the template for future APEC work toward the common goals. The first action plan, based on the OAA, was published in 1996 in Manila, i.e. Manila Action Plan for APEC (MAPA).

Since 1996, the APEC Ministers have annually reaffirmed their commitment to achieve APEC's trade and investment liberalization goals through the process of individual and collective actions. Ministers continued to view trade and investment liberalization as an important element in restoring confidence in the region and in stimulating economic growth. In the 1998 Ministerial meeting, Ministers endorsed the submission of improved 1998 IAPs and welcomed the IAPs of the three new members. Ministers were encouraged by the continued implementation and improvement of the plans, particularly by economies affected by the financial turmoil. Ministers also called for further development of the CAPs and their implementation in 1999. In particular, Ministers called for intensification of the work on trade facilitation that encourages the use of technologies and techniques which will help members to build up expertise, reduce costs and lead to better movement of goods and services.

Recently, particularly in 1999, APEC has reaffirmed the importance of IAPs and CAPs. For instance, the Senior Officials' Meeting (SOM) in February 1999 reaffirmed the central role of IAPs and CAPs in progressing work towards the achievement of APEC's trade and investment liberalization and facilitation goals. Recalling the instructions of Ministers and Leaders, the SOM confirmed the importance of continuing to improve IAPs annually. The SOM agreed that a thorough and comprehensive 'stocktake' of progress on IAPs in 1999 would be helpful in enhancing APEC's credibility and would provide a valuable indication of APEC's progress towards the Bogor Goals in accordance with the principles, objectives and guidelines of the Osaka Action Agenda (OAA). The SOM also reaffirmed the

importance of the CAPs and the role of Committee on Trade and Investment (CTI) in their implementation and development.

The 'modelable' measures in the APEC action plans are limited to the reduction of tariff and trade facilitation.[6] Reliable quantitative assessments are not available for other measures, such as those in government procurement, intellectual property rights and dispute mediation. In the following report, the quantitative assessment covers only the tariff reduction and trade facilitation measures which were included in IAPs and CAPs up to 1998. First, quantification is made of the measures to make input data suitable to be fed into the CGE model.

Further Tariff Reduction in Individual Action Plans since 1997

Since 1997, commitment to tariff reduction by the APEC members has been in the form of revision in IAPs. The following Table 2-1 summarizes the tariff reduction statements included in MAPA and IAPs in 1997 and/or 1998 (IAP97/98). In the table, the MAPA tariff reductions contain only "Uruguay Round Plus" measures that are beyond the UR commitments, so do IAP97 and IAP98. The reference year is 2010, following the methodology of 1997 Project. That means the table lists all the measures which are indicated to be implemented on or before the year 2010. It should be noted that the table only includes the measures that can be quantified.

Some of the descriptions in the IAPs do not contain sufficient information to obtain precise figures. Owing to the lack of a rigorous standard format in the 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 the information gaps.

As of the end of June 1999, the IAPs 1999 have not been finalized. However, the preliminary plans for 1999 IAP improvements and reports on implementation demonstrate continued commitments to APEC's trade and investment liberalization and facilitation goals, as well as heightened recognition of the importance of strengthening markets and improving trade facilitation.

6 PECC attempts to quantitatively asses the progress of the IAPs toward the Bogor target. See I. Yamazawa and S. Urata, *Trade and Investment Liberalization and Facilitation*, (1999), submitted to 25th Pacific Trade and Development Conference on APEC.

Table 2-1: Quantified IAP "UR Plus" Tariff Reductions in 2010

Economy	MAPA Tariff Reduction: Items	MAPA	IAP97/98
Australia	• max. 5% except for below: - passenger motor vehicles - textile clothing and footwear - certain vegetables • ITA [1]	current rates (0 - 5%) 15% 10-25% 5% (1998) 0%	– 10% 7.5-17.5% – 0%
Brunei Darussalam	• progressive liberalization towards zero tariff to 2020	82% of total tariff lines bound at 5%	82% of total tariff lines bound at 5%
Canada	• all original equipment automotive parts and articles • reduction in GPT rates • ITA[1]	0% (on 1996) 0% 0%	– – 0%
Chile	• almost all products	0%	0%
China	• simple average tariff • industrial products • ITA 185 products	around 15% – –	around 15% 10.8% 0%
Hong Kong, China	• bind tariff at 0% on all imports • ITA[1]	0% 0%	0% 0%
Indonesia	• items with surcharges and tariffs of 20 % or less in 1995 (except automotive parts) • items with surcharges and tariffs of more than 20% in 1995 (except automotive parts) • chemicals, steel, metal and fishery products • ITA[1]	max. 5% by 2003 max. 10% by 2000 5-10% by 2003 0% by 2005	max. 5% by 2003 max. 10% by 2000 5-10% by 2003 0% by 2005
Japan	• expand Tariff Elimination Initiative on pharmaceuticals by 2000 • ITA[1]	– 0%	– 0%
Korea	• ships from 1997 • ITA[1]	0% (from 1997) 0 % by 2004	– 0% by 2004
Malaysia	• ITA[1]	0% by 2005	0% by 2005
Mexico	• elimination of tariffs on certain electronic components, and computers equipment	–	–
New Zealand	• all imports • ITA[1]	duty free 0% by 2006	duty free 0% by 2006
Papua New Guinea	• reduce to 5% tariff on basic steel, aluminum, capital equipment, machinery, basic chemicals. Chemical agricultural inputs by 1997	By 2006 bound at 30% for nonagricultural products	By 2006 bound at 30% for nonagricultural products
Peru	–	–	–
Philippines	• all imports, except sensitive agricultural products	One uniform rate of 5%, except sensitive agricultural products by 2004	One uniform rate of 5%, except sensitive agricultural products by 2004
Russia	–	–	–
Singapore	• progressive binding of tariffs at 0% by 2010 • ITA[1]	0% 0%	0% 0%
Chinese Taipei	• average tariffs • ITA[1]	Around 6% average nominal tariff rates and applied rate of 5% or lower on about 65% of tariff lines 0% by 2002	Around 6% average nominal tariff rates and applied rate of 5% or lower on about 65% of tariff lines 0% by 2002
Thailand	• ITA[1]	0% by 2005	0% by 2005
USA	• ITA[1]	0%	0 %
Viet Nam	–	–	–

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

Trade Facilitation Actions

Trade facilitation has been a salient feature of the APEC process. Trade facilitation generally means any trade measures to reduce trade costs, but excluding trade liberalization measures, such as tariff cuts. Typically and traditionally, trade facilitation means the move toward a paperless and harmonized customs system, and conclusion of a Mutual Recognition Arrangement on Conformity Assessment for Standards and Alignment with International Standards. These facilitation measures are in most cases included in CAPs.

Since 1997, APEC has advanced progress with the enhancement and implementation of CAPs. In particular, APEC Ministers in Kuala Lumpur in 1998 called for intensified work on trade facilitation. In addition, Ministers agreed that economies commence implementation of the facilitation and Economic and Technical Cooperation (ECOTECH) initiatives as agreed in all nine sectors of Early Voluntary Sectoral Liberalization (EVSL), implementation of those agreed in the other six sectors, and that additional facilitation and ECOTECH initiatives be developed on a continuous basis.

The trade facilitation initiative in general has received more attention in APEC in 1999. Recent success stories stand out (i) in trade administration, recent initiatives are the multi-faceted approaches to promote "paperless trading" in the region; (ii) standards related work is gaining momentum; (iii) five of six non-binding principles on government procurement have been agreed, and the sub-committee in charge aims to deliver the full suit of principles this year; (iv) business mobility has been enhanced by use of multiple entry visas, and the APEC Business Travel Card trial; and (v) sector-specific initiatives demonstrate a direct link between facilitation work and market access.

The 1997 Project quantitatively assessed the trade facilitation measures in APEC. The magnitude of the estimated benefits, about three times as large as the effect of tariff cuts in MAPA, proved the value of trade facilitation. The 1997 Project quantified the cost reduction effects by using the survey results of existing literature: the Cecchini Study on intra-EC trade facilitation; the United Nations Conference on Trade and Development (UNCTAD) study; and a study by the Australian Industry Commission (IC95). Table 2-2 below summarizes the major findings of the studies.

Table 2-2: 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	1.6-1.7% of total intra-EC trade value for administrative costs to firms. (Approximately 5% if lost business opportunities are included.)	Surveyed using extensive interviews of firms in the area.
	Removing barriers affecting overall production (protective public procurement, divergent technical standards and other restrictions)	2.0-2.4% of GDP in the area	Assessed using 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 the 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	5% of total trade value	The figures are used for inputs to the CGE model.
	- Direct cost savings from above plus a more extensive set of facilitation measures.	10% of total trade value	

(Source): *The Impact of Trade Liberalization in APEC,* APEC Economic Committee, (1997).

