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A CGE Analysis of Some Economic Effects of Trade Agreements

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About this supplement

The Australian Government asked the Productivity Commission to undertake a study of bilateral and regional trade agreements (BRTAs). Among other things, the Commission was asked to assess:

- the impact of trade agreements on Australia's trade and economic performance, in particular any impact on trade flows, unilateral reform, behind-the-border barriers, investment returns and productivity growth; and
- the scope for Australia's trade agreements to reduce trade and investment barriers of trading partners or to promote structural reform and productivity growth in partner countries.

To assist in addressing this issue, the Commission has undertaken two streams of quantitative economic modelling. In one, an econometric analysis was used to examine the effects of 27 representative trade agreements, as implemented, on the value of actual merchandise trade flows using a comprehensive trade database over the period 1970 to 2008. That stream of work utilised a gravity model of trade, with results reported in a separate supplement.

This supplement reports the results of the other stream: a quantitative analysis of some economic effects of selected features of trade agreements using computable general equilibrium modelling (CGE).

Some trade agreements display preferential characteristics while others can be non-discriminatory. The scenarios in this supplement are designed to illustrate some of the economic mechanisms at work in agreements. This is done through a variety of scenarios in which barriers to trade and investment are reduced.

The economic effects of any particular agreement, however, are specific to the modalities of that agreement and the barriers and structures of the economies involved. In particular, the modalities of an agreement usually consist of more than tariff reductions: they often include trade facilitation measures, reductions in barriers to investment, mutual recognition of products and qualifications, which affects trade in goods and services, and reductions in other barriers to trade in services.

The results presented in this supplement are drawn from a range of simulations to illustrate some of the possible effects of various elements commonly found in trade agreements.

The simulations illustrate that:

- Reducing tariff barriers is likely to afford larger projected increases in trade, output and income when:
  - the reductions are non-preferential and include a larger geographical area;
  - the commodity coverage is extensive; and
  - in preferential arrangements, the costs of Rules of Origin (RoO) are minimised.
- Reducing barriers to trade facilitation is likely to generate increases in international trade and income. The magnitude of these effects would depend on the amount and type of trade facilitation pursued.
- Reducing barriers to investment has the potential to increase output and income in an economy, and this potential is more likely to be achieved when the barriers are lowered on a non-preferential basis and new Foreign Direct Investment (FDI) is associated with improvements in productivity.

The supplement has benefited from the input of participants at a workshop, which was held on 17 May 2010 and from two referees: Associate Professor Terrie Walmsley (Principal Fellow, Department of Economics, The University of Melbourne and Director of the Center for Global Trade Analysis, Purdue University) and Mr Ken Heydon (former Deputy Director, Trade Directorate, Organisation for Economic Co-operation and Development, Paris).

This supplement supports the Commission's report on Bilateral and Regional Trade Agreements, which was released on 13 December 2010.

1 The modelling approach

1.1 GTAP model and modifications

The model used in this supplement is a modified version of the GTAP model, a multi-country, multi-sector general equilibrium model of the global economy (Hertel 1997).[1] The main features of the model are outlined in box 1.1.

The model has been used widely to examine the effects of changes in tariffs, trade barriers and industry assistance arrangements across countries. The sectoral and regional detail of the model makes it particularly useful for the analysis of policies that have different effects across activities and countries. Like all models of economic activity, GTAP embodies some simplifying assumptions. Some limitations relevant to this study are outlined in box 1.2. While the results of any economic modelling need to be interpreted carefully, the multi-country nature of the GTAP model and its rich sectoral detail make it well suited for comparing the relative magnitudes of the potential effects of different changes in tariffs and other economic factors across countries.

The GTAP model produces projections of changes in economic values that are attributable to the shocks modelled, abstracting from any other influences, such as other policy changes or autonomous growth. Any projected changes in trade patterns reported are therefore attributable to the shocks as modelled and can be interpreted as the projected contribution of the modelled policy changes, given modelling assumptions, to movements in trade that might be observed.

As a deterministic model, the GTAP model produces point estimates. Although they are subject to uncertainty, in common with most studies of this nature and in the absence of relevant empirical information, no attempt has been made to estimate confidence intervals.

[1] The terms 'region', 'country' and 'economy' are used interchangeably in this supplement to designate a regional entity appearing in the model, which can be a country or a group of countries (for example, the United States of America, the European Union and the Rest of Africa).

Box 1.1 **Main features of the modified GTAP model**

- A 'representative household' in each region maximises a Cobb-Douglas utility function by allocating total regional income between private consumption, public consumption and savings. The 'super household' budget constraint consists of income from factors and from commodity taxes. Income taxes are not modelled.
  - Households are assumed to save a fixed proportion of the value of regional income. Savings from each country can be invested domestically and abroad. The 'global bank' in the standard GTAP model is replaced, in the modified model, by a constant elasticity of transformation supply function to investment funds across regions. These modifications make it possible to model the effects of trade and investment liberalisation on regional economies and to trace investment flows bilaterally between regions.
  - As the aggregate value of government expenditure in each region is modelled as varying with household income, it is not linked to tax revenue and government budgets are not modelled explicitly. This implies that the fiscal balance has no impact on model results.
- The allocation of private consumption is modelled using a constant difference in elasticities (CDE) function, in which the price and income elasticities of demand vary in response to changes in prices and aggregate expenditure. The allocation of government expenditure is governed by a Cobb-Douglas function.
- The demands of producers, households and government for composite commodities are determined by their relevant behavioural functions. Composite commodities are formed through nested structures, with constant elasticity of substitution (CES) between imported and domestically produced goods and CES substitution between imports from different countries (the 'Armington' assumption). The demand for commodities at each level in the nesting depends on relative prices and the relevant elasticity of substitution (the elasticities of substitution between imported goods originating from different countries are twice those between domestic and aggregated imported commodities).
- Producers in each region are divided into sectors (industries) and are assumed to minimise costs subject to a constant returns to scale production technology. They combine intermediate inputs and a primary factor bundle in fixed proportions to produce their output. Skilled and unskilled labour, capital and land are combined using a CES function to form a primary factor bundle. Goods and factor markets are assumed to be competitive and clear in equilibrium.
- Regional capital stocks in the standard GTAP model are replaced by CES aggregates of domestic and foreign capital stocks in the modified model. After-tax returns to foreign capital can be transferred to their owner regions as their offshore income.
- In some simulations, 'tax' revenues are interpreted as economic rents to factors additional to normal returns.

Box 1.2 **Some limitations and simplifications**

All models of economic activity require simplifying assumptions to operate. Box 1.1 outlines a range of assumptions used in this exercise. A particular strength of the GTAP model is its country and sectoral detail and the associated real resource flows. However, the standard GTAP model does not explicitly account for matters including:

- economies of scale and scope in production;
- heterogeneity within the products in the database;
- financial flows and financial instruments; or
- risk and uncertainty.

The GTAP model and closure used in this supplement does, however, feature a stylized treatment of savings and investment behaviour.

Some commentators (for instance, Stanford and Conroy 2007) have argued that assumptions and parameter values commonly used in the CGE modelling of trade agreements — including those relating to employment levels, trade balances, product differentiation and capital mobility — call into question the results obtained.

The objective of any economic modelling should be to provide insights relevant to the policy analysis at hand. The Commission's CGE modelling in this supplement focuses on relativities in the long run (or 'enduring') changes in trade and investment flows, and associated changes in aggregates such as GDP, that can be attributed to different trade liberalisation scenarios. Thus, for example, it does not seek to track inter-temporal changes in aggregate employment, which would largely be determined by factors such as labour market arrangements and macroeconomic policies and conditions that are outside the scope of a trade agreement or reform. The economic environment (or model closure) used for the simulations is described below. More generally, while modelling results should always be interpreted carefully, taking into account the strengths and limitations of the model being used, the balance of feedback from the Commission's modelling workshop supported the model used in this supplement as a suitable tool for helping to examine the policy questions under reference.

The model database and extension

The database used is an extended version of GTAP database version 7, which represents a 2004 base year.[2] The standard database is comprised of 113 regional economies and 57 single-output industries. It is composed of:

- detailed input–output tables representing the industrial structure in each country;
- bilateral trade data for each of the 57 commodities; and

[2] The GTAP database is documented in Narayanan and Walmsley (2008) and on the GTAP website: https://www.gtap.agecon.purdue.edu/databases/v7/default.asp. The GTAP database is expressed in 2004 US dollars.

- measures of international transport costs (transport margins) to account for the difference between the border price of products in the source country (free on board or fob) and at the border in the country of use (cost including insurance and freight or cif).

Border protection on merchandise trade is included in the model in terms of tariff equivalents measured at the border of the importing country.[3] Behind-the-border assistance, such as subsidies or price supports to agriculture and manufacturing industries, are included in the database but are not shocked in any of the scenarios.

For the purpose of this supplement:

- 20 economies in the original GTAP database are retained with the remaining economies aggregated into five regional groupings to facilitate the computation process (appendix A); and
- all 57 industries in the original GTAP database are retained (appendix B).

The model theory was modified to account for bilateral capital flows to accommodate certain preferential scenarios.

To accommodate the modified model, this 25-region version of the database has been extended to include two more sets of data:

- a bilateral capital stock matrix to replace the regional capital stock vector that is present in the standard GTAP database, which does not identify the origin of the capital; and
- a bilateral saving and investment matrix to replace the regional saving vector that is present in the standard GTAP database.

The modifications made to the GTAP model code and to the database are outlined in appendix C. Data to support these extensions were obtained from the International Monetary Fund's Balance of Payments Statistics (IMF 2010) and UNCTAD's Foreign Direct Investment (FDI) database (UNCTAD 2009).

Model closure (economic environment)

The variant of the GTAP model used in this supplement is a comparative-static model that compares the global economy with and without the changes applied, allowing for full adjustments across the global economy. As the model is

[3] Since Australian tariffs rates are applied on the fob value of goods, the rates in the GTAP model are smaller than might be expected on the basis of the Australian customs schedule, but consistent with the schedule.

comparative-static, it does not seek to trace the path through time by which adjustment occurs, or the length of the adjustment period.

Within this comparative-static framework, the modelling results describe the potential longer-term effects of policies, that is, after the effects of a policy have had time to work through the global economy. The projected effects reflect those that might occur after capital and labour markets have fully adjusted (generally taken to be in the order of 10 or more years).[4,5]

The longer-run economic environment for the modified GTAP model assumes that:

- The supplies of effective labour and land are fixed in each country. Within each country, labour is assumed to move between industries in response to differences in wages; 'land' is assumed to be mobile across designated agricultural land-using and resource industries.[6]
- Factor prices (wages and returns to capital and land) in each economy adjust to ensure that there is no change in the 'capacity utilisation' implied in the model database for labour, capital and land.[7]
- All tax rates are held fixed with tax revenue and the ratio of tax revenue to regional income adjusting in each country.

The model closure used in this supplement allows the capital stock to adjust to its long-run equilibrium rate of return (closure A4, box 1.3), implicitly capturing the effects of the increased savings and investment that are induced by the modelled policy changes.[8] Sensitivity of the results to this choice are reported in box 1.3.

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4 While the comparative static approach adopted in this study provides an indication of the longer-run impacts on the level of economic activity, the approach does not delineate possible adjustment paths between the current and projected new level of activity. To trace possible paths, a dynamic modelling framework would be required. Such modelling is beyond the scope of this study.

5 In addition, the model solves quickly; a valuable feature in policy modelling (and in particular for this study, which consists of a large number of simulations). This feature was noted by one of the referees at the workshop as being valuable, as well as the fact that the developments required to adapt newer dynamic models based on GTAP, such as GDyn (Walmsley, forthcoming), to the needs of this project would not be practicable in the time available.

6 'Land' represents agricultural land in agricultural industries and natural resources in mining and forestry industries. For other industries, industrial land is accounted for in capital. The supply of labour is assumed not to be affected by the policies modelled, but rather a function of education and other relevant labour market policies.

7 It is assumed that the microeconomic policy changes do not affect the distribution of labour between countries. Aggregate labour supply in each country (aggregate employment) is therefore assumed to be determined by factors beyond the scope of the modelling.

8 Francois and McDonald (1996) introduce capital accumulation and mobility effects of liberalisation by tying capital growth to investment and allowing rates of return to vary.

Box 1.3 **Choosing a suitable closure**

Reflecting the longer-run focus of the study, the closure used in this supplement is designed to capture some of the flexibility in the mobility of capital stocks that might be expected to exist over a longer time frame.

In the long term, two assumptions can be used to represent adjustments in capital.

1. Consistent with growth theory, it can be assumed that in a steady state, investment and capital grow at the same rate; that is, the ratio of capital to investment remains fixed. For example, if tariff reductions reduce the cost of investment goods, investment will increase and capital will increase correspondingly to keep the ratio constant.
2. Alternatively, the capital stock might be assumed to adjust to maintain the original long-run rates of return. For example, if tariff reductions cause returns to capital in industry to rise relative to returns in other industries, capital will move into the industry until returns to capital return to the original levels.

By contrast, a short-term environment might be one in which capital is assumed to move across industries within an economy to seek the highest return, but not across borders — this closure is traditionally adopted in GTAP simulations. A medium-term environment might be one in which capital is allowed to move between economies while the global stock of capital is assumed fixed

The effects of these varying assumptions about capital adjustment in the GTAP model simulations are illustrated against a common scenario of a global reduction in tariffs below.

Estimated effects of alternative closure assumptions — global reductions in tariffs

		Australia			*World*		
Closure		*Real GDP*	*Export volumes*	*Import volumes*	*Global product*	*Total trade*	*RoR*[d]
		% change	% change	% change	% change	% change	% change
A1	K stock fixed globally and in each economy[a]	0.12	5.16	5.88	0.24	5.14	0.2 – 24.0
A2	K stock fixed globally, mobile across economies	0.25	5.44	6.36	0.36	5.74	1.78
A3	Variable global K, fixed investment/capital ratio[b]	0.72	5.75	7.07	0.90	6.46	0.60
A4	Variable global K stock, fixed rates of return[c]	0.94	6.32	7.15	1.18	6.84	0

[a] Standard GTAP closure. [b] Closure used in PC (2009). [c] Closure used in this supplement. [d] Changes in regional rates of return, which vary across regions in closure 1, but are modelled as the same across regions in other closures.

Source: Simulation results.

(continued next page)

Box 1.3 **(cont'd)**

The results show that, as constraints on the adjustment of capital are relaxed, global product and Australian real GDP are projected to increase.[9] Most of the projected increases in *trade* are attributable directly to the tariff reductions; increasing capital mobility magnifies these effects through an expansion in the size of the economy.

- In closure A1, the effects of trade liberalisation are constrained by the assumption of fixed capital stock by region; all changes are due to a more efficient allocation of factors of production within each region.
- In closure A2, the reallocative effects of capital moving across regions to its most productive use result in more efficient patterns of production around the world and global trade and output are projected to increase, although the increase is limited by the assumption of a fixed global capital stock.
- In closure A3, the level of global capital stock is allowed to vary, but the investment-to-capital ratio is assumed fixed.
- In closure A4, capital stock is modelled as adjusting at the regional and global levels until rates of return adjust back to their original (assumed) long-run rates. This increased mobility of capital results in projected increases in GDP of around one third greater than under closure A3.

Projected changes in rates of return are consistent with the constraints on capital in each closure.[10]

1.2 Outline of scenarios modelled

The scenarios presented in this supplement are designed to illustrate the effects of policies that are often included in preferential trade and investment agreements. Other policy experiments (some non-preferential) are also included for comparison purposes. The illustrative scenarios include:

- preferential, unilateral and multilateral tariff reduction scenarios (in chapter 2);
- a variety of sensitivity analyses (in chapter 3) of the possible effects of costs associated with:
  - rules of origin;
  - carve-outs of sensitive products and industries; and

9 Australian GDP increases are smaller than the average because Australian tariffs are low relative to tariffs in other economies and therefore reductions in Australian tariffs are smaller.

10 The assumption of fixed capital stock at the regional level is accompanied by variations in projected rates of return across economies; changes in the global rate of return decrease across the simulations as the stock of capital is modelled with increasing flexibility to adjust globally.

  - incomplete pass-through of bilateral tariff preferences (that is, duty-paid prices decrease by less than the margin of preference);
- implementation of trade facilitation measures (chapter 4);
- other trading partners reducing tariffs bilaterally (chapter 5); and
- reductions in barriers to foreign direct investment (chapter 6).

Detailed results tables, model and database modifications, and database aggregation tables are included in appendixes A, B, C and E.

The scenarios are intended to illustrate aspects of reductions in barriers to trade and investment between:

- Australia and a small country;
- Australia and a large country;
- Australia and other members of APEC; and
- all regions across the globe.

Although simulations reported in this supplement are based on economic data included in the GTAP model, none of the simulations are intended to provide — or are capable of providing — an assessment of the effects of any specific agreement. In particular, the simulations should not be interpreted as being equivalent to ex-ante or feasibility studies of possible agreements. The results in this study also should not be taken as an ex-post assessment of the impact of any particular agreement.

In the preparation of this supplement, it has been recognised that the prospective effects of some agreements have been modelled elsewhere in advance of negotiation or signing. Appendix D outlines some of these studies of Australian preferential trade agreements as background to the analysis reported in this supplement. However, a comparison between results presented in this supplement and in those studies is not made; nor would it be appropriate. Rather, the scenarios in this supplement are intended to provide insights into the mechanisms and orders of magnitude of various aspects of trade and investment arrangements.