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.[7] This is smaller than those in the UNCTAD study, since it covers more narrowly defined trade facilitation measures that address direct costs reduction.[8] 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[9]. 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, that is, 2-3 percent of total import value. The UNCTAD recommendations on trade facilitation are largely comparable to undertakings in the OAA, which influenced the MAPA. It should be noted, however, that the

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

8 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).

9 UNCTAD, Columbus Ministerial Declaration on Trade Efficiency, premble.

recommendations include not only the traditional trade facilitation measures, but also some measures which can be classified in non-tariff measures (NTM) reductions.

The Australian Industry Commission made an extensive analysis of APEC trade facilitation, as well as trade liberalization.[10] This study adopted 5 percent and 10 percent reductions of total trade value as the impact of the facilitation measures in the OAA. The figures are empirically based on a series of research papers of UNCTAD[11] and the Cecchini Report.[12] The IC95 report adopted a 5 percent cost reduction for the completion of the Bogor Declaration, since it covered some actions on facilitation of investment flows.

The 1997 Report concluded that the range of 2 to 3 percent of total import value was a consensus of the potential direct cost savings from various trade facilitation measures. The Project, accordingly, used 1 percent of import prices for the direct cost savings from trade facilitation for the industrial economies and the newly industrializing economies of Korea, Chinese Taipei and Singapore, and 2 percent for the other developing economies. These estimates are on the conservative side, in the range of about half the consensus estimates.

The estimated figures in 1997 Project are confirmed by new empirical information on direct cost savings. A survey of Japanese manufacturing and trading companies was conducted by the Ministry of International Trade and Industry in Japan (1998)[13], which provided more detailed information for assessing the impact of trade facilitation in the Asian developing economies. According to the survey, feasible cost reduction from narrowly-defined facilitation is around 2 percent of import prices for most of the Asian developing economies. The specific impacts differed among economies and sectors. Without sector-specific information however, an across-the-board cost reduction would be the most realistic approach for the estimate of the effect of trade facilitation.

SIMULATION METHODOLOGY AND MODEL SPECIFICATION

Simulation Methodology

Generally, a model simulation is conducted by applying two different input data sets to the model, and taking the difference in the resulting values of the endogenous variables in the model. The difference between the input data sets is the exogenous shock. In the case of trade policy simulation, the shocks are the changes in the protection level, calculated from the tariff lines on a sector-by-sector basis. In this project, various shocks to the international economy since 1996 have taken into account. Such shocks include the remaining commitments of UR, MAPA and IAP97/98. The Figure 2-1 below illustrates schematically the shocks to the model. The baseline case is the implementation of remaining UR commitment only, represented by the straight line AB. The controlled cases reflect the

10 Dee et al, The Impact of APEC's Free Trade Commitment, Industry Commission of Australia.

11 UNCTAD, Columbus Ministerial Declaration on Trade Efficiency, (1994).

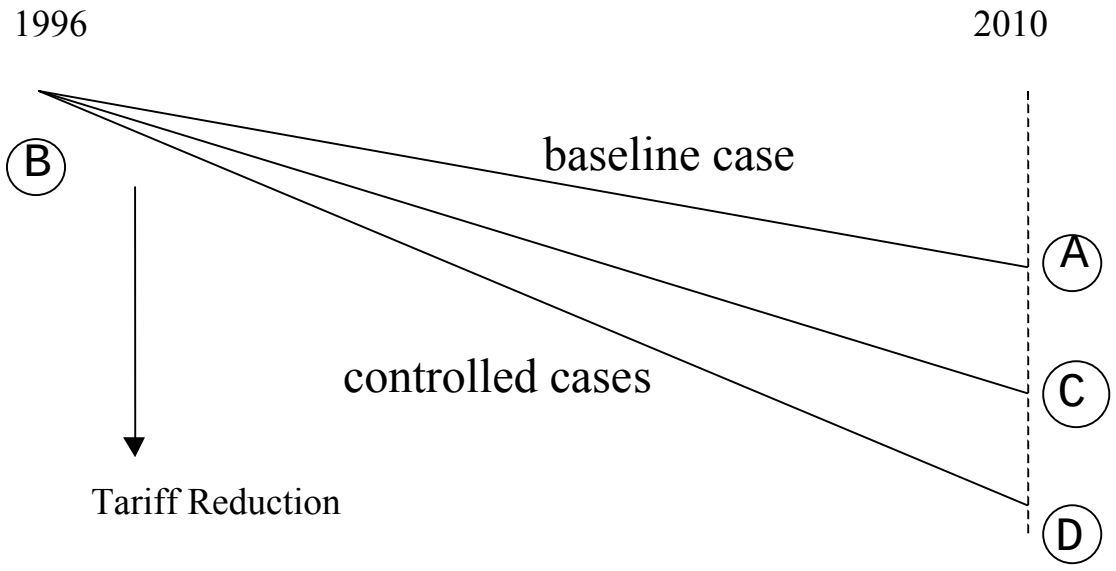
12 The Committee of European Communities conducted extensive studies on the EC market integration, including Paolo Cecchini with Michael Catinat and Alexis Jacquemin, "The European Challenge 1992" (1988); and "The Economics of 1992," *European Economy,* No.35, March 1988.

13 Ministry of International Trade and Industry in Japan, *Report on Asia-scale Industrial Structure Policies*, (1998) (written in Japanese). For detailed analysis, see Kawasaki, K., *Applications of the Computable General Equilibrium Model: Simulation Analysis on Trade Liberalization and Regulatory Reform*, (1999), Tokyo (written in Japanese). The costs from administrative procedures rest within the range of 0.5-1.2 percent for transportation machinery, and 0.5-2.4 percent for machinery and equipment.

exogenous shocks; that is, tariff reductions from MAPA only, and those of MAPA and IAP97/98, represented by the lines AC and AD, respectively.

Figure 2-1: Illustration of Database Time Points and Cases[14]

	Time Point	Cases
A : Base Year	1996	–
B : UR	2010	Baseline
C : UR+MAPA	2010	Controlled
D : UR+ MAPA+IAP97/98	2010	Controlled



In addition to the tariff reduction, the effect of other measures that reduce trade costs, such as trade facilitation, should be treated as shocks to the model. Intuitively, the implementation of cost-reducing measures is similar to a downward shift in the supply line 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 of a simple tariff reduction) by the amount of productivity gain in the international transport sector.[15] The 1997 Project adopted the approach of productivity gain. This is justified and is again adopted in this study again, since most of the trade facilitation measures appear to provide real efficiency improvement. It is assumed that the efficiency improvement will take place on or before the reference year 2010.

Model Specifications

14 These figures describe the images of tariff reduction schedules only, and are not based on actual schedules.

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 Abe, K. *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.

In 1997 Project, the simulation model consisted of 14 sectors and 19 regions. All APEC economies, except for Brunei, Papua New Guinea and Peru were individually disaggregated.[16] Reflecting the entry of the new members since 1999, this study includes Russia and Viet Nam, resulting in a model with 14 sectors and 21 regions.

The model specifications are identical to those of the 1997 Project, assuming perfect competition and constant returns to scale technologies, and incorporating a medium-term income-savings-investment linkage to capture dynamic effects. Constant returns to scale and perfect competition are assumed in order to retain model stability.

The model 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 resulting from trade liberalization measures stimulates savings and investment. The increase in investment, in turn, contributes to the accumulation of capital stock, and generates a further increase in income through more capital inputs.[17] 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, and it must be stressed that this method reflects only part of the dynamic effects that can be expected over the medium-term. The dynamic specification was adopted as the standard because it is likely to be closer to reality.

However, many possible dynamic effects that would go well beyond these gains are still not taken into account. Recent applied research on trade liberalization has stressed the importance of dynamic effects, not only in stimulating domestic investment, but also stimulating direct investment, pro-competitive effects and technology transfer. Chapter 3 of this report will examine further the dynamic effects that could not be covered here.

Finally, the original GTAP database is slightly modified in the case of Hong Kong, China. The original data set for Hong Kong, China includes a negative savings rate that reflects an underestimate of re-exports or investment and overestimate of consumption. Based on the actual figures in 1995, some of the government consumption has been moved to investment, which amounts to 10 percent of GDP, as the minimum amendment.

Nature of the Estimates of the Simulation

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 are higher than they otherwise would have been if the liberalization had not taken place. The Australian Industry Commission (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

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

17 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.

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.[18]

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, IAPs, CAPs and UR packages.[19] 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 1995 benchmark economy on which the estimates for 2010 are based. Dynamically, long-run outcomes can depend on the basecase forecasts and incorporating growth in the basecase may lead to larger gains from trade. Furthermore, APEC action plans, including IAPs and CAPS, 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 Appendix 3 to avoid quoting a single number for the estimate.