Although specific agreements might occasionally be referred to in this supplement, it should be noted that the projected effects reported pertain to a stylised implementation of reform possibilities. For example, references to reductions in tariffs in bilateral trade between Australia and the United States (the comparator large country adopted in this supplement) or between Australia and Thailand (the comparator small country) do not refer to the corresponding agreement between Australia and Thailand or Australia and the United States, but are simulations of an assumed bilateral reduction in tariffs from their estimated levels in 2004 to zero.

Characteristics of results

The results provided in this supplement are projections, not forecasts of what might or might not have occurred. The projections in this supplement therefore are:

- predicated on the assumed economic behaviour and market structures embodied in the equation structure and database of the model, and on the parameters that determine the degree of responsiveness in key relationships; and
- designed to illustrate the mechanisms and orders of magnitude involved in reducing barriers to trade and investment.

The effects captured in the scenarios arise mainly from a reallocation of resources and from adjustments in capital induced by reductions in barriers to international trade and investment. Due to the longer-run approach adopted in the modelling which allows for flexibility in capital markets, many results are likely to be larger than those that would be obtained from GTAP modelling that assumed sectoral and national capital stocks to be fixed (see box 1.3).

In most simulations, the reductions in barriers to trade and investment are not, unless otherwise stated, assumed to induce or be associated with any technological changes or productivity improvements. In particular, this is the case in almost all tariff reduction scenarios. To the extent that tariff reductions and increased competition from imports induce improvements in productivity among import competing firms or within import competing industries, the projections in this supplement could underestimate the possible increases in trade and income from reducing barriers to trade.[11]

A summary of the results of the scenarios presented in the remainder of the supplement is shown in table 1.1.

[11] Increased competition from imports could improve the productivity of import competing industries by improving the productivity of import competing firms or by eliminating the least competitive parts of the industry, as suggested by Melitz (2003) and Chand, McCalman & Gretton (1998).

Table 1.1 List of simulations used in this supplement and projected effects on Australian real GDP

Scenario	*Description*	*Real GDP*
		% change
Trade liberalisation		
T1	Australia and a small country remove bilateral tariffs preferentially	0.054
S1	Additional RoO costs: exporting industries in partners incur additional costs in the form of rents that accrue to factors used	0.053
S2	Tariff reductions are not passed through to duty paid prices: exporters raise prices by the amount of the margin of preference and receive a rent that increases their income	-0.004
T2	Australia and a large country remove bilateral tariffs preferentially	0.117
S3	Additional RoO costs: exporting industries in partner countries incur additional costs in the form of rents that accrue to factors used	0.112
S4	Tariff reductions are not passed through to duty paid price: exporters raise prices by the amount of the tariff reduction and receive a rent that increases their income	0.001
S5	Importers do not avail themselves of available preferential rates (partial utilisation)	0.087
T3	Australia removes tariffs on imports from all sources, non-preferentially	0.559
T4	APEC member countries remove tariffs on imports from all countries, non-preferentially	0.862
T5	All countries remove tariffs on imports	0.940
Regional tariff reductions with and without Australia		
R1	Australia removes tariffs bilaterally with China, Korea, Japan and the United States	0.950
R2	R1 plus China, Korea, Japan and the United States remove tariffs bilaterally with each other	0.691
R3	China, Korea, Japan and the United States remove tariffs bilaterally	-0.088
S6	R3 with increased flexibility in the export sector modelled as a higher elasticity for land supply in Australia	-0.029
S7	R3 with increased flexibility in the export sector modelled as an endogenous increase in the supply of land in Australia	-0.001
R4	R3 plus Australia removes tariffs on imports from all countries	0.473
Trade facilitation I		
F1	1 per cent reduction in the cost of imports between Australia and a large country	0.067
F2	1 per cent reduction in the cost of all imports into Australia and a large country	0.368
F3	1 per cent reduction in the cost of world imports	0.417
F4	T5 plus F3	1.365
Trade facilitation II		
S8	5 per cent reduction in transport costs on trade between Australia and a large country	0.009
S9	5 per cent reduction in transport costs on all imports into Australia and a large country	0.045
S10	5 per cent reduction in transport costs on world trade	0.058
Foreign investment liberalisation		
V1	a 5 basis point reduction in the risk premium on bilateral FDI originating from the partner country in Australia and a large country — preferential	0.009
V2	a 5 basis point reduction in risk premium on all FDI in Australia and a large country — non preferential	0.062
V3	V1 plus a 5 per cent induced productivity improvement on the corresponding FDI	0.022
V4	V2 plus a 5 per cent induced productivity improvement on the corresponding FDI	0.080

2 Reductions in border assistance

The tariff reduction scenarios are designed to illustrate various aspects of preferential and non-preferential reductions in border assistance (table 2.1). Since the database, including the protection data, represents the global economy in 2004, the scenarios represent the potential impact of changing barriers that prevailed at that time on the structure of the economies modelled.

Table 2.1 **Tariff reduction scenarios**[a]

Code	*Scenario*	*Description*
	Preferential	
T1	Preferential trade agreement between Australia and a small country	To illustrate the potential impacts of bilateral preferential arrangements between Australia and another small country, reduce estimated tariff rates to zero for all trade between Australia and Thailand[b]
T2	Preferential trade agreement between Australia and a large country	To illustrate the potential impacts of bilateral preferential arrangements between Australia and a large country, reduce estimated tariff rates to zero for all trade between Australia and the United States[b]
	Non-preferential	
T3	Australian unilateral tariff liberalisation	To illustrate the potential impacts of unilateral action to eliminate remaining tariffs on imports into Australia, reduce estimated tariff rates to zero for all imports into Australia from all countries
T4	APEC members' tariff liberalisation	To illustrate the potential impact of full achievement of the APEC Bogor Declaration, reduce estimated tariff rates to zero for all imports into APEC member countries
T5	Global tariff liberalisation	To illustrate the potential impact of action to eliminate tariff protection globally, reduce estimated tariff rates to zero for all imports into all countries

a The base case assumes industry, trade and tariff structures prevailing in 2004. **b** This is not the same as modelling the impact of the Thailand-Australia or the Australia-United States trade agreements. The scenarios do not allow for factors including how the General System of Preferences (GSP) and developing country trade preferences might interact with the preferences modelled or other factors such as extended phase-in periods, carve outs for sensitive commodities, partial take up of preferences or the impact of rules of origin. The potential impact of some of these factors is considered in a range of sensitivity tests (see chapter 3).

The trade-weighted average applied rates for the countries represented in the model vary from zero in entrepôt economies (Hong Kong and Singapore) to more than 10 per cent in many developing economies (table 2.2). These averages mask large variations within the tariff schedules. For example, Australian tariffs on items of wearing apparel were 25 per cent in 2004.[1]

Table 2.2 **Estimated trade weighted average tariffs**[a]

GTAP region	*Tariff rate*
	%
Australia	3.2
New Zealand	2.5
China	5.6
Hong Kong	0.0
Japan	3.2
Korea	5.3
Taiwan	3.8
Indonesia	3.4
Malaysia	5.2
Philippines	3.3
Singapore	0.0
Thailand	8.0
Bangladesh	16.8
India	12.8
Rest of Asia	7.1
Canada	1.3
United States	1.5
Mexico	2.7
Brazil	6.2
Rest of America	6.9
European Union	0.8
Russia	7.5
Rest of Europe	3.1
South Africa	5.0
Rest of Africa	11.3

a Trade weighted ad valorem equivalents, calculated by dividing estimated tariff revenue by estimated value of imports (cif).

Source: GTAP database.

1 To the extent that Australia and other countries have reduced tariffs unilaterally since 2004, the simulations presented in this supplement might overstate the potential effects from bilateral reductions to barriers modelled.

Calculating the shocks

The model shocks consist of reducing the appropriate tariff rates from their database values to zero, implying that no tariff revenue would be collected on bilateral merchandise trade between the partner economies. Tariffs on all items of merchandise trade were included in the scenarios.

Simulation results

Australian GDP and trade are projected to increase (table 2.3) as the reach of tariff reductions increases with:

- the importance of bilateral trade — in the GTAP database, Australia imports more from the illustrative large country (the United States in this supplement) — than the illustrative small country (Thailand); and
- the coverage of countries and global trade flows — as trade liberalisation expands from unilateral tariff reductions by Australia to tariff reductions across APEC economies and to the world.

Table 2.3 **Projected effects of tariff reductions on real GDP, real GNP and trade volumes**[2]

		Australia				*World*	
Scenario		*Real GDP*	*Real GNP*	*Export volumes*	*Import volumes*	*Global product*	*Total trade*
		% change	% change	% change	% change	% change	% change
T1	Zero tariffs on all trade between Australia and a small country	0.054	0.045	0.394	0.471	0.002	0.011
T2	Zero tariffs on all trade between Australia and a large country	0.117	0.097	0.967	1.151	0.001	0.023
T3	**Zero tariffs on all imports into Australia from all countries**	**0.559**	**0.482**	**5.302**	**3.715**	**0.012**	**0.066**
T4	Zero tariffs on all imports into APEC member countries	0.862	0.782	5.972	6.342	0.532	3.427
T5	Zero tariffs on all imports globally	0.940	0.881	6.320	7.146	1.179	6.844

Source: Simulation results.

2 Changes in Gross National Product (GNP) are used for the purposes of this supplement to measure changes in economic welfare. GNP is a measure of income and accounts for what a country can either consume or save. Unlike GDP, it accounts for income from capital owned domestically but used overseas as well as income paid on capital used domestically but owned by foreigners.

The potential increase in Australian GDP from eliminating tariffs unilaterally is projected to be:

- around 10 times the increase from eliminating tariffs on imports from an illustrative small country;
- nearly 5 times the increase from eliminating tariffs on imports from an illustrative large country;[3] and
- more than half of the increase from eliminating tariffs globally.

Some of the projected expansion in Australian activity levels comes from Australia attracting capital from other parts of the world as the competitiveness of Australian industry improves.

The preferential tariff reduction scenarios (T1 and T2) are projected to provide no noticeable change in global product or trade. The projected impact on global production from unilateral Australian reductions (T3) is small because the Australian economy is relatively small by global standards. Projected increases in global production and trade rise as the geographic coverage of tariff reductions is extended.

All scenarios project net trade creation for Australia and globally. Nevertheless, the projected effects of the preferential scenarios on Australian exports and world trade are of a smaller order (0.011 and 0.023 per cent net increases in world trade, respectively) than the projected trade outcomes from the non-preferential scenarios (0.066 to 6.84 per cent — table 2.3).

While tariff reductions are projected to increase the level of activity and global income, government tariff revenue is projected to decline (box 2.1).

[3] It should be noted that the gains from eliminating tariffs bilaterally with multiple partners are not linearly additive. That is, the gains from eliminating tariffs bilaterally with two (identical) small countries, or alternatively with two (identical) large countries, would not be double the gains from eliminating tariffs bilaterally with one small country, or one large country.

Box 2.1 Some implications of tariff reductions on government revenues

Reducing tariffs would reduce revenues collected on imports from trading partners. In the GTAP database, Australian tariff revenues are estimated to be in the order of US$ 4 billion.

Preferential reductions in tariffs have two immediate effects on tariff revenue. The first effect is the elimination of revenue from tariffs on imports from the partner country. In scenarios T1 and T2, Australia is projected to forgo tariff revenues collected on imports from the small country and the large country, respectively (see table below). The second effect arises from tariffs applied on imports from third parties. If imports from third parties increase, tariff revenues could increase. If, however, the preferential reduction in tariffs diverts trade away from third parties towards the preferential partner then tariff revenue on imports from third parties would decline also. This is the case in scenarios T1 and T2.

Under non-preferential tariff reductions (T3), all tariff revenues are projected to be foregone since tariffs are assumed to be reduced to zero for all partners.

Projected effects of tariff reductions on real tariff revenues — Australia[a]

	Revenue collected from partner countries before tariff reductions	*Change in tariff revenue collected*
	US$ m	US$ m
T1. Australia–small country	124.3	-163.3
T2. Australia–large country	414.9	-498.5
T3. Australia[b]	**3959.3**	**-3959.3**

[a] Real changes, which account for changes in relative prices around the world. [b] Non-preferential elimination of tariffs reduces all tariff revenues to zero for T3, T4 and T5.

Source: Simulation results.

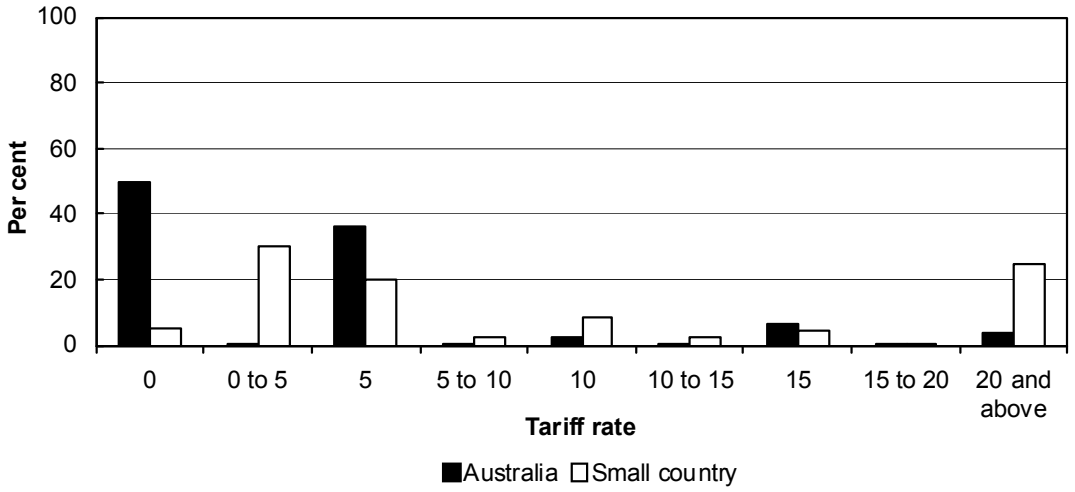
Scenario 1 — Australia–small country bilateral tariff reduction

The level of the tariffs applied to trade between Australia and an illustrative small country influences the relative size of the effects on industries in both partners. On average, the illustrative tariffs in the small country are assumed to be higher than Australian tariffs:

- the small country is assumed to apply tariffs of up to 40 per cent on many products and 25 per cent of 6-digit HS codes are assumed to have applied tariffs exceeding 20 per cent (figure 2.1); and
- Australian tariffs are recorded at 5 per cent or less, except for some motor vehicle and textile products (table 2.4).

Figure 2.1 **Estimated MFN tariff rates — Australia and an illustrative small country, 2004[a,b]**

Per cent of tariffs in range (HS6 sub-headings)



[a] Data for Thailand are used for the illustrative small country. [b] Ad valorem MFN tariffs only.

Source: WTO Tariff Analysis Online database.

Generally, industries with the largest tariffs are projected to experience the largest decreases in output when their protection is removed. This is the case for bovine meat products and fruit and vegetables in the small country, and leather products, wearing apparel and textiles in Australia (table E.3). Resources are projected to move into other industries that can use them more efficiently, including into motor vehicles and parts, and machinery and equipment in the small country, and into crops and ferrous metals in Australia (table E.4).

Trade in the goods with the highest initial tariffs is projected to increase between Australia and the small country (table E.4). For example, the results project Australian exports of sugar to the small country to increase when the tariff of more than 50 per cent is removed and the small country's exports of leather products to Australia are also projected to increase.

Trade between Australia and the small country is projected to increase by more than 30 per cent (table 2.5). Australia is projected to divert around 0.5 per cent of its exports away from other economies towards the small economy in response to the tariff reductions. The small economy is projected to divert a much smaller share of its trade to Australia because the estimated tariff reductions result in a small margin of preference over other imports into the Australian market. The preferential tariff reduction is projected to be net trade creating with imports replacing some domestic production in both economies and world trade projected to increase by 0.01 per cent, or US$ 1.1 billion (table 2.3).

Table 2.4 Estimated bilateral trade weighted average tariffs — Australia and an illustrative small country, 2004[a,b]

Commodity	*Australia*	*Small country*
	%	%
Paddy rice	0	0
Wheat	0	27.0
Cereal grains nec	0	27.0
Vegetables, fruit, nuts	0.5	55.2
Oil seeds	0.2	35.0
Sugar cane, sugar beet	0	0
Plant-based fibres	0	5.0
Crops nec	0	35.2
Cattle,sheep,goats,horses	0	11.3
Animal products nec	0	0.7
Raw milk	0	0
Wool, silk-worm cocoons	0	1.0
Forestry	0	16.6
Fishing	0	59.4
Coal	0	1.0
Oil	0	0
Gas	0	0
Minerals nec	0.1	1.3
Bovine meat	0	56.2
Meat products nec	0.3	16.9
Vegetable oils and fats	0.5	21.1
Dairy products	0.6	7.7
Processed rice	0	52.0
Sugar	0	65.0
Food products nec	1.9	22.6
Beverages and tobacco products	1.1	34.4
Textiles	9.5	3.4
Wearing apparel	22.0	27.5
Leather products	11.9	0.8
Wood products	4.7	14.2
Paper products, publishing	2.6	18.8
Petroleum, coal products	0	1.0
Chemical,rubber,plastic prods	5.4	9.2
Mineral products nec	3.8	12.3
Ferrous metals	2.4	5.0
Metals nec	0.2	1.5
Metal products	4.6	18.7
Motor vehicles and parts	5.3	30.0
Transport equipment nec	1.8	8.2
Electronic equipment	1.2	7.2
Machinery and equipment nec	5.2	7.3
Manufactures nec	4.3	10.7

a Data for Thailand are used for the illustrative small country. **b** Trade weighted ad valorem equivalent average tariffs; ratio of relevant tariff revenue to cif imports.

Source: GTAP database.

Table 2.5 **Projected changes in bilateral trade flows from eliminating tariffs on trade between Australia and an illustrative small country[a]**

Imp → *Exp ↓*	***Australia***	*China*	*Japan*	*USA*	*European Union*	*Rest of APEC*	*Rest of World*	***Thailand***
	US$ m	US$ m	US$ m	US$ m	US$ m	US$ m	US$ m	US$ m
Australia	**-**	**-45**	**-77**	**-58**	**-75**	**-144**	**-115**	**944**
China	**-83**	-	6	18	20	17	12	**-9**
Japan	**-99**	9	-	19	17	22	9	**25**
USA	**-44**	4	9	-	6	10	32	**-62**
European Union	**-101**	-6	-2	0	-	6	16	**9**
Rest of APEC	**-40**	-4	9	2	9	-	13	**-54**
Rest of World	**-21**	-2	1	-16	-30	9	-	**8**
Thailand	**916**	**-6**	**8**	**5**	**-16**	**-2**	**-5**	**-**

a These changes exclude changes in the exports of transport margin services, because transport margin exports are not calculated bilaterally in the GTAP database.

Source: Simulation results.

Incomes in Australia and the small country are projected to increase when reducing tariffs preferentially. Australia is projected to experience a small increase in its terms of trade (0.11 per cent — table E.5) and, in both countries, real GNP is projected to increase (0.05 per cent in Australia and 0.37 per cent in the small country — table E.6).

Scenario 2 — Australia–large country bilateral tariff reduction

Although Australia has, and the illustrative large country is assumed to have, low average tariff rates, both countries apply high tariffs to some goods (figure 2.2). For example, the average Australian applied tariff on wearing apparel, motor vehicles and parts, and textiles imported from the large country exceeds 8 per cent. Australian sugar exports to the large country attract tariffs in excess of 40 per cent, and bovine meat and dairy exports face barriers of 12 per cent (table 2.6).

Table 2.6 Estimated bilateral trade weighted average tariffs — Australia and an illustrative large country , 2004[a]

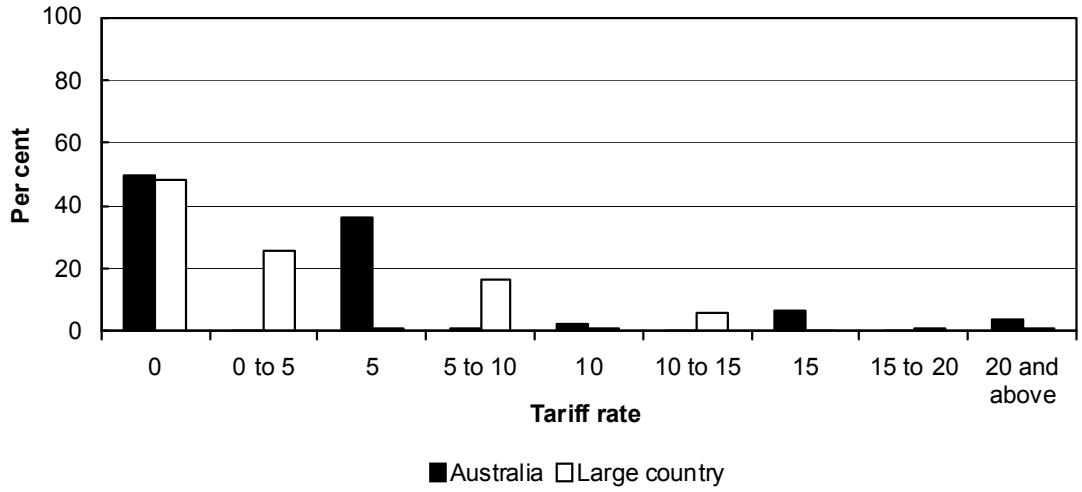
Commodity	*Australia*	*Large country*
	%	%
Paddy rice	0	0
Wheat	0	3.0
Cereal grains nec	0	0.4
Vegetables, fruit, nuts	1.7	2.3
Oil seeds	0.2	1.8
Sugar cane, sugar beet	0	0
Plant-based fibres	0	11.9
Crops nec	0	2.5
Cattle,sheep,goats,horses	0	0
Animal products nec	0	0.4
Raw milk	0	0
Wool, silk-worm cocoons	0	1.0
Forestry	0.3	0.2
Fishing	0.2	0.5
Coal	0	0
Oil	0	0.4
Gas	0	0
Minerals nec	0.1	0.1
Bovine meat	0	12.2
Meat products nec	3.1	1.1
Vegetable oils and fats	0.1	6.0
Dairy products	1.0	15.6
Processed rice	0	7.2
Sugar	0.5	42.9
Food products nec	2.6	3.3
Beverages and tobacco products	4.1	4.7
Textiles	9.4	9.9
Wearing apparel	15.6	11.3
Leather products	8.0	5.6
Wood products	4.4	0.7
Paper products, publishing	3.0	0
Petroleum, coal products	0	1.2
Chemical,rubber,plastic prods	2.8	1.8
Mineral products nec	5.1	4.1
Ferrous metals	4.7	0.5
Metals nec	0.9	0.7
Metal products	5.9	2.0
Motor vehicles and parts	8.1	2.0
Transport equipment nec	0.2	0.3
Electronic equipment	0.4	0.3
Machinery and equipment nec	3.1	1.0
Manufactures nec	3.6	0.7

a Data for the United States are used for the illustrative large country.

Source: GTAP database.

Figure 2.2 **Estimated MFN tariff rates — Australian and an illustrative large country, 2004[a,b]**

Per cent of tariffs in range (HS6 sub-headings)



a Data for the United States are used for the illustrative large country. **b** Ad valorem MFN tariffs only.

Source: WTO Tariff Analysis Online Database.

When barriers to trade are reduced in Australia and in the large country, Australian exports are projected to increase correspondingly and outputs of bovine meat products, dairy products and sugar expand, along with outputs of the corresponding raw products that are required for their production including bovine cattle, raw milk and sugar cane. Similarly, in the large country, output of wearing apparel, leather products, and motor vehicles and parts is projected to increase.

As total output in both countries is projected to increase, demand for factors of production also increases, raising returns to these factors. Returns to capital remain fixed according to the assumptions made about capital mobility. Capital stocks in both countries are projected to increase, largely by attracting investment from the rest of the world. As the capital–labour ratio increases, wages are projected to increase 0.02 per cent[4] in the large country, and 0.45 per cent[5] in Australia.

Trade between Australia and the large country is projected to increase 14 per cent or US$ 2.1 billion (table 2.7). In total, the preferential reduction in tariffs is projected to increase world trade by 0.02 per cent or US$ 2.3 billion (table 2.3).

4 0.022 per cent for skilled labour and 0.021 per cent for unskilled labour.

5 0.42 per cent for skilled labour and 0.50 per cent for unskilled labour.

Table 2.7 **Projected changes in bilateral trade volumes from eliminating tariffs on trade between Australia and an illustrative large country[a]**

Imp → *Exp ↓*	***Australia***	*China*	*Japan*	***USA***	*European Union*	*Rest of APEC*	*Rest of World*
	US$ m	US$ m	US$ m	US$ m	US$ m	US$ m	US$ m
Australia	**-**	**-94**	**-210**	**2119**	**-173**	**-376**	**-217**
China	**-185**	-	21	**54**	29	48	17
Japan	**-302**	20	-	**79**	28	61	18
USA	**2743**	**-49**	**-51**	**-**	**-308**	**-301**	**-147**
European Union	**-536**	4	14	**53**	-	62	82
Rest of APEC	**-258**	4	56	**-196**	44	-	46
Rest of World	**-97**	8	24	**-175**	6	56	-

a These changes exclude changes in the exports of transport margin services, because transport margin exports are not calculated bilaterally in the GTAP database.

Source: Simulation results.

The terms of trade in both countries are projected to improve (0.27 per cent in Australia and 0.02 per cent in the large country — table E.10) and income is also projected to increase (an increase in GNP of 0.003 per cent in the large country and 0.1 per cent in Australia — table E.11). The projected increase in the large country is small due to the assumed small size of its trade with Australia and the relatively low tariffs in both countries. Real GDP is projected to increase in the large country by 0.003 per cent and in Australia by 0.12 per cent (table E.11). The difference between the projected changes in real GNP and real GDP in Australia arises because income paid on assets owned by foreigners but used in Australia exceeds the estimated income received from Australian-owned assets that are used overseas.

Scenario 3 — Australian unilateral reduction in tariffs

Although average tariffs in Australia are low relative to those prevailing in many other regions, several industries are characterised by relatively high tariff rates, for example wearing apparel, textiles, leather products, and motor vehicles and parts. Not surprisingly, therefore, these industries are projected to experience the largest declines in activity as the corresponding protective tariffs are removed — wearing apparel output is projected to decrease by 14.7 per cent and textiles output by 9.8 per cent (table E.12).

As the domestic market switches to cheaper imports, exports of wearing apparel, textiles, leather products, and motor vehicles and parts are projected to increase by

more than 15 per cent. These industries all use a high proportion of intermediate inputs that attract a high tariff or receive high tariff protection. Once these tariffs are removed, access to cheaper inputs is projected to cause the price of exports to decline and foreign demand for the product to increase. Australian output is projected to increase by 0.5 per cent (table E.15).

Australia's total trade is projected to increase as a result of the tariff reductions, with exports projected to increase more than imports (table 2.8). Total trade is projected to increase in most other regions and in the world as a whole (0.065 per cent — table 2.3). Australia is projected to experience a small terms of trade loss which would be expected from a unilateral tariff reduction.

Table 2.8 **Projected changes in bilateral trade volumes from Australian unilateral reduction in tariffs[a]**

Imp → *Exp ↓*	***Australia***	*China*	*Japan*	*USA*	*European Union*	*Rest of APEC*	*Rest of World*
	US$ m	US$ m	US$ m	US$ m	US$ m	US$ m	US$ m
Australia	**-**	**422**	**605**	**803**	**950**	**1769**	**1214**
China	**2122**	-	-195	-470	-441	-457	-275
Japan	**1167**	-51	-	-224	-165	-359	-158
USA	**121**	59	14	-	36	-92	-75
European Union	**893**	83	3	-122	-	-223	-374
Rest of APEC	**-3**	196	23	103	104	-	-55
Rest of World	**-27**	27	-18	64	195	-87	-

a These changes exclude changes in the exports of transport margin services, because transport margin exports are not calculated bilaterally in the GTAP database.

Source: Simulation results.

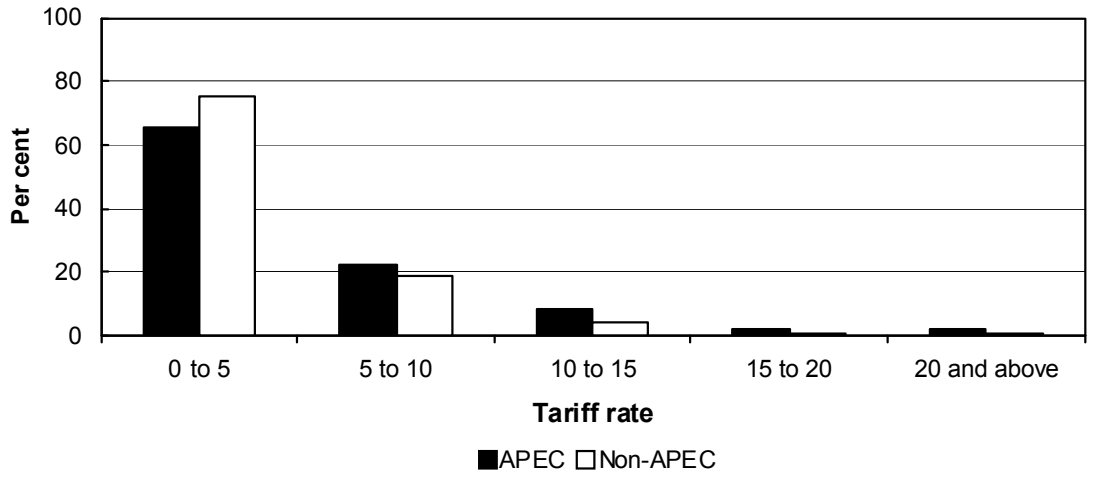
Australian GDP is projected to increase by 0.56 per cent as a result of an increased capital stock and improved allocative efficiency. Australian real GNP is projected to increase by slightly less (0.48 per cent) because returns to the additional foreign capital are assumed to be sent overseas (table E.15).

Scenario 4 — Unilateral reduction in tariffs by APEC members

In this scenario, the unilateral tariff reductions are extended to all APEC members.[6] The effects of this scenario depend upon the level of the tariff rates in each APEC member region (figure 2.3).

Figure 2.3 **Estimated MFN tariff rates — APEC and Non–APEC, 2004**[a]

Per cent of tariffs in range (HS6 sub-headings)



a Ad valorem equivalents of MFN tariffs.

Source: WTO Tariff Analysis Online Database.

Results for Australia project a decrease in output of wearing apparel, leather products and textiles by 17.9, 12.7 and 11.5 per cent respectively (table E.16). The output of industries modelled as facing large barriers from other APEC countries is projected to increase the most, including for bovine meat products (31.7 per cent), processed rice (30 per cent) and paddy rice (25.1 per cent). Once tariffs on these goods are removed, the demand for these exports is projected to increase. Without a significant change in domestic demand (Australia did not apply high tariffs to these products before the tariff reduction so the removal of small tariffs is not projected to induce a strong switch away from domestically produced varieties towards imports), the increased demand for exports is projected to cause total output to increase.

Trade is projected to increase between APEC members and, in some cases, with the rest of the world (table 2.9). There is evidence that reductions in tariffs by APEC members might cause some trade diversion away from the EU and other non-APEC regions. The largest trade effects are projected to occur in China where average

6 All APEC members are shocked in this simulation except Papua New Guinea, Chile and Brunei Darussalam because they are not identified separately in the aggregated GTAP databases.

tariffs rates are assumed to be somewhat higher than in some other parts of APEC — table E.17. For Australia, exports and imports are projected to increases by more than 5 per cent and 3 per cent respectively (table 2.3).

Table 2.9 **Projected changes in bilateral trade volumes from unilateral reductions in tariffs by APEC members[a]**

Imp → *Exp ↓*	***Australia***	*China*	*Japan*	*USA*	*European Union*	*Rest of APEC*	*Rest of World*
	US$ m	US$ m	US$ m	US$ m	US$ m	US$ m	US$ m
Australia	**-**	**2074**	**2829**	**640**	**-203**	**1236**	**-183**
China	**3238**	-	11428	24454	13913	37888	6053
Japan	**913**	17352	-	139	-1200	24713	-891
USA	**1269**	8608	8864	-	17116	-4914	8817
European Union	**506**	12922	2856	-5107	-	27479	-9712
Rest of APEC	**1612**	48135	13148	19447	18749	-	14372
Rest of World	**-142**	3121	78	-1627	-4661	9823	-

a These changes exclude changes in the exports of transport margin services, because transport margin exports are not calculated bilaterally in the GTAP database.

Source: Simulation results.

The projected terms of trade effects among APEC and non-APEC regions vary — Australia is projected to experience an increase in its terms of trade of 1.1 per cent. All regions are projected to experience an increase in allocative efficiency as resources shift away from protected industries to their highest value use. This, combined with an increase in the capital stock, causes projected increases in real GDP in Australia of 0.86 per cent (table E.19).

Australian real GNP (the model estimate of income) is projected to increase by 0.78 per cent (table E.19). Projected real GNP increases exceed real GDP increases in some economies in North Asia, North America and Europe, consistent with these economies being modelled as providing most of the capital required for the projected expansion in other economies (table E.19).

Scenario 5 — Global tariff elimination

Results for global tariff elimination build on those described for tariff reductions in APEC regions. Protected industries in Australia are projected to decline and export-oriented industries that faced barriers expand — for example, the projected outputs of processed rice, bovine meat products, paddy rice and wool all expand, by 33.4, 30.6, 25.1 and 21.3 per cent, respectively (table E.20). This pattern also emerges in

other areas of the world such as in the EU where agriculture is projected to contract with the removal of protection, and mining and some manufactured outputs are projected to expand.

Table 2.10 **Projected changes in bilateral trade volumes from global MFN tariff reductions[a]**

Imp → *Exp ↓*	***Australia***	*China*	*Japan*	*USA*	*European Union*	*Rest of APEC*	*Rest of World*
	US$ m	US$ m	US$ m	US$ m	US$ m	US$ m	US$ m
Australia	**-**	**2123**	**2633**	**359**	**306**	**1073**	**200**
China	**2283**	-	7298	9335	26087	28438	29514
Japan	**300**	15616	-	-6062	9264	18364	6411
USA	**990**	9812	9498	-	21662	-6733	13552
European Union	**2740**	24276	10187	16963	-	49876	62464
Rest of APEC	**590**	46405	11051	7240	23438	-	40576
Rest of World	**1492**	10133	6582	28278	88545	30609	-

a These changes exclude changes in the exports of transport margin services, because transport margin exports are not calculated bilaterally in the GTAP database.

Source: Simulation results.