Considerations on Non-modelable Factors

The model estimates indicate long-run net benefits, where the short-run adjustment costs are not explicit. This issue is briefly discussed in Chapter 3. In addition, there will be various "non-modelable" factors. External economies and diseconomies are usually involved in the production process. External economies and diseconomies can lead to desired production, consumption, and trade levels different from those which would be determined by the market mechanism alone. When externalities generate a desired solution different from a supply-demand market equilibrium, the public sector is frequently expected to play an important role in assigning costs and allocating benefits. These externalities may reach beyond national borders, and can entail trade-offs between neighboring economies or trading partners. This implies that the equilibrium results indicated by the CGE models may not necessarily give an optimal solution, if there are significant externalities. Despite the constraints, it should be noted that the existence of externalities does not usually imply that the liberalization itself is not optimal. The issues of environmental protection and the management of natural resources are also important. These limitations may also occur in the growth function approach in Chapter 3, if higher growth of per capital GDP involves more external diseconomies, such as greater pollution.

SIMULATION AND ESTIMATED IMPACTS

The CGE model simulations measure the likely trade and real income effects from implementation of trade measures in APEC. The trade effects represent the changes in the volume of merchandise exports and/or imports. The real income effects mean that the liberalization and facilitation create larger incomes than there would otherwise be 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.

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18 Dee et al,. *The Impact of APEC's Free Trade Commitment*, pp. 4-5.

19 GATT, The Results of the Uruguay Round of Multilateral Trade Negotiations.

Database Updates and Consistency of the Estimates

Before examining the impacts of APEC trade liberalization, it would be useful to discuss the consistency between the simulation results obtained from version 3 and 4 of the database. To test this, the two simulation are conducted under the exactly same model specification and same shocks but using different database versions. One simulation is the replica of the simulation in the 1997 Report that used database version 3, and the other, with same model specification but using database version 4. Table 2-3 demonstrates that the results are almost identical in the estimates of the impact of the MAPA.

Table 2-3: Comparison of Impacts of Trade Liberalization and Facilitation (Effects on APEC Member Economies)

	Export Volume		Real Income	
	Version 3	**Version 4**	**Version 3**	**Version 4**
UR commitments	9.1	8.29	0.9	0.77
MAPA	2.99	2.97	0.39	0.42
UR and MAPA	12.1	11.25	1.3	1.18

Source: Economic Committee, *The Impact of Trade Liberalization in APEC* (1997), and Ono, M., submitted to the Experts' Seminar on Impact of Trade Liberalization, Tokyo, June 1999.

Rather surprisingly, the estimates of the real income effect on APEC as a whole are almost the same, while there are differences in the impacts on individual economies. This implies that changes in the world trade and economic structure during 1992-1995 have had little effects on the impact of trade liberalization on APEC as a whole. The CGE model measures the efficiency gains for shares, of which, in essence, the individual economies compete with each other. The trade structure may affect the share of each economy, but the effects on the region as a whole remain the same, as the size of the 'pie' is determined by the magnitude of the distortion from trade barriers in the region that are assumed to remain. The consistency of the estimates may provide stronger confidence in the simulation results based on the new database.

Trade Effects

Table 2-4 summarizes the estimated trade effects in 2010. Owing to the structure of model, the trade balance of each economy remains constant. The rates of change in the volume of merchandise exports approximate the magnitude of the trade effects. The base year of the simulation is set at the year 1996. This means that there are some remaining commitments under the UR. The simulation result indicates that the remaining UR commitments will increase the volume of merchandise exports of APEC economies and the world by about 7.9 percent and 5.3 percent, respectively. If APEC commitments are also implemented, the figures will be about 10.7 percent and 6.6 percent. Therefore, the net effects of APEC measures on exports from APEC and the world would be approximately 3.3 percentage points and 1.6 percentage points, respectively. APEC action plans will increase the UR trade effects by approximately one-third in the case of APEC member economies.

As the results are generally comparable to those in the 1997 study, the estimates are considered to be within the range of plausible figures for the trade effects of APEC measures. It is likely that the estimated impacts of APEC measures would be larger if the specification of imperfect/monopolistic competition could be adopted in the model.

Table 2-4: Trade Effects of APEC Trade Liberalization and Facilitation
Estimated Change in Merchandise Export Volume in 2010
(Contribution to Changes, Percent)

Initiatives	APEC	World
UR Commitments	7.9	5.3
APEC: Total	3.3	1.6
(Liberalization)	(2.0)	(1.0)
(Facilitation)	(1.3)	(0.6)
UR and APEC	10.7	6.6

Notes:
1. Base year for simulation: 1996.
2. The dynamic version of the model is used, assuming constant returns to scale and perfect competition and allows capital accumulation through the income-investment linkage.
3. "APEC: Total" covers individual action plans up to 1998, collective actions up to 1998, Osaka Initial Actions, and the Information Technology Agreement.
4. "UR and APEC" is the sum of the impacts from the UR commitments and "APEC: Total".

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, in part, reflects an aspect of the trade diversion effect.[20] 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. However, trade diversion for other economies and third parties may also occur. 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.[21]

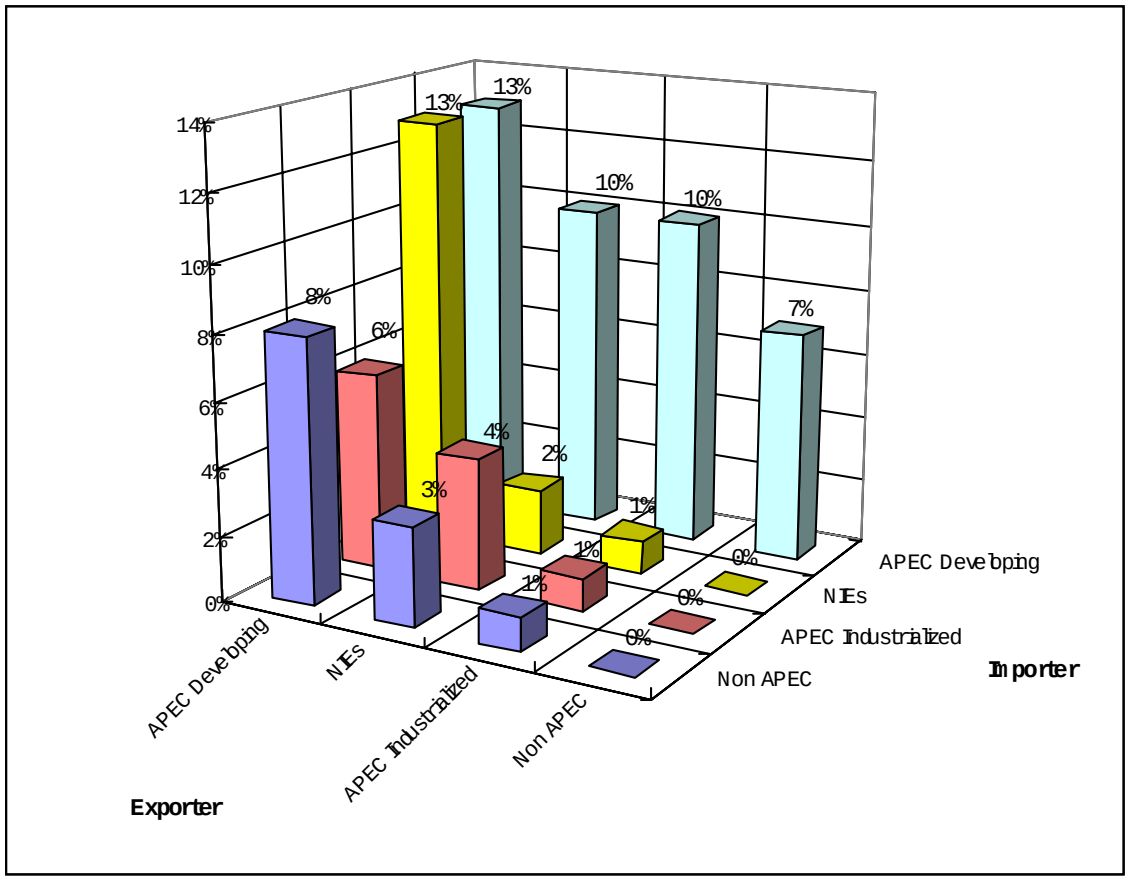
APEC trade liberalization is, in principle, on a unilateral and non-discriminatory basis. Therefore, significant trade diversion, i.e. the shift of trade flows from inter-regional (between APEC and non-APEC) to intra-regional (within APEC), would not be expected. It is, however, expected that the growth rates of exports and imports may diverge, reflecting the degree of liberalization and trade interaction among the region.