Income is projected to increase across regions, but by varying amounts. Australian real GNP is projected to increase by 0.88 per cent (table E.23) which is lower than the world average increase of 1.2 per cent (table 2.3). This is due to Australia's relatively low tariffs. Regions with higher recorded tariffs such as China and the rest of Asia region are projected to achieve higher than average income growth.

Production in all regions is projected to increase with the elimination of tariff protection. The relative effects depend on the relative size of the tariffs. Real GDP in China and the rest of Asia (where tariffs are relatively large) is therefore projected to increase the most (nearly 3 per cent). Projected real GDP increases in the European Union and North America are smaller (0.48 and 0.11 per cent respectively). Australian real GDP is projected to increase by 0.94 per cent (table E.23).

Trade is projected to expand in all regions with the largest increases occurring in China which is recorded as having some of the highest tariffs and import and export flows (table 2.10). Australian and world trade is projected to increase by more than 6 per cent and 6.8 per cent respectively (table 2.3).

3 Sensitivity of results to alternative trade liberalisation assumptions

This chapter reports on the effects of alternative assumptions that might reduce the projected increases in trade and output from the preferential tariff reductions described in chapter 2. These potential increases in output and trade might be reduced by: the imposition of costly rules of origin (RoO); the exclusion of sensitive products (carve-outs); or tariff reductions that fail to reduce prices to consumers (incomplete or no 'pass-through').

Table 3.1 **Tariff reduction sensitivity scenarios**

Reference scenarios	*Sensitivity scenarios*	*Description of alternative assumptions applied*
T1, T2	S1, S3	RoO affect the production and trade costs of a selection of products characterised by significant tariff differentials across countries. Exporting industries in partner countries incur additional costs in the form of rents that accrue to factors used.
T1, T2	S2, S4	Tariff reductions are not passed through: exporters raise prices by the amount of the margin of preference and receive a rent that increases their income.
T2	S5	Importers do not avail themselves of available preferential rates — partial preference utilisation.

3.1 Effects of rules of origin

Rules of origin (RoO) are the criteria used to determine the national source of a product. They are included in PTAs to prevent transhipment, which is the practice of shipping goods that are produced outside a preferential trade area through a low tariff to a high tariff partner to avoid the higher tariffs. Approaches for determining origin include:

- local content requirements — which might stipulate a minimum of, say, 40, 50 or 60 per cent local content; and
- the requirement that an import undergo 'substantial transformation' before it can be exported to a partner — for example, sufficient to effect a change in the product's tariff classification (known as 'change in tariff classification' or CTC).

Box 3.1 **Transhipment and RoO in GTAP**

The GTAP database does not account for transhipment. The results for the bilateral tariff liberalisation scenarios presented in this supplement assume that the RoO are sufficiently stringent to prevent transhipment.

To model the effects of a RoO in a situation where the transhipment is likely to occur would require identifying transhipment opportunities in the database and creating a transhipment module to describe this behaviour. The potential projected increases in trade and activity from bilateral tariff liberalisation with transhipment would be larger than those presented in this supplement since the effect of transhipment is to extend the tariff reduction indirectly to other trading partners.

In the simulations reported in chapter 2, RoO are assumed to prevent transhipment but not to result in any additional costs (box 3.1). In the following scenarios, RoO are assumed to generate additional compliance costs. RoO are likely to increase production and compliance costs in the following ways:

- *Increased production and transaction costs for exporters*: in order to satisfy local content requirements, producers in a partner economy might need to switch some inputs from cheaper imported varieties to more expensive locally produced goods. Additional compliance certification costs might also increase transaction costs.
- *Increased transaction costs for importers*: in order to qualify for preferential access in Australia, the onus is on the importer to be able to prove that a good imported from the partner country satisfies local content requirements in the exporting partner country in order to benefit from the preferential tariff rate instead of the MFN tariff rate. This imposes transaction costs to produce and verify a certificate of origin demonstrating that a product satisfies the RoO criteria.

Some argue that these costs are not inconsequential; for example, Cadot et al. (2002) estimated that compliance costs related to NAFTA RoO were in the order of 2 per cent of the value of Mexican exports to the US. In this context, traders and producers are likely to bear additional costs associated with RoO provided that the benefits of accessing the tariff preference outweigh the costs of meeting the RoO.

Alternatively, traders might choose to avoid the additional costs and pay the non-preferential tariff, in which case the domestic producer still receives the assistance afforded by that tariff. Since RoO are typically negotiated with industry before an agreement enters into force, there is a distinct possibility that the production processes of some incumbent producers satisfy the RoO. When this is the case, the only additional costs required to access the preferential rate are likely to be

increased transaction costs. However, RoO might still impede the adoption of new processes and represent a barrier to entry to new producers.

Modelling tariff liberalisation with rules of origin

Consider the two types of RoO compliance costs discussed above:

- type 1: production adjustment costs (producers reduce imported content and increase domestic content to be eligible for preferential treatment) and transaction costs on exporters; and
- type 2: transaction costs on importers, for example, costs of providing proof of origin.

Producers and traders are likely to find it commercially worthwhile to incur these costs when the tariff in the partner country (and hence the margin of preference) is high.

In this supplement, type 1 effects are modelled by increasing the cost of exports to the partner country in line with the assumed increase in costs faced by producers and exporters. Under this approach, the additional cost would be transferred back to producers and assumed to be dissipated by firms through lower quality inputs or more expensive local products for that part of their production that is exported to the partner country. This is represented by a productivity decrease pertaining to that part of industry output affected by the RoO — typically a small part of an industry's output.[1]

The simulation of type 2 compliance costs could be modelled as a technical change to specific imports sourced from a partner country. In this supplement, only type 1 is simulated.[2]

Costs of binding RoO in Australia – small country trade (Scenario S1)

The Australia–small country tariff scenario (T1) assumes that RoO prevent any transhipment but do not involve any compliance costs. To illustrate the potential

1 This approach does not capture the substitution effects of producers switching from imported intermediate inputs towards domestically produced inputs to meet the requirements of RoO or any expansion of domestic production of intermediate inputs. The size of these effects is likely to be small in the context of this scenario.

2 Consistent with scenarios in Chapter 2, this chapter refers to Australia's trading partners as an illustrative small country and an illustrative large country. Data for Thailand and the United States are used to represent the small country and large country, respectively.

costs of RoO that cause producers to change their production processes, scenario T1 is re-run with:

- a 5 per cent increase in the price of exports from industries with tariffs exceeding 9.5 per cent in the GTAP database;[3] and
- a decrease in productivity for the corresponding industries as a whole, equivalent to the increased cost generated by the relevant exports.[4]

Because of the mix of industries involved and the tariffs applied, the effects of this simulation are complex (table 3.2). Australian exports to the small country are assumed to face tariffs above 9.5 per cent for seven commodities, while small country exports to Australia are assumed to face tariffs above 9.5 per cent for three commodities. The tariff rates faced by Australian exporters are assumed to be, on average, higher than those faced by the small country.

Table 3.2 **Estimated average tariff rates applied to selected trade of manufactured goods between Australia and an illustrative small country, 2004[a]**

	Australia	*Small country*
	%	%
Textiles	9.5	3.4
Wearing apparel	22.0	27.5
Leather products	11.9	0.8
Wood products	4.7	14.2
Paper products, publishing	2.6	18.8
Mineral products nec	3.8	12.3
Metal products	4.6	18.7
Motor vehicles and parts	5.3	30.0
Manufactures nec	4.3	10.7

a Industries shocked with a rent and productivity decline identified in grey.

Source: GTAP database.

RoO that entail additional compliance costs reduce the potential projected increases in output and trade relative to the projected increases from scenario T1 (chapter 2). The projected reductions in trade volumes amount to about one third of the

3 The rate of 9.5 per cent is chosen to illustrate the range of industries likely to face sufficient incentives to incur ROO compliance costs as described. GTAP average tariffs indicate that at least some tariff lines in the GTAP group exceed 9.5 per cent.

4 The decrease in productivity is calculated as that which is required to represent the assumed additional cost, as represented by a shift in the industry supply curve back to its original position.

increases projected for Australian exports to the small country, which reduces the substitution effect for Australian TCF exporters (table 3.3).

Table 3.3 **Projected effects of RoO costs on the output of industries with tariffs above 9.5 per cent in Australia and an illustrative small country**[a]

	Australia		*Small country*	
Industry	*Non-binding (T1)*[b]	*Binding (S1)*[c]	*Non-binding (T1)*[b]	*Binding (S1)*[c]
	% change	% change	% change	% change
Textiles	-0.164	0.015	1.022	0.599
Wearing apparel	-0.250	-0.217	0.941	0.651
Leather products	-0.600	-0.433	1.264	0.926
Wood products	-0.038	-0.098	0.128	0.184
Paper products, pub.	0.049	0.027	0.434	0.414
Mineral products nec	0.069	0.039	0.693	0.675
Metal products	0.121	0.048	1.113	1.172
Motor vehicles and parts	0.104	-0.002	1.774	1.742
Manufactures nec	-0.104	-0.135	0.592	0.586

[a] Industries shocked with a rent and productivity decline identified in grey. Five per cent increase in the landed duty-paid price of the corresponding imports. [b] RoO are assumed to prevent transhipment but do not create compliance costs. [c] RoO are assumed to prevent transhipment and add compliance and production costs.

Source: Simulation results.

The additional costs from more restrictive RoO reduce by around 50 per cent the potential projected increases in the output of several industries that arise from scenario T1. For the Australian automotive industry, the potential increases in output from reducing tariffs to zero are fully eroded by the costly RoO.

The additional costs associated with RoO are projected to reduce the potential increase in income in Australia from scenario T1 by 2 per cent (from 0.054 to 0.053 per cent — table 3.4). This is a combination of price increases in TCF imports from the small country and productivity losses in the industries projected to expand with the growth of tariff preferences under scenario T1. If the RoO costs were greater or extended over a wider range of products, the erosion of potential benefits would be commensurably larger.

Similar mechanisms are at work in the small country. In that case, because of assumed higher tariffs, the increase in GDP projected in scenario T1 is reduced by 8 per cent (from 0.418 to 0.388 per cent — table 3.4).

Table 3.4 **Projected effects on real GDP of RoO costs imposed on selected manufacturing industries when eliminating tariffs on Australia–small country trade**

	Non-binding RoO (T1)		*Binding RoO (S1)*	
Region	*Change*	*Value*	*Change*	*Value*
	%	US$ m	%	US$ m
Australia	0.054	347	0.053	337
Small country	0.418	676	0.383	619
World	0.0020	823	0.0019	766

Source: Simulation results.

Costs of binding RoO in Australia–large country trade (Scenario S3)

The same process is applied to project the possible effects of RoO compliance costs on Australia–large country trade and the same mechanisms can be observed. In this scenario, tariffs in the large country are assumed to be lower than in the small country, and to affect a smaller number of commodities (table 3.5).

Table 3.5 **Estimated average tariff rates applied to imports of selected industries between Australia and an illustrative large country, 2004**[a]

Industry	*Australia*	*Large country*
	%	%
Textiles	9.4	9.9
Wearing apparel	15.6	11.3

a Industries shocked with a rent and productivity decline identified in grey.

Source: GTAP database.

The small projected results in the large country relate to the small size of the Australian market relative to the output of the textiles and wearing apparel industries in the large country. Nevertheless, the additional costs of RoO imposed on wearing apparel from the large country cause a reduction in the projected increases in output in this industry of more than 50 per cent (table 3.6). In Australia, RoO costs on the TCF industry reduce the projected increases in output of scenario T2 by nearly 75 and 55 per cent for textiles and wearing apparel, respectively.

Economy-wide, the impacts of costs at the levels of RoO assumed are negligible, because the industries and the size of trade involved are small relative to total bilateral trade (table 3.7).

Table 3.6 **Projected effects of RoO costs on the output of industries with tariffs above 9.5 per cent in Australia and the large country[a]**

	Australia		*Large country*	
Industry	*Non-binding (T2)[b]*	*Binding (S3)[c]*	*Non-binding (T2)[b]*	*Binding (S3)[c]*
	% change	% change	% change	% change
Textiles	2.667	0.626	0.047	0.075
Wearing apparel	0.559	0.248	0.087	0.038

[a] Industries shocked with a rent and productivity decline identified in grey. [b] RoO are assumed to prevent transhipment but do not create compliance costs. [c] RoO are assumed to prevent transhipment and add compliance and production costs.

Source: Simulation results.

Table 3.7 **Projected effects on real GDP of RoO costs imposed on selected manufacturing industries when eliminating tariffs on Australia–large country trade**

	Non-binding RoO (T2)		*Binding RoO (S3)*	
Region	*Change*	*Value*	*Change*	*Value*
	%	US$ m	%	US$ m
Australia	0.117	748	0.112	716
Large country	0.003	386	0.003	379
World	0.001	445	0.001	447

Source: Simulation results.

What if preferential tariff reductions are not passed on? (Scenarios S2 and S4)

Another instance under which the potential effects of tariff reductions might not be achieved is when tariff preferences are not passed on through lower prices ('less than full pass through'). This might occur if, due to insufficient competition, exporters are able to increase the price of their exports to the partner country and appropriate all or part of the margin of preference (Chang and Winters 2002; Feenstra 1989).

At the limit, exporters might increase the prices by the full amount of the preference, and importers might not see any change in the border price. This would generate an economic rent which could be appropriated by factors of production or dissipated through inefficiencies or higher input costs. [5]

[5] This rent is assumed not to affect producer decisions in the exporting country and it is modelled as a transfer to the exporting country's households.

The main effects in this scenario are:

- no resource reallocation occurs in the importing country; and
- income is transferred from the importing country (the former tariff revenue) to the exporting country (in the form of higher export prices).

In the following two simulations, the costs of not passing the tariff reduction through are illustrated using the Australia–large country and Australia–small country scenarios (scenarios T1 and T2) as benchmarks.

In the scenarios, importers are assumed to face the same price for imports as they would have prior to the granting of tariff preferences. The tariff revenues that would have been collected by the importing country under scenarios T1 and T2 are assumed to be transferred to the exporting country (table 3.8). Initial tariff revenues give an indication of the increase in income that is assumed to accrue to each country — for example, under scenario S4, more than US$ 400 million is projected to be transferred from Australia to the large country. The additional income, in the form of higher priced exports, is modelled as projected increases in real GNP (table 3.9).

Table 3.8 **Bilateral tariff revenue on trade between Australia and the large country and Australia and the small country**

Scenario	*Australian tariff revenue*	*Partner's tariff revenue*
	US$ m	US$ m
Australian–small country (S2)	124	143
Australian–large country (S4)	415	338

Source: GTAP database.

Table 3.9 **Projected effects on real GNP of assuming that tariff reductions on trade between Australia and partner countries are not passed through**

	Australian real GNP		*Partner's real GNP*	
Scenario	*Change*	*Value*	*Change*	*Value*
	%	US$ m	%	US$ m
Australia—small country (S2)	0.001	5.625	-0.005	-7.782
Australia—large country (S4)	-0.004	-23.580	..	12.062

.. less than 0.0005 per cent.

Source: Simulation results.

In both simulations, the projected efficiency effects captured by the tariff reductions that were modelled in T1 and T2 are eliminated because import prices are assumed

not to decline and resources in the importing country are projected not to be reallocated away from the industries that benefitted from the protection.

For the Australia–small country simulation, Australian income, as measured by GNP, is projected to increase because the net transfer is positive for Australia. This is projected to increase demand and output. The small country's income is projected to decrease, along with its demand and output.

In the Australia–large country simulation, Australian income is projected to decline, because Australia experiences a net transfer of income to the large country. As income is projected to decline, demand for Australian (and imported) products is projected to decrease and, with this, real GDP. Conversely, as the large country's income is projected to increase, demand, output and therefore real GNP are projected to increase for that country.

Effects of less than 100 per cent take up of preferences — carve-outs and binding rules of origin (Scenario S5)

Scenarios T1 and T2 assume that when two countries reduce their tariffs preferentially they reduce tariffs to zero on all goods and that this is applied to all relevant traders. Trade data often indicate, however, that tariffs can continue to apply on some trade between partners to a preferential trade agreement. Two reasons for this include:

- the existence of 'carve-outs' — usually sensitive products that retain (at least some of) their tariff protection for an extended phase-in period under the agreement; this might often affect agricultural commodities, but not exclusively; and
- firms trading at the non-preferential (generally the MFN) tariff rate rather than at the preferential rate, which might affect largely, but not exclusively, manufacturing.

The extent to which these two factors reduce the effects of bilateral tariff reductions can be estimated by the proportions of trade that enter under the various tariff regimes available for bilateral trade. The proportion of trade subject to a positive MFN tariff but that enters under zero tariff is an estimate of the 'take up' of preferences. For example, trade data between Australia and the United States in 2008 reveal the extent of take up of preferences. Ratios of the average applied rates to the average MFN rates for GTAP commodities are presented in table 3.10; ratios greater than zero mean that there is less than full preference utilisation occurring.

Table 3.10 **Ratio of estimated applied rates to estimated MFN rates on trade, Australia and an illustrative large country, 2008**[a]

Commodity	*Australian tariff*	*illustrative large country tariff*
	%	%
Paddy rice	..	n.a
Wheat	n.a	n.a
Cereal grains nec	…	..
Vegetables, fruit, nuts	0.7	100.0
Oil seeds	..	100.0
Sugar cane, sugar beet	n.a	n.a
Plant-based fibres	92.6	..
Crops nec	7.1	4.5
Bovine cattle, sheep, goats, horses	..	..
Animal products nec	4.3	33.5
Raw milk	n.a	n.a
Wool, silk-worm cocoons	39.6	100.0
Forestry	10.6	56.4
Fishing	..	7.7
Coal	..	..
Oil	n.a	100.0
Gas	..	n.a
Minerals nec	8.0	92.8
Bovine meat products	..	3.0
Meat products nec	0.1	29.1
Vegetable oils and fats	22.3	6.7
Dairy products	47.5	3.4
Processed rice	..	n.a
Sugar	43.9	100.0
Food products nec	15.6	58.4
Beverages and tobacco products	n.a[b]	99.9
Textiles	62.5	69.0
Wearing apparel	92.1	75.3
Leather products	42.5	12.3
Wood products	13.8	5.7
Paper products, publishing	11.0	57.7
Petroleum, coal products	n.a[b]	100.0
Chemical, rubber, plastic prods	12.7	19.8
Mineral products nec	41.7	12.3
Ferrous metals	9.8	0.5
Metals nec	12.8	9.3
Metal products	15.1	28.8
Motor vehicles and parts	10.3	19.4
Transport equipment nec	8.4	26.8
Electronic equipment	9.6	27.7
Machinery and equipment nec	11.5	38.0
Manufactures nec	17.6	16.7

.. Indicates an average applied rate of zero (including for goods with an average MFN rate of zero). **n.a.** Indicates a lack of available data. [a] Data for the United States are used for the illustrative large country. [b] Average rate is greater than the MFN, possibly due to excise collected at the border — tariffs on these goods were not shocked.

Sources: ABS trade data (unpublished) 2010, USITC 2010, WTO Tariff Analysis Online database.

To illustrate the possible effects of the partial uptake of preferences, scenario T2 was re-run with the shocks scaled down; the shocks were calibrated to the extent to which tariff reductions were estimated to be taken up according to table 3.10. Under this scenario, Australia is projected to experience 75 per cent of the projected increase in real GDP from scenario T2 and 75 per cent of the projected increase in exports (table 3.11).

Table 3.11 **Projected effects of illustrative bilateral tariff reductions between Australia and an illustrative large country under full and partial take up of preferences**

Scenario	*Real GDP*	*Real GNP*	*Export volumes*	*Import volumes*
	% change	% change	% change	% change
Full take-up (T2)	0.117	0.097	0.967	1.151
Partial take-up (S5)	0.087	0.071	0.728	0.850

Source: Simulation results.

The industry effects are driven by the initial tariff rates and the extent to which they are reduced in the simulation — for example, the Australian output of sugar expands by 16 per cent in scenario T2 but, after carving sugar out of the large country tariff reductions, Australian sugar output is projected to decline by 0.3 per cent.

4 Trade facilitation

Trade facilitation is a term used to describe the reduction of transaction costs in international trade. The WTO has defined trade facilitation as 'the simplification and harmonisation of international trade procedures', corresponding to the 'activities practices and formalities involved in collecting, presenting, communicating and processing data required for the movement of goods in international trade' (OECD 2005). WTO negotiations around trade facilitation seek, among other outcomes, to achieve increased cooperation between customs and other relevant authorities with a view to enhancing prospects for trade (WTO 2009). However, Grainger (2008) notes that there are broader definitions of trade facilitation and cites the United Nations Centre for Trade Facilitation and Electronic Business definition which describes trade facilitation as the 'simplification, standardization, and harmonization of procedures and associated information flows required to move goods from seller to buyer and to make payment'.

In broad terms, trade facilitation can be regarded as dealing with the efficiency of border procedures in international trade. As noted by the OECD (2005a), inefficient border procedures can impose costs on firms, which suffer direct costs such as expenses related to supplying documentation to authorities, in addition to indirect costs, such as loss of business opportunities and additional transport and storage costs due to time delays. Governments may also have difficulty in implementing trade policies and collecting tax and information due to inefficient border procedures.

The potential benefits of trade facilitation are afforded through firms obtaining inputs more quickly and at a lower overall price. Consumers can gain from lower prices and reduced delays for the receipt of goods. The OECD (2005a) has also suggested that improvements in the efficiency of border procedures can make a country more competitive in trade terms, attracting additional foreign investment and increasing activity.

A number of studies have sought to gauge the effects of enhanced trade facilitation on activity levels and income. One stream of work has explored trade facilitation measures that reduce the costs of processing goods at the border of the importing country. One example is OECD (2003) which used the GTAP model to illustrate the impacts of reducing trade transaction costs (equivalent to 1 per cent of the value of

imports) and found that such trade facilitation measures could result in projected increases in global activity in the order of US$(1997) 40 billion. Some more recent work has focused on quantifying the effects of reduced time delays in international trade — for example, building on the work of Minor and Tsigas (2008), Minor (2010) derives a database of time costs for modelling purposes.

Another stream of research explores the effect of trade facilitation measures that reduce the costs of transporting goods between countries. For example, UNCTAD (2001) modelled 1 per cent increases in the productivity of maritime and air transport in developed countries in separate simulations. The simulation for maritime transport obtained a projected increase in trade and activity of around US$(1997) 3.7 billion, while that obtained for air transport was around US$(1997) 3.4 billion (see UNCTAD 2001, table 7).

For the purpose of this supplement, the impact of trade facilitation measures are considered from both perspectives. Both sets of scenarios examine the possible trade creating effects of trade facilitation measures offered on a:

- preferential bilateral basis — between Australia and an illustrative large country (in this case, the United States) (scenarios F1 and S8);
- non-preferential basis — on import procedures that apply to all imports into both Australia and the large country (scenarios F2 and S9); and
- worldwide basis, in which import procedures in all regions are simplified or harmonised and costs are reduced accordingly (scenarios F3 and S10).

4.1 Trade facilitation at the border

Hummels (2001) examined the importance of time as a barrier to trade and found that each day saved in shipping time was worth 0.8 per cent of the value of the goods. In this supplement, trade facilitation measures at the border are modelled as reducing costs as a constant share of the value of the imported goods (table 4.1).

As simulations encompass a greater share of world trade, the projected effects increase (table 4.2). For example, in scenario F1, the cost of Australian imports from the large country is projected to fall, causing demand to switch towards imports from that country and away from other regions (table E.24). The same occurs with large country imports from Australia. As the area covered by the simulations increases, the cost lowering effects of the trade facilitation measures are extended, and projected effects on global trade and production increase (table E.25).

Australia's exports are projected to increase as trade facilitation expands to global trade. The modelled 1 per cent decrease in import costs from the implementation of cost-reducing trade facilitation measures across the globe is projected to increase Australian real GDP and real GNP by 0.42 per cent (table 4.2).

Table 4.1 **Scenarios for trade facilitation at the border**

Code	*Scenario*	*Description*
F1	Preferential trade facilitation — goods from the partner country are given 'express treatment' upon entry	Productivity shock of 1 per cent to the technical change variable *ams* for all trade between Australia and a illustrative large country
F2	Non-preferential trade facilitation — both countries introduce more efficient (harmonised) customs technology, shortening processing for all imports in both countries	Productivity shock of 1 per cent to the technical change variable *ams* for all trade entering Australia and a illustrative large country
F3	Global trade facilitation — all countries introduce more efficient (harmonised) customs technology, shortening processing for all imports into all countries	Productivity shock of 1 per cent to the technical change variable *ams* for all trade between all regions of the world

Table 4.2 **Projected effects of trade facilitation at the border**

	Australia				*World*	
Scenario	*Real GDP*	*Real GNP*	*Export volumes*	*Import volumes*	*Global product*	*Total trade*
	% change	% change	% change	% change	% change	% change
Preferential bilateral trade facilitation (F1)	0.067	0.062	0.168	0.200	0.001	0.003
Non-preferential bilateral trade facilitation (F2)	0.368	0.351	0.709	0.576	0.078	0.181
Global trade facilitation (F3)	0.417	0.420	0.817	0.874	0.610	1.369

Source: Simulation results.

Interaction between tariff elimination and trade facilitation

Reductions in tariffs may also lead to reductions in the processes required to clear customs (although the converse might also be true if multiple bilateral reductions associated with different agreements increase the complexity of the tariff schedule and processing).

The projected effect of the global trade facilitation simulation (F3) combined with the global tariff liberalisation simulation (T5) is larger than the sum of each simulation (table 4.3).[1]

Table 4.3 **Projected effects of interaction between tariff elimination and trade facilitation at the border**

	Australia				*World*	
Scenario	*Real GDP*	*Real GNP*	*Export volumes*	*Import volumes*	*Global product*	*Total trade*
	% change	% change	% change	% change	% change	% change
Global tariff liberalisation (T5)	0.940	0.881	6.320	7.146	1.179	6.844
Global trade facilitation (F3)	0.417	0.420	0.817	0.874	0.610	1.369
Both T5 and F3	**1.365**	**1.310**	**7.136**	**8.077**	**1.806**	**8.305**

Source: Simulation results.

4.2 Trade facilitation in international transport

Trade facilitation measures might also affect the costs of international transport. An additional set of trade facilitation scenarios in which trade facilitation was assumed to increase the productivity of international transport by 5 per cent are included (table 4.4).[2]

The projected effects of these hypothetical cost decreases are smaller than those modelled above because international trade margins in the GTAP database account for an average of 3.5 per cent of the FOB value of all traded goods. As a result, the projected effects on Australian income of this type of simulation are smaller than those projected in the trade facilitation at the border scenarios (compare tables 4.2 and 4.5).

1 These results may of course understate the potential projected increases in trade and activity, if reductions in processing costs associated with eliminating part of customs procedures are larger than the modelled 1 per cent of reduction in trade value.

2 Shock applied to the *atall* variable in the GTAP model.

Table 4.4 **Scenarios for trade facilitation in international transport**

Code	*Scenario*	*Description*
S8	Preferential trade facilitation — transport costs of goods traded between partner countries are reduced	5 per cent productivity improvement on international transport between Australia and a illustrative large
S9	Non-preferential trade facilitation — both countries introduce more efficient transport technology for all imports	5 per cent productivity improvement on all international transport to Australia or the illustrative large country
S10	Global trade facilitation — all countries introduce more efficient transport technology for all imports	5 per cent productivity improvement to global international transport

Table 4.5 **Projected effects of trade facilitation in international transport**

	Australia				*World*	
Scenario	*Real GDP*	*Real GNP*	*Export volumes*	*Import volumes*	*Global product*	*Total trade*
	% change	% change	% change	% change	% change	% change
Preferential bilateral trade facilitation (S8)	0.009	0.007	0.035	0.070	0	0.001
Non-preferential bilateral trade facilitation (S9)	0.045	0.039	0.189	0.355	0.006	0.051
Global trade facilitation (S10)	0.058	0.055	0.220	0.471	0.066	0.368

Source: Simulation results.

Proportional reductions in transport costs are projected to increase trade on routes over which the cost of transport is highest (for example, over longer distances). Projected increases in output are larger for industries for which transport margins of imported intermediate inputs make up a larger share of costs. As in the trade facilitation at the border scenarios, the projected increases in Australian output and income increase as trade facilitation is assumed to extend from a single route (S8) to all Australian routes (S9) and affect all routes globally (S10).

5 Some implications of preferential regional tariff arrangements

An argument advanced for signing preferential trade agreements is that they can act as a 'defence measure' against trade diversion and other deleterious effects to Australia of other economies signing preferential agreements. This chapter illustrates some of the mechanisms at work and possible orders of magnitude in play with hypothetical combinations of preferential and non-preferential tariff reductions between North Asia, North America and Australia (table 5.1).[1] The scenarios are illustrative only and do not imply such regional preferential arrangements would eventuate in the foreseeable future.

Table 5.1 **Scenarios to illustrate the effects of regional preferences with and without Australia**

Code	*Scenario*	*Description*
R1	Australia as a 'hub'	Australia reduces tariffs bilaterally with countries in the North American and North Asian regions — the other countries do not reduce tariffs for each other
R2	Australia joins a hypothetical preferential trading bloc	Australia reduces tariffs bilaterally with countries in the North American and North Asian regions and they reduce tariffs bilaterally with each other
R3	Australia excluded from a hypothetical preferential trading bloc	The countries in the North American and North Asian regions reduce tariffs bilaterally and Australia does not reduce tariffs
R4	Australia excluded from a hypothetical preferential trading bloc and pursues unilateral tariff liberalisation	The countries in the North American and North Asian regions reduce tariffs bilaterally and Australia reduces tariffs non-preferentially

Bilateral tariff reductions between Australia and the selected regions are projected to increase Australian real GDP. This increase is projected to diminish when the countries in those regions grant bilateral preferences to each other.

In scenarios R1 to R4, it is assumed that there are no transaction costs to reducing tariffs bilaterally with many countries, that there is a full take up of preferences, and that the RoO do not have any impact on business costs. The scenarios also abstract

1 North Asia is represented by China, Japan and Korea. North America is represented by the United States.

from the 'spaghetti bowl' effect on administrative and other costs that might be created by overlapping agreements and the associated difficulty traders might have navigating through the specificities of different trade agreements with different trading partners. Were such costs taken into account in the modelling, the projected increase in activity from the regional arrangements would be lower than reported in this chapter.

Australia reduces tariffs bilaterally with selected partners

In scenario R1, real GDP is projected to increase for Australia and the economies that enter into bilateral preferential arrangements with Australia (table 5.2). The relative impacts are determined by the initial bilateral trade shares and margins of preference between Australia and the partners undertaking the bilateral tariff reductions.

Australia's real GDP is projected to increase by about 1 per cent with tariff preferences applying to goods imported from the North American and North Asian regions (41 per cent of Australia's total imports in the GTAP database). By contrast, the experiment affects less than 5 per cent of the partners' imports. GDP is projected to increase by around 0.1 per cent or less for the countries in the North American and North Asian regions.

Another reason why North American real GDP is projected not to change substantially is that tariffs on trade between Australia and North America are two to three times lower than the average tariffs on trade between Australia and North Asia; removing North American tariffs is therefore projected to have smaller effects.

In scenario R2, Australia, and the illustrative North American and North Asian economies are modelled as reducing tariffs preferentially. In this scenario, Australia's real GDP is projected to increase by 0.7 per cent. Hence, the bilateral tariff preferences between North America and North Asia are projected to reduce the projected increase in Australian real GDP from scenario R1 (1 per cent). This is largely due to trade diversion, with Australian exports projected to be 0.4 per cent smaller and Australian imports 2.6 per cent smaller than in R1, as trade among the illustrative regions increases.

As a result of relatively large modelled reductions in tariffs in the illustrative regions, real GDP in the illustrative North Asian economies is projected to rise by between 1.5 and 3 per cent.

Table 5.2 **Projected effects on real GDP and trade volumes of regional tariff preferences with and without Australia[a]**

	Australia reduces tariffs bilaterally	*Australia reduces tariffs bilaterally*	*Australia does not reduce tariffs*	*Australia reduces tariffs non-preferentially*
	North American and North Asian regions do not reduce tariffs with each other	*North American and North Asian regions reduce tariffs bilaterally with each other*		
Scenario	*R1*	*R2*	*R3*	*R4*
	% change	% change	% change	% change
Real GDP				
Australia	0.950	0.691	-0.088	0.473
China	0.090	1.467	1.364	1.387
Japan	0.032	0.443	0.410	0.416
Korea	0.118	2.952	2.811	2.834
USA	0.002	0.056	0.055	0.056
European Union	-0.010	-0.062	-0.053	-0.051
Rest of Asia	-0.027	-0.333	-0.311	-0.308
Rest of the world	-0.009	-0.143	-0.132	-0.131
Export volumes				
Australia	5.077	4.644	-0.227	5.051
China	0.396	7.336	6.932	6.975
Japan	1.197	5.011	4.620	4.653
Korea	0.633	8.260	7.880	7.898
USA	0.098	2.656	2.579	2.585
European Union	-0.012	-0.135	-0.124	-0.118
Rest of Asia	-0.061	-0.604	-0.556	-0.541
Rest of the world	-0.035	-0.294	-0.268	-0.268
Import volumes				
Australia	8.885	6.042	-0.681	3.000
China	0.457	9.285	8.835	8.964
Japan	1.054	6.809	6.378	6.460
Korea	0.570	10.799	10.440	10.497
USA	0.024	1.727	1.722	1.729
European Union	-0.042	-0.220	-0.187	-0.175
Rest of Asia	-0.121	-1.124	-1.033	-1.011
Rest of the world	-0.026	-0.467	-0.433	-0.429

a Scenarios listed in table 5.1.

Source: Simulation results.

In scenario R3, the illustrative countries in North America and North Asia are modelled as reducing their tariffs on a bilateral preferential basis while Australia leaves its tariffs unchanged. In this scenario, Australian real GDP is projected to decrease almost 0.1 per cent, mainly due to trade diversion effects that are projected to be induced by the bilateral tariff preferences between partners.

Scenario R1 illustrates the impacts of Australia lowering tariffs on its imports from a group of countries that do not reduce tariffs among their group. The difference between R2 and R3 illustrates the effects on Australia of bilateral tariff preferences with a group of countries that *does* reduce tariffs on each other's imports.

In scenario R4, Australia is assumed to reduce its tariffs non-preferentially, while countries in North America and North Asia are assumed to lower their tariffs bilaterally. Under this scenario, Australian real GDP is projected to increase by 0.5 per cent, which is 0.2 per cent lower than in scenario R2 (where Australia reduces tariffs on a preferential basis with the group of countries under consideration).