Indeed, Figure 2-2 demonstrates the increase in all the intra-regional and inter-regional trades, except for exports from non-APEC to non-APEC and the exports from non-APEC to APEC industrialized economies. Intra-APEC trade generally increases by a much larger rate than inter-regional trade. Notably, the highest increase in exports, around 13 percent, is found in the two bilateral exports, "from APEC developing economies to Asia NIEs" and "from APEC developing to APEC developed economies". This may reflect the higher impacts on the efficiency gains and capital accumulation in the APEC developing economies, which in turn increase real income, exports and imports. This is supported by the finding in Figure 2-2 that the imports of APEC developing economies will also grow rapidly. The APEC trade liberalization and facilitation measures will stimulate inter-regional trade, which will contribute to economic recovery, particularly in APEC developing economies.

20 The trade diversion effects in wider sense indicates a shift of imports from a more efficient non-member to a less efficient member of the region.

21 See *The Impact of Subregionalism on APEC*, APEC Economic Committee, (1997). This study includes the estimates of trade and income effects of MAPA on ASEAN, NAFTA and CER, using the version of the model used by the 1997 study.

Figure 2-2 Impact on Bilateral Trade



Notes:
1. APEC Developing, includes Russia.
2. Change in export volumes.

Effects on Real Income

Trade liberalization and facilitation create gains in real income, which are initiated from efficiency improvements. Real income and production become higher than they would have been without the liberalization and facilitation. In the specification of the model adopted here, the initial efficiency improvement induces capital accumulation that creates further increases in real income. The income gains in money terms are usually smaller than those of trade effects.[22]

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

22 GATT, "The Results of the Uruguay Round of Multilateral Trade Negotiations" (1994), pp. 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."

is expressed in 1997 US dollars. It should be noted that the numbers in money terms tend to be larger as time passes and the economies grow.

Table 2-5 summarizes the real income effects of the APEC measures by 2010 of the APEC measures and remaining UR commitments, in terms of both money amounts in 1997 US dollars and in percentage changes. In the APEC economies as a whole, the remaining UR commitments will create annual income gains at the level of about US$114 billion. Implementation of APEC commitments will further increase the gains to the level of US$189 billion for APEC members. The net gain of APEC measures to APEC economies, amounts to more than half of the impact of the remaining portion of the UR which had not been implemented as of 1996. Attention should also be given to placed on the magnitude of the remaining UR commitment and APEC measures that add up to US$189 billion. This large amount reflects the potential benefit which can be expected from the implementation of the remaining measures to which economies are already committed.

The estimated figure may be larger, if the model captures wider rage of dynamic gains. According to McKibbin (1999), which makes an effort in incorporating the linkage of total factor productivity growth to tariff change. The paper identified significantly larger gains compared to the standard CGE estimates.[23]

Table 2-5: Estimated Change in Real Income in APEC
Impact of Trade Liberalization and Facilitation
(Contribution to Changes, Percent)

Initiatives	APEC		World	
	Amount (US$ Billion in 1997)	Percentage Change (GDP)	Amount (US$ Billion in 1997)	Percentage Change (GDP)
UR Commitments	113.8	0.7	154.9	0.5
APEC: Total	75.3	0.4	79.9	0.3
(Liberalization)	(29.5)	(0.16)	(30.5)	(0.10)
(Facilitation)	(45.8)	(0.25)	(49.4)	(0.15)
UR and APEC	189.1	1.1	234.8	0.8

Notes:
1. Base year for simulation: 1996.
2. The dynamic version of the model are used, assuming constant returns to scale and perfect competition and allows capital accumulation through the income-investment linkage.
3. "APEC Total" covers individual action plans up to 1998, collective actions up to 1998, Osaka Initial Actions, and the Information Technology Agreement.
4. "UR and APEC" is the sum of the impacts from the UR commitments and "APEC Total".

As shown above, the updated model tends to indicate estimates of the real income gains for

[23] McKibbin, W., "Trade Liberalization in a dynamic Setting," (1999), Second Annual Conference on Global Economic Analysis. The paper also noted that the gains from trade points to greater fluctuations in asset prices and capital flows which need to be understood in the context of optimal resource reallocation both with economies and over time. Managing the adjustment process is likely to be a challenge for policy makers and would best be handled not by direct intervention but ny greater research into better understanding the rich dynamics that can arises in the short run adjustment to trade liberalization.

APEC and the world, comparable to those of the model used for the 1997 study. The 1997 study concluded that the MAPA would raise the real income of APEC by approximately 0.4 percent. While the estimates of real income gains increase marginally from the 1997 study (less than 0.05 percent), the dollar amount of the gain in this study increases to US$75 billion. This increase reflects some progress in the tariff reduction in IAPs, the inclusion of new members of APEC, and the estimated stronger impact on the APEC developing economies where the economic growth was significant during 1995-97 period. In addition, the updated model appears to increase the estimated impact of tariff reduction by modest amount, probably less than 0.05 percent.

The nature of the estimates are essentially similar to the 1997 study. The trade facilitation measures are estimated to have a larger impact than the modelable trade liberalization measures contained therein. The real income of APEC member economies will increase by much more than that of non-APEC economies, which will be only US$5 billion. Free-rider gains flow out from APEC only to a very small extent. Members, therefore, need not have significant concerns about long-run free-rider gains from implementation of APEC measures.

Geographical Distribution of Real Income Effects

Table 2-6 presents the real income effects on individual economies in APEC. The percentages range from 0.1 to 4.5. The income gains in terms of money amounts in Table 2-6 are obtained by multiplying the percentage changes by the level of GDP of the economies in 1997. Generally, developing members will enjoy higher benefits in percentage terms. Trade liberalization and facilitation have an important role, particularly in to bolstering the long-term growth of the crisis-affected Asian economies.

Table 2-6: Income Effects of APEC Measures
Estimated Real Income Effects on APEC Economies

Economies/ Regions	Amount (1997 US$ billions)	Percentage Change (GDP)
Australia	1.1	0.3
Canada	4.4	0.7
Chile	2.4	3.1
China	25.5	2.8
Hong Kong, China	0.1	0.1
Indonesia	2.1	1.0
Japan	5.3	0.1
Korea	3.4	0.8
Malaysia	4.5	4.5
Mexico	3.4	0.8
New Zealand	0.7	1.1
Philippines	3.6	4.4
Russia	0.8	0.2
Singapore	1.6	1.6
Chinese Taipei	5.4	1.9
Thailand	3.6	2.4
USA	7.5	0.1
Viet Nam	0.1	0.6
APEC Total	75.3	0.4
Rest of World	4.6	0.0
World MAPA Total	79.9	0.3

Notes:
1. Base year for simulation: 1996.
2. The dynamic version of the model are used, assuming constant returns to scale and perfect competition and allows capital accumulation through the income-investment linkage.

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* (i.e. economies that liberalize the most gain the most).[24] Hence the comparatively large positive impact on Chile, the Philippines and China;

(iii) *The expected interactions of domestic and foreign economies*. In some cases, the liberalization of one economy would involve a reduction of income in other

24 Existing studies on the impact of the Uruguay Round concluded that there was a strong relationship between liberalization and estimated welfare gains in individual economies. See Francois, *et. al op cit* (1996).

economies, because the liberalization of an economy might cause a deterioration in the terms of trade of other economies. However, there will be no 'loser' in APEC; and

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

Tariff Elimination and Potential Impact of Trade Facilitation

To illustrate the magnitude of the total impacts of APEC trade liberalization assessed above, the simulation results may be compared against the effects of full tariff elimination in APEC, as simulated in the *1997 APEC Economic Outlook* and the 1997 Project on the *Impact of Trade Liberalization*. The same methodology is adopted to make the case, that is, unconditional trade liberalization is adopted, which assumes APEC members extend 100 percent tariff reductions to both members and non-members.

Using the specification of the CGE model in this project, the total impact of tariff elimination in the APEC member economies on the real income is estimated at 1.2 percent of GDP, or US$200 billion in 1997 prices. As this amount includes the impact of remaining UR commitments, around 0.7 percent, the net impact on real income would be around 0.5 percent of GDP, or US$87 billion. According to available literature, this estimate is plausible.[25] Taking this net impact on real income as the denominator, APEC tariff reductions up to 1998, which amount to $30 billion, will be equivalent to around one-third of the total gains to be realized from 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.[26] The above figure, US$87 billion at 1997 prices, covers only tariff elimination. To measure the potential impact of trade facilitation, the survey results in Table 2-2 can provide a rough order of estimates to be used as the model inputs. The UNCTAD report stated that, once the recommendations by UNCTAD are fulfilled, "achieving total annual savings equivalent to quarter of the total value of procedures (that is, 7-10 percent of total trade value) is a realistic objective that we shall strive to reach by the turn of the century." Considering the technical feasibility and the fact that the UNCTAD measures included some NTMs as well as traditional trade facilitation, it would be plausible to assume an across-the-board cost reduction in import prices by 2 percent for the industrialized economies and NIEs, and 3 percent for other developing economies. The simulation of full trade facilitation based on the UNCTAD estimation indicates that the real income gains would be 0.4 percent of GDP, or US$64 billion. This amount is smaller than the above-mentioned economic gains from tariff elimination. However, it should be emphasized at the same time that trade facilitation has a large undeveloped potential for the improvement of economic efficiency and productivity.