The projected increase in Australian real GDP under non-preferential tariff reduction in scenario R4 is consistent with the projected results for the other unilateral tariff reduction scenario (scenario T3, in which only Australia is assumed to reduce its tariffs). The reductions in tariffs in the North American and North Asian regions contribute to some trade diversion and to a small reduction in the projected increase in real GDP under scenario T3.

On the other hand, the larger increases in GDP projected in scenarios R1 and R2 relative to scenario R4 result from the reductions in tariffs that apply to Australian exports. In scenario R2, however, this effect is mitigated by the trade diversion that is associated with the North American and North Asian regions reducing their tariffs bilaterally.

Australian exports are projected to increase by around 5 per cent in scenarios R1, R2 and R4; in scenarios R1 and R2, the increase arises because tariffs on Australian exports are reduced, while in R4, Australia's unilateral tariff reduction makes its exports more competitive internationally. In scenario R3 there is a small reduction in Australian exports because of trade diversion.

Australian imports are projected to increase the most in scenario R1 (9 per cent), followed by scenario R2 (6 per cent) and scenario R4 (3 per cent). The projected increase in scenario R1 is larger than in scenario R2 because the bilateral tariff reductions between countries in North America and North Asia are projected to increase the relative price of many Australian imports. The projected increase in imports in scenario R2 is greater than in scenario R4, despite more widespread

Australian tariff reductions, because the absence of preferences means that projected real GDP increases are smaller under scenario R4 and the demand for imports is reduced.

Sensitivity of results to assumptions about output flexibility in Australia's export sectors

Two sensitivity simulations were run on scenario R3 to test whether increased demand from preferential bilateral tariff reductions would be sufficient to outweigh the trade diversion that Australia experiences when some of its trading partners are assumed to reduce tariffs and Australia is assumed not to.

In the first sensitivity simulation (S6), the elasticity of supply of effective land in Australia is increased by a factor of 10.[2] This mainly increases the supply response of Australia's mining exports. With this increased supply response, projected Australian real GDP contracts 67 per cent less (table 5.3) than when the supply response of the export sectors (in this case mining) is more constrained (scenario R3). The change is not sufficient to avoid trade diversion with projected Australian exports contracting by 0.078 per cent.

Table 5.3 **Sensitivity of projected results to alternative assumptions on export sector (that is, mining) supply response**

Scenario	*real GDP*	*Export volumes*
	% change	% change
Australia leaves its tariffs unchanged, while the illustrative North American and North Asian economies reduce tariffs bilaterally with each other (R3)	-0.088	-0.227
R3 with increased elasticity supply of effective land to the mining industry (S6)	-0.029	-0.078
R3 with endogenous supply of effective land to the mining industry (S7)	-0.001[a]	0.012

a If the assumed flexibility applied to the mining sector (relative to the availability of effective land) is also applied to the rural sector, a small increase in GDP is projected.

Source: Simulation results.

2 The output of resource industries is limited by their access to relevant resources (for example, iron ore, coal, fish stocks). These stocks are represented by the same variable as agricultural land in agricultural activities. In the standard model, their supplies are assumed to be limited and they act as an industry-specific input. In these two sensitivity simulations, the industry-specific inputs are assumed to restrict output expansion less than they do in the standard model. Given the structure of the model, this is achieved by increasing the elasticity of substitution between different types of 'land'. Although this means that agricultural land is 'transformed' into iron ore or coal, in the model, the effect on agriculture is negligible. However, alleviating the constraint on mining supply response allows mining output and real GDP to expand more easily than with the standard setting.

In the second simulation, the supply of effective land is set endogenous in the mining industry so there is no restriction on the output of mining in response to an increase in demand. Under this setting, Australian real GDP is projected to decrease by 0.001 per cent while exports are projected to increase by 0.012 per cent (table 5.3). In scenario S7, the mining industry is projected to expand (around 1.5 per cent). If the assumed flexibility applied to the mining sector (relative to the availability of effective land) is also applied to the rural sector, a small increase in GDP is projected.

6 Reductions in barriers to investment

Barriers to investment may arise for a variety of reasons. Although the underpinnings of each type of barrier differs, the ultimate effect of any barrier to investment is to raise the price of an effective unit of capital used in production.

One category of barriers to investment applies only to investments from abroad (for example, the Foreign Investment Review Board). Such discriminatory barriers might:

- create economic rents for foreign and domestic owners of capital;
- increase the sovereign risk associated with foreign investment, resulting in a risk premium, which adds to the cost of investment by increasing the rate of return required by foreigners to undertake investment; and
- increase the costs associated with investing from abroad by adding administrative costs that do not apply to domestic investment.

Although some barriers to investment might relate to both portfolio and direct investment, this supplement focuses on the possible implications of reducing barriers to foreign direct investment (FDI). The effects of barriers to FDI are likely to vary depending on the direction of capital flows, the industry structure or the stage of development of an economy. Although variation in this respect is substantial across economies, the illustrative scenario examined in this supplement relates to the potential effect of reducing barriers to FDI in the case of Australia, a small export-oriented economy with net FDI inflows, and a large economy with a diverse industrial base and net FDI outflows (the United States has been used in the scenarios as the illustrative large economy).

Another category of barriers to investment might also arise from more general regulations or practices (for example, banking licences) irrespective of whether the investment is domestic or foreign (OECD 2006). These can be thought of as non-discriminatory.

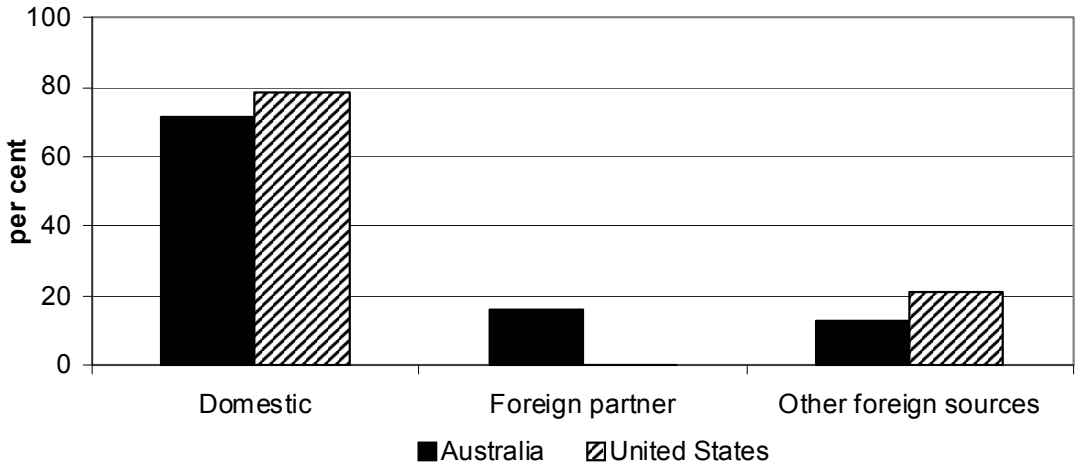
Ultimately, higher priced capital reduces the competitiveness of capital-using activities and lowers potential output. Reducing barriers to investment can therefore provide an incentive to increase investment activity (raising the level of global activity) as the cost of supplying a unit of effective capital is reduced.

While different studies have explored the effects of barriers to foreign investment from different perspectives, for illustrative purposes this supplement adopts an approach similar to that followed in the assessment of the AUSFTA (CIE 2004a), modelling reductions in barriers to investment as a reduction in equity risk premium.

6.1 Scenarios modelled

A change in the equity risk premium associated with a change in impediments to investment could apply on a non-preferential basis (reducing the premium required for investment from all regions, including domestic sources) or on a narrower preferential basis only (reducing the premium on investment from specific regions). Both scenarios are presented in this supplement. Figure 6.1 shows the total capital stock for Australia and the United States by source.

Figure 6.1 **Share of total capital stock by source of direct funding, Australia and the United States**[a]



[a] Foreign partner refers to capital sourced from the United States for Australia and vice versa. Foreign partner and other foreign sources is inclusive of foreign direct investment and foreign portfolio investment.

Source: GTAP database and Commission estimates.

To illustrate the potential impacts of cost reductions in barriers to investment and improvements in productivity associated with reductions in investment barriers, the Commission modelled four scenarios (table 6.1).

In addition, new investment (particularly FDI) is often thought to embody some technical change, which is likely to improve the productivity of the industry in which it occurs. To illustrate this point, a related 5 per cent productivity improvement is implemented in a second set of simulations.

Table 6.1 **Reductions in barriers to investment scenarios**[a]

Scenario		*Description*
V1	Preferential reduction in risk premium[b]	5 basis point reduction in the risk premium on bilateral FDI originating from the partner country in Australia and the large country
V2	Non-preferential reduction in risk premium[c]	5 basis point reduction in a risk premium that affects domestic capital and all FDI into Australia and the large country
V3	Preferential reduction in risk premium plus a productivity improvement[b]	V1 plus a 5 per cent assumed productivity improvement on the corresponding FDI[d]
V4	Non-preferential reduction in risk premium plus a productivity improvement[c]	V2 plus a 5 per cent assumed productivity improvement on the corresponding FDI[d]

[a] Modelled as a reduction in the required rate of return, scaled by the share of partner's FDI in foreign owned capital in each country's manufacturing sector. [b] The extensions to the GTAP model pursued for this supplement allow modelling of preferential reductions in risk premia. [c] Modelled as the non-preferential reduction of a non-discriminatory barrier assuming that the sovereign risk affects the cost of foreign and domestically supplied capital. [d] Productivity shocks applied at the industry level in proportion to the relevant FDI content. The average FDI intensity is higher in Australia than in the United States.

6.2 Results

As reflected in the simulation results, a hypothetical decline in the risk of investing in Australia and the United States could make both countries more attractive investment destinations. An increase in investment in the United States and in Australia would lead to an increase in available capital and production capacity in both economies, and higher real GDP (table 6.2).

Table 6.2 **Projected effects of a 5 basis point reduction in Australian and US risk premia and a 5 per cent improvement in productivity of FDI**[a,b]

	Australia		*United States*	
Scenario	*Real GDP*	*Real GNP*	*Real GDP*	*Real GNP*
	US$ m	US$ m	US$ m	US$ m
No productivity improvement				
V1 Preferential	58	-169	46	390
V2 Non-preferential	392	321	5976	5008
Productivity improvement				
V3 Preferential	140	-97	66	413
V4 Non-preferential	507	424	6383	5390

[a] See table 6.1 for a description of the scenarios modelled and appendix E, table E.29 and E.30 for detailed results table. [b] Extension of the preferential sim (V1, V3) to include all foreign sources of capital would further reduce (or make negative) the estimated effect of the simulation on real GNP.

Source: Simulation results.

The preferential treatment is projected to limit the increases in real GDP that are available from reducing barriers to investment relative to the non-preferential approach. Any productivity improvement associated with increased FDI would add to the projected increases in production possibilities and real GDP.

The projected effects on real GNP in the preferential scenario are conditioned by the net lending situation in the United States and in Australia in the database: Australia is portrayed as a net borrower of FDI capital from the United States. As income in both countries increases, Australia is projected to increase its borrowing (through both new capital usage and substituting existing domestic for US capital due to the change in relative prices) and the United States is projected to increase its lending to Australia. In aggregate, this translates into increased repayments by Australia to the United States which are projected to exceed the value of increased domestic production attained from greater capital use, lowering real GNP for Australia (scenario V1).

While the outcome of preferential liberalisation will depend on the direction of net investment flows between partners and the level of substitution of domestic for foreign capital, non-discriminatory liberalisation (over the full investment base) affords projections of higher activity and income.

For example, reducing the risks associated with investing in Australia and the United States on a non-discriminatory basis for all investment in Australia and the United States (scenario V2) is projected to increase investment in both countries, increasing their resource base and output as indicated by the larger increases in GDP than in scenario V1. The non-preferential reduction in barriers to investment is modelled as affecting Australia's domestic capital stock as well and avoids substantial changes in the relative price of domestic to foreign capital. As domestic capital accounts for a large proportion of total capital used in Australia, a larger proportion of increased income (GDP) is estimated to be retained by Australian capital owners, and Australian GNP is now projected to increase (although some of the increase in payments to capital still flow to foreign capital owners, and the projected increase in GNP remains less than the projected increase in real GDP).

Adding the assumed productivity improvements is projected to increase the stock of effective capital, and real GDP, in both economies (scenarios V3 and V4). The assumed productivity improvement is also projected to compensate for part of the net income flow from Australia to the USA that is projected in scenario V1 and V2.

A Regional aggregation

Table A.1 **Country/region mapping adopted**

Regions in GTAP database	*Code*	*Regions in aggregated database*
Australia	AUS	Australia
New Zealand	NZL	New Zealand
China	CHN	China
Hong Kong	HKG	Hong Kong
Japan	JPN	Japan
Korea	KOR	Korea
Taiwan	TWN	Taiwan
Indonesia	IDN	Indonesia
Malaysia	MYS	Malaysia
Philippines	PHL	Philippines
Singapore	SGP	Singapore
Thailand	THA	Thailand
Bangladesh	BGD	Bangladesh
India	IND	India
Rest of Asia & Oceania	ROA	Cambodia; Iran; Kazakhstan; Kyrgyzstan; Laos; Myanmar; Pakistan; Sri Lanka; Vietnam; Rest of East Asia; Rest of Oceania; Rest of South Asia; Rest of Southeast Asia; Rest of Western Asia
Canada	CAN	Canada
The United States	USA	The United States
Mexico	MEX	Mexico
Brazil	BRA	Brazil
Rest of America	ROM	Argentina; Bolivia; Caribbean; Chile; Colombia; Costa Rica; Ecuador; Guatemala; Nicaragua; Panama; Paraguay; Peru; Uruguay; Venezuela; Rest of Central America; Rest of North America; Rest of South America

(Continued next page)

Table **A.1** **(continued)**

Regions in GTAP database	*Code*	*Regions in aggregated database*
European Union (27)	EUN	Austria; Belgium; Bulgaria; Cyprus; Czech Republic; Denmark; Estonia; Finland; France; Germany; Greece; Hungary; Ireland; Italy; Latvia; Lithuania; Luxembourg; Malta; Netherlands; Poland; Portugal; Romania; Slovakia; Slovenia; Spain; Sweden; United Kingdom
Russia	RUS	Russian Federation
Rest of Europe	ROE	Albania; Armenia; Azerbaijan; Belarus; Croatia; Georgia; Norway; Switzerland; Turkey; Ukraine; Rest of EFTA; Rest of Eastern Europe; Rest of Europe; Rest of Former Soviet Union
South Africa	ZAF	South Africa

B GTAP industry list

Table B.1 **GTAP industry and industry group concordance**

GTAP Industry	*Code*	*Industry grouping*
Paddy rice	PDR	Agriculture/Food products
Wheat	WHT	Agriculture/Food products
Cereal grains nec	GRO	Agriculture/Food products
Vegetables, fruit, nuts	V_F	Agriculture/Food products
Oil seeds	OSD	Agriculture/Food products
Sugar cane, sugar beet	C_B	Agriculture/Food products
Plant-based fibers	PFB	Agriculture/Food products
Crops nec	OCR	Agriculture/Food products
Bovine cattle, sheep, goats, horses	CTL	Agriculture/Food products
Animal products nec	OAP	Agriculture/Food products
Raw milk	RMK	Agriculture/Food products
Wool, silk-worm cocoons	WOL	Agriculture/Food products
Forestry	FRS	Agriculture/Food products
Fishing	FSH	Agriculture/Food products
Coal	COA	Mining
Oil	OIL	Mining
Gas	GAS	Mining
Minerals nec	OMN	Mining
Bovine meat products	CMT	Agriculture/Food products
Meat products nec	OMT	Agriculture/Food products
Vegetable oils and fats	VOL	Agriculture/Food products
Dairy products	MIL	Agriculture/Food products
Processed rice	PCR	Agriculture/Food products
Sugar	SGR	Agriculture/Food products
Food products nec	OFD	Agriculture/Food products
Beverages and tobacco products	B_T	Agriculture/Food products

(Continued next page)

Table B.1 **(continued)**

GTAP sector	*Code*	*Industry grouping*
Textiles	TEX	Manufacturing
Wearing apparel	WAP	Manufacturing
Leather products	LEA	Manufacturing
Wood products	LUM	Manufacturing
Paper products, publishing	PPP	Manufacturing
Petroleum, coal products	P_C	Manufacturing
Chemical, rubber, plastic prods	CRP	Manufacturing
Mineral products nec	NMM	Manufacturing
Ferrous metals	I_S	Manufacturing
Metals nec	NFM	Manufacturing
Metal products	FMP	Manufacturing
Motor vehicles and parts	MVH	Manufacturing
Transport equipment nec	OTN	Manufacturing
Electronic equipment	ELE	Manufacturing
Machinery and equipment nec	OME	Manufacturing
Manufactures nec	OMF	Manufacturing
Electricity	ELY	Services
Gas manufacture, distribution	GDT	Services
Water	WTR	Services
Construction	CNS	Services
Trade	TRD	Services
Transport nec	OTP	Services
Water transport	WTP	Services
Air transport	ATP	Services
Communication	CMN	Services
Financial services nec	OFI	Services
Insurance	ISR	Services
Business services nec	OBS	Services
Recreation and other services	ROS	Services
Public administration, defence, education, health	OSG	Services
Dwellings	DWE	Services

C Model modification and database extension

The purpose of this modification is to add a capital ownership dimension to the GTAP model, which allows model users to trace capital or investment movements across regions in a simulation. This modification does not alter the behavioural assumptions about any economic agent adopted in the GTAP model structure.