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25 According to Scollay, R. *op cit* (1999), pp.4 , "The welfare gains reported in all of the studies which have become available lie within the same range, with most estimates of the overall gain to APEC members of complete liberalization clustering around $60 to $80 billion. The results of our simulation indicate gains of between $55 to 118 billion."

26 Philippa Dee, Chris Geisler and Greg Watts, "The Impact of APEC's Free Trade Commitment," *Staff Information Paper*, Australian Industry Commission (1996) (IC95 Report).

CHAPTER 3

DYNAMIC IMPACTS OF TRADE LIBERALIZATION

This chapter concentrates on the dynamic aspects of trade liberalization. Dynamic study, especially an analysis of the linkage between the liberalization and long-term growth, has now become increasingly important. The economic crisis in Asian economies draws stronger attention to the future long-term growth potential in the area. Trade liberalization is one of the pillars of structural reform policies in these economies, because as this paper demonstrates, it is believed that liberalization will improve member economies' long-run potential for growth.[27] It would be timely for APEC to recognize the importance of trade liberalization to ensure continued long-run growth.

In this study, the dynamic gains and adjustment processes are looked into in more detail than in the 1997 study, although the CGE model may face inherent constraints in assessing all the dynamics. While our major interest still rests on the longer-term impacts of trade liberalization, an econometric regression analysis is adopted to capture the wide range of gains from trade liberalization. Specifically, an endeavor is made to estimate a special type of long-term growth function.

The objective of the analysis in this chapter is to examine the relation between economic growth and trade liberalization. Dynamic aspects are discussed, such as the dynamic effects of openness of the economy on the long-term growth through more active domestic investment, promoting competition, and attracting direct investment inflows together with technology transfer. Attention is also paid to the adjustment process and costs caused by trade liberalization. Discussion of the costs and benefits will add to the realism of the study, as well as shed light on the active role of public sectors in mitigating the costs.

First, an econometric estimation on the growth functions is conducted. There are a number of existing studies in this field. This study will cover: a survey of existing studies; the regression analysis of the functions of economic growth on the openness of the economies and trade distortions, and estimation of the impacts. Second, there is discussion of issues arising from the dynamic impacts of trade liberalization. The issues include the role of the competitive market when trade is liberalized, the adjustment costs and the role of public sectors.

TRADE OPENNESS AND GROWTH – ANALYTICAL FRAMEWORK

Recent applied research on trade liberalization has stressed the importance of dynamic economics of scale 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, stimulates domestic investment, and enhances the international transmission of innovation and knowledge, as well as promoting a more rational international specialization of production. Expanded markets can also mean expanded returns to, and hence greater incentive for innovation. Moreover, trade

27 The Ministerial Meeting in Kuala Lumpur in 1998.

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. A number of empirical works have identified significant trade-growth relations in various contexts.

The *1995 APEC Economic Outlook* identified the following paths from economic integration to strengthened growth: (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. The list is, of course, not exhaustive.

A standard approach to estimating dynamic impacts is to assume a growth function and adopt econometric methods to estimate the function. The Barro's study (1991) first provided an empirical estimate for the growth function of per capita income.[28] The study gave an empirical foundation to the famous partial convergence hypothesis. Mankiw, *et al.* (1992) contributed to the theoretical background of convergence in standards of living that poor economies tend to grow faster than rich economies.[29] Following the references, many studies confirmed empirical linkage between long-term growth rates and a variety of economic policy, political and institutional indicators. The standard growth functions usually had the growth rates of per capital GDP as the dependent variable, and, as independent variables, income level, shares of investment in GDP, human resource indicators, and various policy variables, including trade openness, corruption indicators, and so on. International cross-section and time series data were pooled to overcome the constraints of degree of freedom of estimates.

Levine *et al.* (1992), however, found that almost all the empirical results were fragile. They confirmed the robustness in the correlation between growth and the share of investment in GDP and between the investment share and the ratio of international trade to GDP.[30] They adopted extreme-bound analysis to test the robustness of the various variables of the growth function, including the proxies of openness of markets. The proxies, often used, were imports per GDP, exports per GDP, or imports plus exports per GDP.

Their findings included:

- If one substitutes imports or total trade for exports in cross-country growth or investment regressions, one obtains essentially the same coefficient estimate and coefficient standard error. Thus, researchers who identify a significant correlation using an export performance measure should not associate this result with exports *per se*, because it could be obtained using a corresponding measure of imports or total trade.
- The share of trade in GDP is robustly positively correlated with the share of investment in GDP.
- When controlling for the share of investment in GDP, we could not find a robust independent relationship between any trade or international price-distortion indicator

28 Barro, R., "Economic Growth in a Cross Section of Countries," *The Quarterly Journal of Economics*, May 1991.

29 Mankiw, G., Romer, D., and Weil, D., "A Contribution to the Empirics of Economic Growth," *The Quarterly Journal of Economics*, May 1992.

30 Levine, R. and Renelt, D., "A Sensitivity Analysis of Cross-Country Growth Growth Regressions," (1992), *American Economic Review*, vol.82, No.4.

and growth. Therefore, the relationship between trade and growth may be based on enhanced resource accumulation and not necessarily on the improved allocation of resources.

As the empirical study took the data from all over the world. It would be required to test this in the context of APEC economies.

Finally, a study attempted to deal with causality between growth and trade. [31] Frankel et.al (1996) dealt with the endonegeity of trade by using as instrumental variables the exogenous determinants from the gravity model of bilateral trade. The effect of openness on growth was found even stronger when the authors correct for the endogeneity of openness than in ordinary least square estimates. The major conclusion was that many of the explanations offered for East Asia growth indeed appear to play an important role: simple catch-up, investment and education, and an unknown residuals. Openness plays a substantial role in many economies.

The results are largely in line with the recent study by Wacziarg (1997), which calculated that a one standard deviation increase in an index of trade policy openness is associated with a 0.9 percentage point higher per capita GDP growth.[32] The effect can be separated into different components. The largest is the impact through domestic investment, which amounts to about half of the total impact, 0.42 percentage points out of 0.93. Remaining components include induced policy improvement (0.34 percentage points), such as the improvement of macroeconomic environment and shrinkage of black market, and technology transfer (0.20 percentage points) through foreign direct investment and manufactured exports. This study demonstrates that trade liberalization may stimulate growth, not only through the accumulation of capital, but also through policy improvements and technology transfer.

EMPIRICAL ESTIMATES

Specifications of Regression

As shown above, the implication may rest on the empirical results. We will redo the estimate of the growth function, which is tailored for the economic growth of APEC. In this context, the data should cover comparatively recent periods, 1970-1990. The cross-section of growth data should not include African economies since their economic situation appears totally different, even though the degree of freedom may be significantly diminished.

The cross-section dataset of growth rate of real per capita GDP is regressed on the initial level of real per capita income, elementary school enrollment, and trade openness proxy. To

31 Frankel, J., Romer, D. Cyrus, T., "Trade and Growth in East Asian Countries: Cause and Effect?" (1996), NBER Working Paper 5732

32 Wacziarg, R. (1997), "Measuring the Dynamic Gains from Trade," Background Paper prepared for *Global Economic Prospects 1997*, World Bank.

avoid endogeneity, we used lagged explanatory variables. We tested the findings of Levine *et al.* (1992) by including the investment/GDP ratio.[33]

The convergence theory predicts that the initial level of income should have a negative coefficient. The variable of school enrollment provides a proxy of human capital, which is expected to have a positive coefficient. Trade openness is proxied by export-GDP ratio, which is also expected to have a positive coefficient. Because the purpose of this regression is to identify the rough order of magnitude of the impact, the instrumental variable method is not adopted. Therefore, the estimate in this study may significantly understate the impact of liberalization.

Estimated Parameters and Implications

The regression analysis indicates that the signs of the parameters turn out to be as the theory predicts. That is, the initial level of income has negative significant coefficient and school enrollment has positive significant one. Trade openness has generally significant positive coefficients, but sometimes insignificant, depending on the specifications. Investment ratio has always has a positive significant coefficient (see Appendix 4 for details). As found in Levine *et al.* (1992), the relationship between trade and growth may be based on enhanced resource accumulation of capital. This finding may be applicable here. It appears, however, that the significance of the trade openness variable is independent of the existence of investment ratio.

This study will examine the impact of APEC's trade liberalization measures on long-term growth, by combining the estimated impacts on trade (and investment) of the CGE model with the growth function. To do so, two approaches have been adopted. One assumes that trade openness is the only policy variable of the growth function, adopting a regression that omits any investment variables. The other approach is to use both the coefficients of export/GDP ratio and investment/GDP ratio, assuming that these two effects take place independently. Under this approach, trade openness may mainly represent the effects of resource allocation and technology transfer. The two approaches represent the extreme assumptions, and the comparison among their results may provide a prudent estimate.

Table 3-1 summarizes the rough order of magnitude of the estimated long-term effect of trade liberalization and facilitation in APEC. The estimates show that the APEC measures will raise the annual average per capita growth rate by some 0.03 percentage points. As the regression covers 20 years, the result may be interpreted showing that as the APEC trade liberalization and facilitation measures would add about 0.5 to 0.6 percent points to the accumulation of growth for 20 years. In other words, if the wider range of dynamic gains are included, the estimates of the CGE model of the real income gains (0.4 percent of GDP) may be expanded by 1.2 to 1.4 times. If this ratio is applied in the case of tariff elimination

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33 The specification adopted here is:

$$(GDP/POP)_{70\text{-}90} = a + b_1 ln(PGDP)_{70} + b_2 ln(SCHOOL)_{70\text{-}90} + b_3 ln(DUMMMY+1)(OPENNESS)_{70\text{-}90} + b_4 ln(INVESTMENT/GDP)_{70\text{-}90} + DUMMY$$

All the independent variables are expressed in logarithmic forms. Subscripts of 70-90 mean the annual average figures during 1970-1990. The abbreviations are: *GDP*: gross domestic products; *POP*, population; *PGDP*, initial level of real per capita income; *SCHOOL*, elementary school enrollment; *OPENNESS*, export/GDP ratio; *INVESTMENT/GDP*, investment/GDP ratio; *DUMMY*, a dummy variable of APEC developing economies.

and full trade facilitation, the total long-term dynamic gains would possibly be some 180 to 210 billion US dollars. As indicated above, the estimate that are obtained from ordinary least square may significantly understate the benefit.

Table 3-1: Long-term Impact of Trade Liberalization and Facilitation in APEC on Real Income of APEC Region

	Estimated Parameters		Long-term Impact on Growth (Annual average, %)	Accumulation of Growth (%)
	Export/GDP	Investment/GDP		
Approach 1	0.009	--	0.026	0.52
Approach 2	0.006	0.022-0.026	0.026-0.028	0.52-0.56

Notes:

1. Approach 1 assumes that trade openness is the only policy variable of growth function, adopting a regression that omits any investment variables
2. Approach 2 uses both the coefficients of export/GDP ratio and investment/GDP ratio
3. "Long-term Impacts on Growth" are obtained by multiplying the estimated parameters in the growth function with the effects of APEC measures on the annual weighted average of exports ratio (3.2%) and domestic investment ratio (0.5%) that are obtained CGE mode.
4. "Accumulation of Growth" are calculated for 20 years.

ROLE OF THE COMPETITIVE MARKET WHEN TRADE IS LIBERALIZED

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. They are an important complement to regulatory reforms to ensure that competitive conditions prevail in an industry following implementation of reforms.

Recently, APEC has put more focus on strengthening markets. This greater attention reflects the recent trend toward globalization. Business is increasingly thinking globally, not nationally.[34] Markets for factors of production–labor, capital, and technology–are also increasingly global. Deregulation, the growth of foreign investment, the penetration of the Internet, and the spread of air links to and from APEC members have contributed to the growth of this global market. APEC has felt the demand that it take account of these developments in the international economic environment in their approach to both external and domestic policies. Domestic regulation in one economy increasingly has an impact on production and consumption in other economies. There is, increasingly international interest in the development of international standards and processes to assure the quality of regulation, as well as in the development of a robust and open framework for business growth.

An OECD study lists five ways in which inefficiency arises from inappropriate regulations.[35] First, firms have less incentive to economize on resources. This can take the

34 Informal Background Paper by New Zealand, "Strengthening Markets/Competition Policy and Regulatory Reform."

35 OECD, "The Economy-wide Effects of Regulatory Reform," (1996).

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

Deregulation and regulatory reform themselves surely contribute to sustainable, long-term growth. For example, the OECD study estimated that the recommended regulatory reforms, by addressing all these inefficiencies, could increase GDP by 1 to 6 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 direct investment.

In this section, an analysis follows on somewhat specific issue of the competitive markets: the role of the competitive market when trade is liberalized. In general, 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. The specification of the CGE model used in Chapter 2 assumes perfect competition in the market. Another simulation was conducted to examine the outcome under the conditions of non-competitive markets.

Simulation and Implications

Non-competitive markets are typically characterized by the existence of inefficient sectors. Owing to protection by regulation or other impediments, inefficient sectors can hoard labor and capital, making overpayments to the factors of production. When trade is liberalized in an economy with such a non-competitive domestic market, the mechanism of efficiency gains cannot fully work. The inefficient sectors need not adjust themselves to the change in relative prices caused by trade liberalization, and can sustain their previous level of investment and employment. While trade liberalization brings about partial benefits through the reduction of production and consumption costs from cheaper imports, part of these benefits will be lost when the inefficient sectors do not react at all.

To illustrate such a situation using the general equilibrium framework, the GTAP model provides convenient options for a simulation which assumes "sluggish factor mobility".[36] With these options, one can slow down the mobility of factors of production, including skilled or unskilled labor, and capital. The sluggish factors may be sustained in the same sectors over the simulation period, however a disparity exists in relative sectoral returns. The standard specification of the CGE simulation model assumes perfect competition in terms of final goods and services, and factors of production. The result of the simulation is that the APEC trade liberalization and facilitation measures raise the real income of the region by 0.4 percent. Comparing with the standard case, it is expected that the impact

36 GTAP manual indicates, "Within each region (i.e. economy), the model distinguishes between primary factors that are perfectly mobile across productive sectors and those that are sluggish. In an experiment with sluggish factor endowments, it is important to find out *how much of a disparity in relative sectoral returns can be sustained over the simulation period.*

should be smaller than the standard case, if some factors of production are assumed sluggish.

Table 3-2 demonstrates the outcome of simulation of various assumptions of the factor mobility. The assumed cases are: (i) perfect factor mobility, i.e. standard case; (ii) sluggish labor; (iii) sluggish capital; and (iv) sluggish unskilled labor and capital. The sluggish factor mobility significantly curtail the benefits of the trade liberalization and facilitation measures in APEC. The worst case, both unskilled labor and capital sluggish, results in the curtailment by 40 percent of the full impact under perfect factor mobility.

Table 3-2: Effects of Sluggishness in Mobility of Factors of Production Impacts of Trade Liberalization and Facilitation to APEC Economies

	Export Volume (%)	Real Income (%)
Perfect Factor Mobility	3.3	0.42
Labor Sluggish	3.0	0.37
Capital Sluggish	2.9	0.35
Unskilled Labor and Capital Sluggish	2.5	0.24

The result may exaggerate the situation by assuming the sluggishness in all the sectors. It illustrates, however, the critical role of competitive markets to making the benefits of trade liberalization and facilitation fully materialize in the domestic economy. The simulation implies that the trade liberalization measures should be implemented while ensuring the domestic markets are competitive and open.

ADJUSTMENT COSTS AND THE ROLE OF PUBLIC SECTORS

While the dynamic model, introduced in this chapter, may assess most of the impacts of liberalization, adjustment costs are largely omitted from the specification. The analysis indicates that there is positive correlation between trade openness and long-term growth. The results should actually be net of negative costs, if measured in terms of GDP, for the required adjustment process. Trade reform in reality generates both benefits and social and private costs.[37]

The social costs of trade liberalization refer to the value of output that is lost due to resources made idle by liberalization in the short run. Sectors of the economy that had been protected by tariffs, quotas, and other governmental interventions may not be able to sustain output, capacity utilization, and levels of employment once trade is liberalized. Firms in these sectors may shed workers faster than they can be absorbed by other, expanding, sectors of the economy. With idle resources, output will temporarily fall below its level before liberalization. This shortfall is a measure of the social adjustment cost. The size of the gap depends on the number of workers unemployed due to liberalization, the speed at which the economy can re-absorb them, and the wage that they earn once they become re-employed. The size of social adjustment costs relative to efficiency gains will determine the welfare effects of trade liberalization, although it is unlikely that those costs would exceed benefits, since the efficiency gains are permanent and grow with the economy.

[37] The analysis here is drawn on World Bank, 1997 Global Economic Prospects and the Developing Countries, (1997).