To implement the modifications, the GTAP model code needs to be modified and extended to incorporate the bilateral capital stocks and investment flows to be introduced into the model database.

C.1 Bilateral capital and investment mobility

Bilateral capital stock mobility

The modification is related to two GTAP variables: the rental price of capital `pm("capital",s)` and the demand for capital `qo("capital",s)`. It is assumed that capital stock used in each region is a combination of foreign owned capital and domestically owned capital. This implies that the capital owner of each region could own capital assets used in foreign regions.

To introduce bilateral capital ownership, the original (read-in) regional capital stock vector in the database (`VKB(s)`) is replaced by a new bilateral capital stock matrix (`VKB_(r,s)`). The original coefficient `VKB(s)` is redefined as

```
Formula (all,s,reg)
  VKB(s) = sum{r,reg, VKB_(r,s)};
```

It is assumed that firms in each region source their capital not only from their home region but also from foreign regions. A CES function is used to define the demand of destination region `s` for capital stock from source region `r`.

```
Equation E_qK (all,r,reg)(all,s,reg)
  qK(r,s) = qo("capital",s) - CES_cap(s) * [pK(r,s) - pm("capital",s)];
```

where qK(r,s) is a variable for the capital stock owned by region r and used in region s;

pK(r,s) is a variable for the rental price of capital from region r to region s;

CES_cap(s) is a coefficient (parameter) for CES substitution elasticities;

qo("capital",s) is a GTAP variable for the total demand for capital by destination region s;

pm("capital",s) is a GTAP variable for rental price of capital. In equilibrium, it is equal to a CES rental price index, that is,

```
Equation E_pm_cap (all,s,reg)
  pm("capital",s) = sum{r,reg, VKB_(r,s)/sum{k,reg,VKB_(k,s)} * pK(r,s)};
```

If regional capital stocks are assumed to be mobile in a simulation, regional capital owners can reallocate their capital stocks to any region that generates the highest returns. As a result, the rates of return to capital, owned by a given region, will be equalised worldwide in a new equilibrium. This equilibrium condition is captured in the following equation,

```
Equation E_rorc_2 (all,r,reg)(all,s,reg)
  rorc_(r,s) = rorc_s(r);
```

where rorc_(r,s) is a new two-dimensional variable to replace the GTAP variable rorc(s) (the rate of actual return to capital) and rorc_(r) is a new variable for the average rate of return to all capital that accrues to each owner region r. The definition of rorc_(r,s) follows that of the GTAP model for rorc(s),

```
Equation E_rorc_ (all,r,REG)(all,s,reg)
  rorc_(r,s) = GRNETRATIO_(r,s) * [pK(r,s) - pcgds(s)];
```

where GRNETRATIO_(r,s) is a new coefficient with two regional dimensions for the ratio of gross to net return to capital, used to replace the GTAP coefficient GRNETRATIO(s).

Bilateral investment mobility

In the GTAP model, regional savings are internationally 'mobile' through investing in an implicit 'global bank'. The modifications of saving and investment flows are related to chapter 4 of the GTAP model code titled "Investment, global bank and savings".

To introduce bilateral foreign investment flows, each region is allowed to invest its gross savings across all regions (including its home region) to maximise its expected returns. A CET supply function is used to define the investment in destination region s of gross savings from source region r, that is,

```
Equation E_vGINV (all,r,reg)(all,s,reg)
  vGINV(r,s) = vGSAV_s(r) + CET_INV(r) * [rore_(r,s) - rore_s(r)];
```

where `vGINV(r,s)` is a variable for nominal gross investment from source region `r` to destination region `s`;

`vGSAV_s(r)` is a variable for nominal total gross savings from source region `r`;

`CET_INV(r)` is a coefficient (parameter) for CET transformation elasticities;

`rore_(r,s)` is a variable for expected rate of return to investment from source region `r` in destination region `s`;

`rore_s(r)` is a variable for the average expected rate of return to total investment from region `r` (a CET price index), defined as

```
Equation E_rore_s (all,r,reg)
  rore_s(r) = sum{s,reg, GSavGInv(r,s)
             /sum{k,reg, GSavGInv(r,k)} * rore_(r,s)};
```

where `GSavGInv(r,s)` is a coefficient for the base-year gross saving-investment matrix, read in from a data file (more details about data below).

The new variable for regional gross saving, `vGSAV_s(r)`, can be derived from the difference between regional gross national product (GNP) (`vGNP(r)`) and net foreign capital income inflow as follows,

```
Equation E_vGNP (all,r,reg)
  vGNP(r) = 1/GNP(r) * [GDP(r) * (pgdp(r) + qgdp(r))
        + sum{k,reg, CapInc(r,k) * (pK(r,k) + qK(r,k))
                   - CapInc(k,r) * (pK(k,r) + qK(k,r))}];

Equation E_vGSAV_s (all,r,reg)
  vGSAV_s(r) = 1/GSAV_s(r) * { GNP(r) * vGNP(r)
          - sum{i,trad_comm, VPA(i,r) * (pp(i,r) + qp(i,r))}
          - sum{i,trad_comm, VGA(i,r) * (pg(i,r) + qg(i,r))} };
```

where `GNP(r)` is a new coefficient for the base-year GNP of region `r` in purchasers' prices, defined as GDP in purchasers prices plus net after-tax foreign capital income inflows,

```
Formula (all,r,reg)
  GNP(r) = GDP(r) + sum{k,reg, CapInc(r,k) - CapInc(k,r)};
```

where `CapInc(r,s)` is a coefficient for the base-year income of capital owned by region `r` and used in region `s`.

The GTAP variable `rore(s)`, the rate of expected return to capital, is replaced by a two-dimensional new variable `rore_(r,s)`, defined as,

```
Equation E_rore_ (all,r,REG)(all,s,reg)
  rore_(r,s) = rorc_(r,s) - RORFLEX(s) * [qKe(r,s) - qK(r,s)];
```

where qKe(r,s) is a new variable for the end-of-period capital stock owned by source region r and used in destination region s,

```
Equation E_qKe (all,r,reg)(all,s,reg)
  qKe(r,s) = 1/ID01[NSavNInv(r,s) + VKB_(r,s)]
                * [NSavNInv(r,s) * qNINV(r,s) + VKB_(r,s) * qK(r,s)];
```

where NSavNInv(r,s) is a new coefficient for the net saving-investment matrix and qNINV(r,s) is a new variable for real net investment. Net investment is defined as gross investment net of capital depreciation,

```
Equation E_qNINV (all,r,reg)(all,s,reg)
  qNINV(r,s) = 1/ID01[GSavGInv(r,s) - VDEP_(r,s)]
      * [GSavGInv(r,s) * qGINV(r,s) - VDEP_(r,s) * qK(r,s)];
```

where VDEP_(r,s) is a new coefficient for capital depreciation, read in from the new data file. In this modelling, the depreciation rates are consistent across source and destination regions and are equivalent to the rates in the GTAP database.

To comply with bilateral investment flows, the GTAP variable for net saving price, psave(r), needs to be redefined, because this variable now refers only to source, not destination, regions. The price of net saving, generated in source region r, is defined as the price of gross saving net of depreciation,

```
Equation E_psave (all,r,reg)
  psave(r) = 1/[GSAV_s(r) - sum{s,reg, VDEP_(r,s)}]
* [GSAV_s(r) * pGSAV_s(r) - sum{s,reg, VDEP_(r,s) * pK(r,s)}];
```

where pGSAV(r) is a variable for the price of gross saving, generated in source region r. It can be derived from the price of GNP, net of private and public consumption, as follows,

```
Equation E_pGSAV_s (all,r,reg)
  pGSAV_s(r) = 1/GSAV_s(r) * { GNP(r) * pGNP(r)
          - sum{i,trad_comm, VPA(i,r) * pp(i,r)}
          - sum{i,trad_comm, VGA(i,r) * pg(i,r)} };
```

Similar to nominal GNP vGNP(r), GNP deflator pGNP(r) can be derived from the difference between GDP deflator (qgdp(r)) and the rental price index for net foreign capital income inflows,

```
Equation E_pGNP (all,r,reg)
  pGNP(r) = 1.0/GNP(r) * [GDP(r) * pgdp(r)
+ sum{k,reg, CapInc(r,k) * pK(r,k) - CapInc(k,r) * pK(k,r)}];
```

GTAP variables kb(s) and ke(s) are redefined as the sums (over regions r) of the new variables qK(r,s) and qKe(r,s).

An equation to sum `qGINV(r,s)` over source region `r` is used to link the new bilateral investment flow variable `qGINV(r,s)` with the GTAP investment variable `qcgds(s)`,

```
Equation E_qcgds (all,s,reg)
  qcgds(s) = sum{r,reg, GSavGInv(r,s)
       /ID01(sum{k,reg, GSavGInv(k,s)}) * qGINV(r,s)};
```

To link investment flows to capital stocks, a new variable for the ratio of bilateral net investment flows to bilateral capital stocks could be introduced,

```
Equation E_r_inv_cap (all,r,reg)(all,s,reg)
  r_inv_cap(r,s) = qNINV(r,s) - qK(r,s);
```

This variable may be useful for some closure option that allows capital stocks to follow international investment movements, or vice versa; however, this equation is inactive for this modelling.

C.2 Bilateral capital and investment data

To introduce bilateral investment behaviour and capital accumulation, two sets of new data are needed: a bilateral capital stock matrix and a saving-investment matrix.

The primary sources of foreign capital stock and investment flow data include IMF's Balance of Payments Statistics (BoPS) (IMF 2010) and UNCTAD's FDI database.

Some research institutes have used the data from the above sources to construct their own capital and investment databases. These include foreign capital income shares in the GDyn database and bilateral FDI stock and flow matrices complied by Boumessalla, Gouel and Laborde (2007) of the CEPII. Useful information has been extracted from these data sources in constructing the following capital stock and investment flow databases.

Bilateral capital stock data

This is an extension of the GTAP coefficient for capital stocks `VKB(s)` from a one-dimensional vector to a two-dimensional matrix, denoted as `VKB_(r,s)`. In the new matrix, the integrity of the original GTAP capital stock data is preserved, that is,

```
Formula (all,s,reg)
  VKB(s) = sum{r,reg, VKB_(r,s)};
```

The procedure has five steps:

1. Use the shares of domestic capital in total capital income from the GDyn database to split the GTAP regional capital stock data (`VKB(s)`) into domestic capital stocks (diagonal), foreign capital stocks used (row totals) and foreign capital stocks owned (column totals).

2. Use the international investment position data in the BoPS to split foreign capital stocks into FDI and non-FDI stocks.

3. Use the BoPS FDI stock data and the FDI stock matrix from the CEPII as a base for the RAS procedure to create a FDI stock matrix.[1]

4. Use the BoPS non-FDI stock data and the trade matrix, derived from the GTAP database, as a base matrix for RAS to crease a non-FDI stock matrix.

1 RAS is a method used to adjust input-output tables

5. The final capital stock matrix VKB_(r,s) is the sum of the domestic capital stock matrix (diagonal), the FDI stock matrix and the non-FDI stock matrix.

Table C.1 is a version of the final capital stock matrix aggregated over source region.

Table C.1 **Composition of capital stock in each region**

Region	*Domestic capital*	*Foreign capital*	
		Non-FDI capital	*FDI capital*
	%	%	%
Australia	71.4	20.2	8.4
New Zealand	71.3	18.8	9.9
China	94.6	2.3	3.1
Hong Kong	32.1	35.6	32.3
Japan	96.8	3.0	0.1
Korea	95.4	3.6	1.0
Taiwan	82.4	14.7	3.0
Indonesia	85.7	13.0	1.3
Malaysia	64.7	24.4	10.9
Philippines	89.0	9.1	1.9
Singapore	38.6	36.0	25.4
Thailand	75.6	14.1	10.2
Bangladesh	96.9	2.7	0.4
India	95.5	3.6	1.0
Rest of Asia & Oceania	89.0	8.6	2.5
Canada	73.5	17.7	8.8
United States	78.5	18.2	3.2
Mexico	82.5	9.5	8.0
Brazil	81.4	11.9	6.7
Rest of America	73.8	15.7	10.5
European Union (25)	61.8	31.3	6.9
Russia	87.6	8.7	3.6
Rest of Europe	73.1	22.2	4.7
South Africa	86.4	7.8	5.8
Rest of Africa	84.2	10.0	5.8
World average	76.7	18.6	4.7

Source: Derived using data from various sources.

Bilateral saving-investment data

To model bilateral investment behaviour, a bilateral gross saving-investment matrix is required. The derivation of this matrix is based on an accounting principle of the BoPs, that is, the current account deficit has to be offset by the capital and financial account surplus. As the GTAP database already contains bilateral trade flows, the GTAP trade matrix can be used as a base for compiling the required saving-investment matrix.

The procedure can be summarised in eight steps (figure C.1):

- 1. Split the GTAP trade margin export data `VST(m,r)` into a matrix of transport services from exporting regions to importing regions.
- 2. Create a bilateral trade matrix by adding the transport margin matrix to the GTAP export data `VXWD_i(r,s)`.
- 3. Split the regional capital income `VOA_i(r)` in the GTAP database into a bilateral income transfer matrix using the shares from the capital stock matrix.
- 4. Combine the two matrices from steps 2 and 3 to create a bilateral current account matrix.
- 5. Use the bilateral current account matrix to derive a bilateral current account surplus matrix. Note that this matrix provides information on how a region's gross savings are invested in foreign regions.
- 6. Use regional gross savings and the current account surplus matrix to derive the regional gross savings that are invested in their own home regions. These are used to file the diagonal of the current account surplus matrix. This results in a gross saving-investment matrix, `GSavGInv(r,s)`. Its row totals are equal to regional gross savings while its column totals are equal to regional gross investment.
- 7. Because this matrix is based on the current account surplus matrix, the gross saving-investment matrix contains many zero cells (300 in the current 25 country/region aggregation) . In other words, it shows only the net (one-way) flows of savings from source regions to destination regions. Ideally, such a matrix should contain gross flows of savings. In the absence of information on bilateral flows of gross savings, one can only use any available bilateral investment flow data to fill the zero cells. One such option is to use the FDI flow matrix from the CEPII [2] because FDI flows are an integrated part of total investment flows.

[2] The original FDI flow matrix has been adjusted to be consistent with the FDI shares from IMF's BoPS.

– 8. The FDI flows are incorporated into the gross saving-investment matrix (from step 6 above) in such a way that preserves the integrity of the row and column totals of the original gross saving-investment matrix. This is the final gross saving-investment matrix to be used with the modified model.

The row and column totals of the final capital stock matrix and the gross saving-investment matrix are presented in table C.2. It can be verified that the new database is an extension of the original GTAP database: regional capital stocks used (the second column) and regional investment flows (the fourth column) correspond respectively, to the capital stock `VKB(s)` and investment data `VFA_i(s)` in the GTAP database.