Private costs of adjustment arise not only as a result of transitional unemployment but also when some workers and entrepreneurs find their skills, talents, and investments worth less after liberalization than before, because of the permanent changes in returns to factors of production brought about by trade liberalization. Specific groups of workers and firms also suffer from the reduction or destruction of rents they had previously shared in protected sectors. On the other hand, other workers and entrepreneurs in export sectors find their resources worth more after reform. These re-distributive effects of trade liberalization are likely to be important in determining the political feasibility and sustainability of reforms.

According to the stock of literature on the liberalization of manufacturing sectors, the adjustment costs are unlikely to present an adequate reason for delays in opening up to the world, as long as sound complementary policies are implemented. Such policies include ensuring macroeconomic stability and the credibility of policies to foster a sustained and quick response in the private sector investments in newly competitive sectors of the economy. Structural policy reforms to improve labor market flexibility may provide important support. The relationships between trade, macroeconomic, labor market and other policies may then serve to increase the credibility of, and payoffs to, each.

The above considerations highlight the important role of the public sector. The public sector can play a crucial role in reducing the costs of job transitions required by the shift of production. One key ingredient is education. Workers with a higher level of education are usually better able to make the transition from one job to another. Also, the public sector may facilitate the adjustment process by promoting the structural reforms domestically. The public sector can also play a direct role in facilitating job transition, for example by providing of a job training system. The final role of the public sector is providing a safety net. A social safety net may be important in helping the most vulnerable groups adversely affected by liberalization.

Policymakers should develop an adequate political strategy in support of liberalization, but at the same time, they need to consider an appropriate social safety net for vulnerable, adversely-affected groups. In the APEC context, there might be a role for ECOTECH activities, in particular human resource development activities, to address the social safety net issues.

CHAPTER 4

CONCLUSION

Importance of Trade Liberalization and Facilitation to Long-term Growth

Throughout the analysis in this report, trade liberalization and facilitation measures in APEC have been shown to make an important contribution to the long-term growth in the region. The estimated income gains from the APEC actions committed to amount to US$75 billion (at 1997 prices, 0.4 percent of GDP). The APEC developing economies, including the crisis-affected economies, generally enjoy the higher gains. Including various dynamic effects that cannot be captured by the Computable General Equilibrium model, the gains would increase by 1.2 to 1.4 times over the long-term, or about 90 to 105 billion US dollars. In terms of difference in gains of individual economies, the economies that liberalize the most gain the most. The estimations from the model simulations of tariff elimination and full trade facilitation indicate that there may be significantly greater economic gains.

Trade Facilitation and Competition Policies

The updated model estimates confirmed the significant role of trade facilitation. Real income gains of some US$46 billion (US$55-64 billion, if including various dynamic gains) may accrue to the region from the APEC trade facilitation measures already committed to. There is still the potential to increase these gains (to US$64 billion, or 0.4% of GDP) by progressing those trade facilitation actions which contribute to reducing the costs of imports. The focus of the 1999 APEC process on facilitation is well justified.

The analysis in this report illustrates the important role of competitive markets, where factors of production retain mobility. Without factor mobility, the benefits of trade liberalization and facilitation will be considerably curtailed. There is a need to highlight the linkage between the domestic competition policies/regulatory reforms and trade liberalization and facilitation.

Adjustment Costs and Role of ECOTECH

The model estimates indicate long-run benefits, where the short-run adjustment costs are not explicit. There are also non-modelable factors such as external economies/diseconomies to be considered.

Trade liberalization in reality generates both benefits and social and private costs for the required adjustment process. According to the stock of literature on the liberalization of manufacturing sectors, given the significant net benefits, the adjustment costs are unlikely to present an adequate reason for delays in opening trade up to the world, as long as sound complementary policies are implemented.

The public sector can play some role in reducing the costs of job transitions required by the shift of production. One key ingredient is education since workers with higher level of education are usually better able to make the transition from one job to another. The public sector may also facilitate the adjustment process by promoting the structural reforms

domestically. The public sector can also play a direct role in facilitating job transition, by providing a job training system. The final role of the public sector is to provide a safety net. A social safety net could be important in helping the most vulnerable groups adversely affected by liberalization.

The policymakers should develop an adequate political strategy in support of liberalization, but at the same time, they need to consider appropriate social safety net for vulnerable, adversely-affected groups. In the APEC context, there might be a role for ECOTECH activities, in particular, human resource development activities, to address the social safety net issues.

Further Research

The research teams from Japan and Singapore have identified the following items and issues for further research and application.

- **Assessment of APEC actions of trade liberalization and facilitation.** To date, the IAPs and CAPs have been annually updated and improved. When necessary, it is important to undertake follow-up assessment of the expected impacts of the APEC actions.

- **Application of the tools developed in this project to other economic issues of APEC**. The CGE model and other econometric tools may be applied to the analysis of various economic issues. Such issues may include the Asian economic crisis, subregional trade arrangements, and the assessment of the relationship between investment and growth.

- **Exchange of information of analysis with other international institutions.** The APEC action plans have drawn strong attention from the various international institutions, like OECD and the World Bank, as well as academics and research societies, including PECC and APEC Study Centers. Disseminating the research outputs in this project to such bodies would heighten their interest in, understanding of and attention to the APEC process. As required, there is an option to engage or collaborate with such bodies on the further studies.

APPENDICES

Appendix 1

PROGRESS OF THE PROJECT

November 1997 – APEC Ministerial Meeting in Vancouver, Canada
Submitted the final report of The Impact of Trade Liberalization in APEC.

February 1999 – Economic Committee Meeting in Wellington
Decided to launch a project: Updating Impact of Trade Liberalization.

June 1999 – Experts' Seminar on the Impact of Trade Liberalization in Tokyo, Japan
Discussed the technical aspects of modeling with experts from APEC member economies and academics.

August 1999 – Economic Committee Meeting in Rotorua, New Zealand (TBD)
Discussed and finalized draft final report

September 1999 – APEC Ministerial Meeting in Auckland, New Zealand
Submit the final report of The Impact of Trade Liberalization in APEC: Update and Issues.

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 4.0 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 economy input-output databases that account for intersectoral linkages within each region.

Trade Data

The trade data upon which the GTAP data base is built originates 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 non-factor services. The reconciliation method adjusts reported values based on "relative" biases for bilateral transactions. For almost all the reporting countries there are only slight changes in the total reported values. There are cases of severe under-reporting or non-reporting 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) is expressed in the form of *ad valorem* equivalent, tariff, and non-tariff barrier, and they draw heavily on information submitted to the GATT in connection with the Uruguay Round (UR) negotiations. The protection data is broadly indicative of the level of protection prevailing prior to the UR. The best-quality data in the SPD is that relating to tariffs. There remains considerable bilateral variation in the applied tariff rates, aggregated over all merchandise trade. Non-tariff information is most complete in the cases of agriculture and textiles/apparel. Anti-dumping duties are incorporated for Canada, the European Union (EU) and the United States. Also, the export restraining effects of EU price undertakings are included. However, the SPD is 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 non-tariff 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. Because the IO tables making up the regional databases refer not to 1995, but rather to the latest available year, they will have to be updated to conform to 1995 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 the 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 for 1995, some of the government consumption has been moved to investment, which amounts to 10 percent of GDP, as the minimum amendment.

MODEL

To bring this large database, a standard, multi-region, 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 50 disaggregated sectors and 45 economies/regions, which are aggregated to the appropriate versions for simulations. In this study, regions are aggregated into 21 areas, and 18 areas are allocated to APEC economies. The APEC member economies are disaggregated individually where data is available (data for Brunei, Papua New Guinea, and Peru 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: skilled and unskilled labor, capital; and natural resources and land.

i. Behavior of Firms

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 form 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 by 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 function.

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 the 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 households 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 have been determined, spending is 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 all routes and commodities gives the total demand for international transport services. These services are supplied by individual regional economies, 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 shows the composite import demand elasticity. The second column determines the case of substitution among imports from different sources. In the SALTER parameter file, this is equal to twice the value of the value in the first column. 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 of 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

AGGREGATION		(NAME)	In GTAP Model
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

AGGREGATION		(NAME)	In GTAP Model
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 OF COMPUTABLE GENERAL EQUILIBRIUM MOEDEL

Sensitivity Analysis on Armington Parameters

The simulation results are sensitive to the values of parameters in the equations of the model. It is, therefore, important to undertake a sensitivity analysis to verify the robustness of the model and thus the plausibility of the estimates.

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 4-1. The UR plus IAPs is used for the common trade shock. Simulation results are tabulated in Tables 4-2 and 4-3.

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 4-2 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. The deviations in the economies lie in the range of -41 percent to -16 percent with the 25 percent lower parameters, and 17 percent to 46 percent with the 25 percent higher parameters except for Mexico and Viet Nam. 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 -25 percent with lowered parameters, and 26 percent with higher parameters.

As for real GDP effects, the sensitivity analysis shows that the effects would be almost linear to the parameter changes in each economy. As is shown in Table 4-3, the deviations are different among the economies, ranging from -27 percent to 5 percent with lower parameters, and from 27 percent to -14 percent with higher parameters. For APEC total, the deviations are -12 percent with the lower parameters and 11 percent with the higher parameters.

It should be noted that 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. Particularly, the APEC total demonstrates robustness. 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	1.850	2.466	3.083	3.497	4.662	5.828
MNG	2.100	2.800	3.500	4.200	5.600	7.000
PFD	1.787	2.383	2.979	3.519	4.693	5.866
TXL	2.361	3.149	3.936	4.940	6.587	8.233
CHM	1.534	2.045	2.557	2.975	3.966	4.958
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	1.858	2.478	3.097	4.179	5.572	6.965
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)			Deviation Rate from Base Case		
Economy	Lower by 25%	Standard	Higher by 25%	Economy	Lower by 25%	Higher by 25%
AUS	1.251	1.720	2.189	AUS	-27.250	27.303
NZL	3.586	4.577	5.611	NZL	-21.658	22.590
JPN	0.727	1.181	1.621	JPN	-38.456	37.312
IDN	1.086	1.504	1.920	IDN	-27.761	27.658
MYS	4.838	6.003	7.148	MYS	-19.403	19.081
PHL	19.741	23.614	28.030	PHL	-16.403	18.700
THA	3.221	3.849	4.483	THA	-16.308	16.487
CHN	10.257	13.674	17.244	CHN	-24.985	26.110
KOR	2.174	2.897	3.631	KOR	-24.962	25.330
SGP	3.351	4.081	4.760	SGP	-17.880	16.642
HKG	0.832	1.405	1.938	HKG	-40.788	37.973
TWN	3.367	4.248	5.129	TWN	-20.734	20.741
USA	1.167	1.728	2.293	USA	-32.461	32.670
CAN	1.106	1.495	1.893	CAN	-26.010	26.576
MEX	0.974	1.431	1.884	MEX	31.946	-31.625
CHL	10.363	12.904	15.527	CHL	-19.694	20.328
VNM	-0.033	0.193	0.406	VNM	-117.361	110.566
RUS	0.184	0.350	0.513	RUS	-47.506	46.392
APEC	2.460	3.297	4.147	APEC	-25.390	25.803
LTN	0.160	0.293	0.427	LTN	-45.552	45.721
WEU	0.100	0.135	0.173	WEU	-25.395	28.397
ROW	-0.000	0.061	0.126	ROW	-100.474	105.919
WORLD	1.171	1.577	1.991	WORLD	-25.745	26.263

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

Table 3-3

	Change in Gross Domestic Product (percent)			Deviation Rate from Base Case		
Economy	Lower by 25%	Standard	Higher by 25%	Economy	Lower by 25%	Higher by 25%
AUS	0.275	0.288	0.300	AUS	-4.282	4.316
NZL	0.888	1.059	1.209	NZL	-16.123	14.185
JPN	0.134	0.127	0.124	JPN	5.198	-2.522
IDN	0.960	0.972	0.990	IDN	-1.295	1.779
MYS	3.896	4.539	5.102	MYS	-14.171	12.388
PHL	4.207	4.387	4.710	PHL	-4.119	7.348
THA	2.180	2.364	2.519	THA	-7.779	6.590
CHN	2.046	2.827	3.598	CHN	-27.632	27.269
KOR	0.716	0.763	0.809	KOR	-6.140	6.065
SGP	1.442	1.615	1.727	SGP	-10.716	6.967
HKG	0.073	0.069	0.059	HKG	5.101	-14.815
TWN	1.736	1.887	2.018	TWN	-7.995	6.923
USA	0.094	0.095	0.096	USA	-1.373	1.089
CAN	0.693	0.715	0.734	CAN	3.068	-2.632
MEX	0.825	0.834	0.833	MEX	1.062	0.174
CHL	2.661	3.072	3.406	CHL	-13.368	10.868
VNM	0.533	0.571	0.610	VNM	-6.529	6.885
RUS	0.170	0.182	0.195	RUS	-6.779	6.968
APEC	0.368	0.416	0.463	APEC	-11.527	11.332
LTN	0.010	0.018	0.028	LTN	-44.466	52.218
WEU	0.028	0.034	0.038	WEU	-16.208	11.059
ROW	0.026	0.037	0.051	ROW	-28.972	38.533
WORLD	0.222	0.253	0.282	WORLD	-12.017	11.765

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

Appendix 4

REGRESSION RESULT OF GROWTH FUNCTION

Table: 4-1: Estimation Results for Convergence Regression Model

Equation				
Independent Variable	(1)	(2)	(3)	(4)
Constant	0.12***	0.071***	0.0076***	0.108***
	(0.020)	(0.018)	(0.022)	(0.021)
ln(*PGDP*)	-0.005***	-0.004**	-0.005**	-0.005***
	(0.002)	(0.002)	(0.002)	(0.002)
ln(*SCHOOL*)	0.008***	0.008***	0.008***	0.008***
	(0.003)	(0.003)	(0.003)	(0.003)
ln(*OPENESS*)	0.006*	0.006	0.009***	0.006**
	(0.003)	(0.004)	(0.003)	(0.003)
ln(*INVESTMEMT/GDP*)	0.026***		0.022**	0.022**
	(0.009)		(0.009)	(0.009)
APEC_DUMMY		0.02**	0.011**	0.009**
		(0.01)	(0.004)	(0.004)
ln*(OPENESS)*APEC*		0.006		
		(0.006)		
No. of Economies	75	75	75	75
Adjusted R-Square	0.235	0.211	0.211	0.267
F-statistics	6.691***	4.967***	5.94***	6.403***

Sources: World Bank.(1998) *World Development Indicators.*

Notes: 1) Estimation method is the Ordinary Least Squares.
2) Numbers in parentheses are standard deviations. "***","**"and "*"show statistical significance level at 1%.5% and 10%, respectively.
3) ln(*PGDP*):Natural logarithm of GDP at 1970(1987 prices).
ln(*SCHOOL*):Natural logarithm of secondary school enrollment rate at 1970.
ln(*OPENESS*):Natural logarithm of annual average export-GDP ratio(1970-1990).
ln(*INVESTMEMT/GDP*):Natural logarithm of annual average investment-GDP ratio(1970-1990).
APEC_D:APEC economy dummy variable.
ln(*OPENESS)*APEC*: Product of ln(OPENESS) and APEC economy dummy.
4) F-statistics: Null hypothesis is that the residuals are homoscedastic.

The estimated coefficient on the initial level of per capita real income confirmed the partial convergence theory, being significantly negative. The human capital variable also complies with the usual theory of positive contribution to the growth. Four specifications are regressed. The variables which always appear in the regression include: (i) constant; (ii) initial level of real per capita GDP; (iii) human resource level, and (iv) trade openness proxied by export per GDP. The other variables, such as investment per GDP and APEC dummies, appear in the regressions as optional.

Table 4-2 summarizes the result of regression in another specification, which uses the GDP ratio to the sum of exports and imports as the trade openness variable. We have obtained almost identical estimates. While this specification may fit marginally better, it faces more

strict data constraints. It should be noted that both specifications indicate almost the same result.

Table 4-2: Another Specification

	Equation		
Independent Variable	(1)	(2)	(3)
Constant	0.102***	0.124***	0.070***
	(0.024)	(0.024)	(0.017)
Ln(*PGDP*)	-0.007***	-0.006***	-0.005**
	(0.002)	(0.002)	(0.002)
Ln(*SCHOOL*)	0.010***	0.009***	0.008***
	(0.003)	(0.003)	(0.003)
Ln(*OPENESS*)	0.008***	0.009***	0.010***
	(0.003)	(0.003)	(0.003)
Ln(*INVESTMEMT/GDP*)	0.034***	0.028***	
	(0.009)	(0.009)	
APEC_DUMMY		0.008*	0.013***
		(0.004)	(0.004)
No. of Economies	73	73	73
Adjusted R-Square	0.292	0.316	0.235
F-statistics	8.416***	7.659***	6.537***

Sources: World Bank. (1998) *World Development Indicators.*

Notes 1) Estimation method is the Ordinary Least Squares.
2) Numbers in parentheses are standard deviations. "***","**"and "*"show statistical significance level at 1%. 5% and 10%, respectively.
3) ln (*PGDP*):Natural logarithm of GDP at 1970(1987 prices).
ln (*SCHOOL*):Natural logarithm of secondary school enrollment rate at 1970.
ln (*OPENESS*):Natural logarithm of annual average export and import-GDP ratio(1970-1990).
ln (*INVESTMEMT/GDP*):Natural logarithm of annual average investment-GDP ratio(1970-1990).
APEC_D: APEC economy dummy variable.
4) F-statistics: Null hypothesis is that the residuals are homoscedastic.

Appendix 5

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