Figure C.1 **Compiling a gross saving-investment matrix**

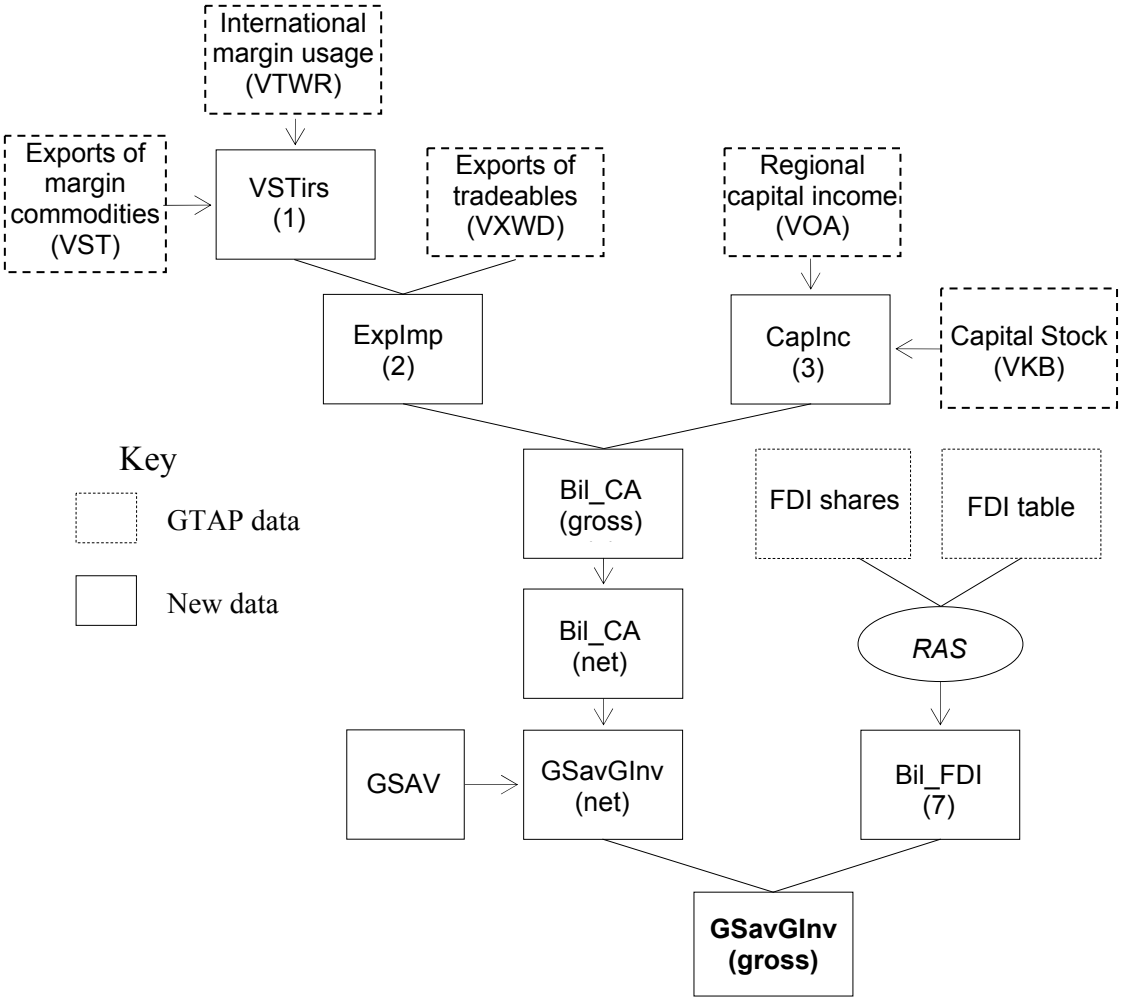


Table C.2 **Capital stocks and investment flows**[a]

Region	*Capital stock*		*Gross saving-investment*		
	Owned	*Used*[b]	*Saving*	*Investment*[b]	*Inflow*[c]
	US$ bn	US$ bn	US$ bn	US$ bn	US$ bn
Australia	1,375.4	1,669.8	109.1	156.5	47.4
New Zealand	191.3	249.8	13.6	21.4	7.8
China	3,888.8	3,954.3	767.0	688.2	-78.7
Hong Kong	471.1	450.0	39.6	33.7	-5.9
Japan	18,312.2	16,803.6	1,392.3	1,095.0	-297.4
Korea	1,998.3	2,003.8	245.6	194.8	-50.8
Taiwan	570.6	576.0	93.1	54.9	-38.2
Indonesia	472.8	542.5	44.9	49.3	4.4
Malaysia	260.5	332.4	56.0	17.3	-38.7
Philippines	222.7	225.0	14.5	14.1	-0.4
Singapore	254.8	311.8	24.3	31.4	7.1
Thailand	441.6	523.9	44.2	40.3	-3.9
Bangladesh	125.1	128.2	10.6	13.6	3.0
India	1,327.3	1,368.0	124.5	156.4	31.9
Rest of Asia & Oceania	*2,738.7*	*2,816.2*	*281.8*	*253.1*	*-28.7*
Canada	2,195.8	2,464.2	186.7	205.6	18.8
The United States	26,883.3	26,138.0	1,801.7	2,198.5	396.7
Mexico	1,717.6	1,943.5	125.6	139.4	13.8
Brazil	1,474.0	1,772.8	122.2	122.0	-0.3
Rest of America	1,821.2	2,231.9	139.3	180.9	41.5
European Union (25)	*36,894.1*	*37,004.8*	*2,499.0*	*2,535.2*	*36.2*
Russia	1,243.6	1,330.5	163.8	106.5	-57.3
Rest of Europe	*4,064.1*	*3,864.9*	*285.2*	*263.5*	*-21.7*
South Africa	652.9	713.8	33.5	35.1	1.6
Rest of Africa	*1,610.5*	*1,788.8*	*111.5*	*123.3*	*11.7*
World	111,208.5	111,208.5	8,729.7	8,729.7	0

a Expressed in 2004 US$ **b** Regional capital stocks used and investment flows are consistent, respectively, with `VKB(s)` and `VFA_i(s)` in the GTAP database. **c** Regional foreign investment inflows are equal to the difference between regional investment and saving.

Source: Derived on data from various sources.

D Outline of selected CGE modelling of bilateral trade agreements

This appendix outlines a sample of studies into the benefits and costs of bilateral trade agreements between Australia and the United States and Thailand as background to the preparation of scenarios and modelling presented in this supplement. The estimated overall effects of these agreements are generally small, with the Centre for International Economics' assessment of the Australia–United States agreement being the exception (table D.1).

Table D.1 **Assessments outlined in this appendix**

Assessment	*Model*	*Changes modelled*	*Estimated impact*	
CIE analysis of AUSFTA	G-Cubed	Goods and services, Australian foreign investment rules	0.60	per cent increase in real GNP ten years after entry into force (2014)
	GTAP	Goods and services, US government procurement rules	0.05	per cent increase in real GDP
Dee's analysis of AUSFTA	GTAP	Goods and services, US government procurement rules, intellectual property, other costs	0.01	per cent increase in real GDP
ACIL analysis of AUSFTA	Tasman-Global	Goods and services	-0.09	per cent change in real GNP
CIE analysis of TAFTA	APG-Cubed	Goods and services	0.04	per cent increase in real consumption in 2012

Source: ACIL (2003), CIE (2004a), CIE (2004b) and Dee (2004)

CIE analysis of the Australia–United States Free Trade Agreement

The Centre for International Economics (CIE) published a study of the Australia–United States Free Trade Agreement (AUSFTA) in April 2004, two months after negotiations for the AUSFTA concluded (CIE 2004a). This provided an update to a 2001 feasibility study on the potential effects of a trade agreement between Australia and the United States (CIE 2001).

CIE (2004a) estimated the quantitative impacts of:

- bilateral reduction in barriers to trade in merchandise and services;
- changes to Australian foreign investment rules;
- reduced barriers to Australian participation in the US government procurement market; and
- dynamic productivity gains from the above sources.

Other dimensions of the agreement — including those relating to intellectual property, competition policy, the Pharmaceutical Benefits Scheme, as well as frameworks for further bilateral reductions in trade and investment barriers — were not quantified.

Models

The quantitative impacts of AUSFTA were evaluated using two models:

1. G-Cubed was used to examine dynamic processes, such as capital accumulation, and the effects of the agreement on financial variables such as exchange rates (box D.1).
2. GTAP was used to examine the impacts at a more disaggregated sectoral level. While only minor changes have been made to GTAP's structure since CIE (2004a), two new databases have been released.[1]

Box D.1 **Summary of the G-Cubed model**

G-Cubed is a hybrid model, incorporating features from macroeconomic, general equilibrium and international trade models. It integrates real and financial markets, incorporating interest rates and exchange rates, and allows for the explicit treatment of expectations. G-Cubed is a dynamic model, which is able to capture the phased reductions in trade and investment barriers, and estimate capital accumulation over time. The model covers nine regions, including both Australia and the United States, and 12 sectors. Documentation of the G-Cubed model is available from www.msgpl.com.au.

While the version of GTAP used in CIE (2004a) allows for changes in investment, these changes are not translated into changes in the capital stock, and do not contribute to the productive capacity of the economy. This is the standard GTAP

[1] CIE (2004a) used an updated edition of version five (based on 1997). The CIE (2004a) GTAP model was more aggregated, with 10 regions.

closure, and implicitly represents a short-run equilibrium. CIE (2004a), however, modified GTAP to examine the implications of capital accumulation which would be more characteristic of a longer-run modelling environment.[2]

This was achieved by, firstly, calibrating GTAP so that the change in investment from a given policy-induced change in key variables was similar to the change in investment in G-Cubed. Secondly, G-Cubed was used to estimate the elasticity of capital stock with respect to investment. This allowed CIE (2004a) to model capital accumulation with GTAP. Finally, since some of the capital accumulation was financed by foreigners, adjustments were made (through a wealth-domestic savings elasticity) to allocate ownership of the expanded capital stock between residents of different regions.

Simulations

CIE (2004a) constructed baseline and alternative scenarios to estimate the effects of changes in trade and investment barriers and productivity associated with AUSFTA.

Estimating tariffs and tariff equivalents at the sectoral level

The Australian and United States tariff schedules cover thousands of line items. However, as G-Cubed contains only 12 sectors and GTAP only 57, tariff rates were aggregated to match these levels of sectoral detail. CIE (2004a) used arithmetic averaging for GTAP simulations and trade-weighted averaging, based on GTAP data, to aggregate tariffs for the G-Cubed simulations.

CIE (2004a) made adjustments to account for specific duties and tariff rate quotas (TRQs) imposed by the United States. With specific duties, CIE (2004a) divided the observed 2003 price by the duty per unit to work out a tariff equivalent. With TRQs, CIE (2004a) took a weighted average of in-quota and out-of-quota tariff rates, based on the quantity of Australian products exported to the United States in 2003.

Baseline simulation

CIE (2004a) established a baseline for reductions in trade and investment barriers in the absence of AUSFTA. The baseline accounts for gradual tariff reductions in Australia's TCF and PMV sectors, and the Thailand–Australia Free Trade Agreement. The modelling did not consider the United States' other bilateral trade

2 The Productivity Commission has modified the closure of GTAP to allow the capital stock to adjust.

agreements, nor future commitments to reduce trade and investment barriers made in the WTO or APEC. It is unclear whether reductions in trade and investment barriers under the Uruguay Round were accounted for in the baseline. The same baseline was used for both models.

Alternative simulation

Not all aspects of AUSFTA were addressed in both models (table D.2).

Table D.2 **Alternative scenarios represented in G-Cubed and GTAP**

Reduction in barriers to:	*G-Cubed* [a]	*GTAP*
Trade in goods and services	Yes	Yes
Investment	Yes	No
Government procurement	No	Yes

[a] Includes dynamic productivity gains in goods and services sectors.

Merchandise trade

CIE (2004a) utilised a tariff schedule provided by DFAT to model the change in barriers to merchandise trade. The schedule detailed changes in tariffs expected from AUSFTA. Adjustments (outlined below) were made to account for rules of origin and safeguard measures.

CIE (2004a) identified ten Australian textile and clothing export tariff lines that satisfied US RoO requirements. These lines accounted for an average of 8.8 per cent of Australian textiles and clothing exports to the US. It was assumed that only these exports would access lower preferential rates under AUSFTA.

AUSFTA also established price-based and quantity-based safeguard measures on certain Australian horticultural and beef exports. Safeguard measures on horticulture were not modelled. CIE (2004a) used the Global Meat Industries model to forecast Australian beef exports to the United States.[3] They estimated that the beef preferential quota would be binding between 2006 and 2009, with between 0.8 and 2.9 per cent of Australian beef exports to the United States being subjected to an additional tariff of 26 per cent. Export weights were used to estimate the impact of safeguard measures on the average tariff on Australian beef exports to the United States. In 2006, the estimated average tariff was 0.8 per cent higher than without safeguard measures, with the impact declining to zero in 2010. Safeguard measures

3 More information is available on the CIE's website at http://www.thecie.com.au/section.asp?sID=5

on beef were modelled as not being binding after 2010. Other safeguard measures on beef, such as price-based safeguards, were not modelled.

Services trade

CIE (2004a) drew on a Productivity Commission staff research paper on the regulation of professional services to estimate the impacts of reducing barriers to trade in professional services under AUSFTA. The staff research paper (Nguyen-Hong 2000) examined barriers to the foreign supply of professional services such as engineering, architecture, accountancy and legal services. Australia was given a trade restrictiveness index score of 0.17 based on a restrictiveness index with possible values ranging between 0 and 1.

Nguyen-Hong (2000) also estimated that barriers to engineering services increase the cost of engineering services by around 0.7 per cent. The restrictiveness index for engineering services is 0.04 in a range of 0 to 1, which is substantially less than the average. Assuming a linear relationship between cost and the estimated restrictiveness index value, and that the impact on engineering costs is similar to other activities covered in the index, the CIE estimated the impact of restrictions on professional services was a 3.1 per cent increase in cost. According to CIE (2004a), restrictions on foreign professionals make up 18 per cent of the total barrier, while the United States accounts for 35 per cent of the international market for professional services. CIE (2004a) appear to have modelled the impact as a 0.2 per cent productivity improvement in the Australian 'other business services' sector. A similar method was used to estimate the effect of reducing barriers to trade in professional services in the US. This was modelled as a 0.02 per cent productivity improvement in the United States 'other business services' sector. No other dimensions of reductions in barriers to trade in services were modelled.

Foreign investment

The investment component of the alternative scenario modelled changes to the notification thresholds for foreign investment in Australia, namely an increase in the notification threshold for non-sensitive investments from A$50 million to A$800 million. The quantitative analysis examined the implications of a potential increase in certainty and transparency for investors, which argued could reduce the risk premium on US investments in Australia. CIE (2004a) cited evidence that the long-run equity risk premium for Australia is 120 basis point higher than the equity risk premium in the United States. It suggested many factors could contribute to this difference, and assigned half of the difference (60 basis points) to Australia's prevailing foreign investment rules. To put this number in perspective, it assumed

that the ex-ante cost of the foreign investment rules associated with a A$100 million investment is A$600 000 a year, or A$5.7 million over a thirty year period assuming a 10 per cent interest rate.

The assigned risk premium (60 basis points) was then multiplied by the share of US investment in total foreign investment in Australia (27 per cent in 2001-02), and the share of US investment in sectors that will be exposed to changes in investment barriers (that is, non-sensitive sectors: 66 per cent). To be conservative, the resulting estimate was then halved, generating a final shock of 5 basis points to Australia's equity risk premium. It was recognised that there is substantial uncertainty surrounding the estimate given the assumptions required in deriving the differential risk premium, assigning it to specific investment rules and translating the shock from one area of foreign investment (US investment in non sensitive areas) to foreign investment more generally.

Government procurement

In estimating the effects of increased access to the US government procurement market, CIE (2004a) provided a comparison with Canada, which received preferential access to the United States' government procurement market through provisions in the North American Free Trade Agreement. The CIE examined the prospects for one Canadian company (the Canadian Commercial Corporation), which secured approximately A$650 million in US government procurement service contracts in 2000. As an upper bound estimate, CIE (2004a) assumed that since Australia's economy was 1.8 times smaller than Canada's, the upper bound estimate of increased government procurement Australian service providers could expect would be approximately A$360 million. However, total trade between Canada and the United States was 20 times greater than total trade between Australia and the United States, and so the CIE used a lower bound estimate of A$50 million. For the main simulations, CIE (2004a) assumed a A$150 million a year increase in Australian exports to the US government procurement market as a result of AUSFTA. The impacts of government procurement changes in Australia were not considered.

Dynamic productivity gains

To estimate productivity shocks for the G-Cubed simulations, CIE (2004a) conducted a literature review of studies that estimate the impact of reducing trade and investment barriers on the productivity of the Australian manufacturing sector. Taking a subset of these studies (table D.3), CIE (2004a) estimated a 1 percentage point unilateral reduction in tariffs would result in a 0.3 per cent increase in

productivity. Productivity shocks were computed for each sector by taking the percentage point change in tariffs under AUSFTA and multiplying by 0.3 (with adjustments also being made for the share of US imports).

Table D.3 **Selected empirical studies on the dynamic gains from reduced trade protection**

Study	*Country*	*Sector*	*Year*	*Results*
Chand (1999)	Australia	Manufacturing	1967-95	A 1 per cent reduction in nominal rate of assistance produces a 0.18 to 0.50 per cent increase in productivity
Chand, McCalman and Gretton (1998)	Australia	Manufacturing	1968-95	A 1 per cent reduction in nominal rate of assistance produces a 0.15 per cent permanent increase in output
Chand and Vousden (1996)	Australia	Manufacturing	1970-91	A 1 per cent increase in an independent measure of assistance leads to a 0.3 per cent decline in manufacturing industry output

Source: CIE (2004a), p. 20.

Results

In G-Cubed simulations, the various features of AUSFTA modelled were estimated to gradually increase gross national product (GNP), peaking in 2004 with an estimated increase of 0.6 per cent, before falling slightly (figure D.1). The largest gains were estimated to be the result of reductions in barriers to investment, followed by reductions in barriers to trade, and then dynamic productivity gains.

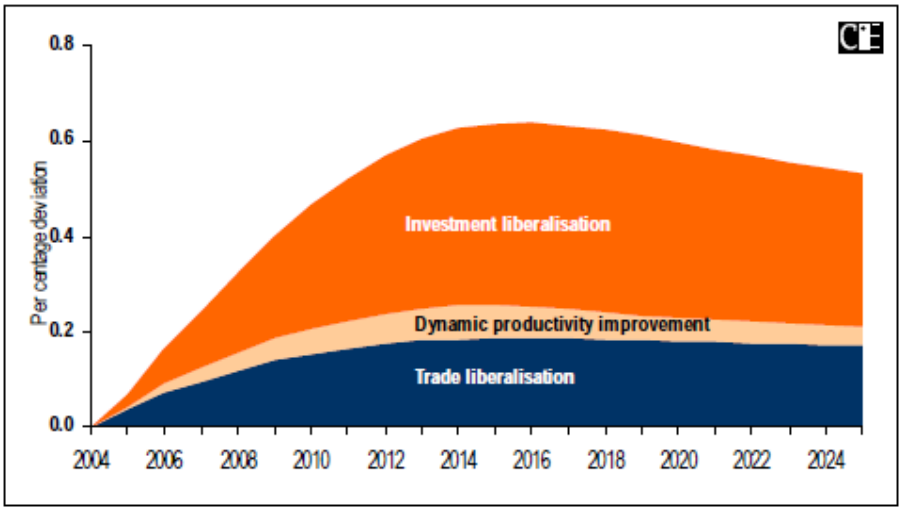
As mentioned above, the GTAP simulations did not include reductions in investment barriers or dynamic productivity gains, but (unlike the G-Cubed simulation) included increased access to US government procurement by Australia. In addition, because GTAP is a comparative static model, the results lack an explicit time dimension. The GTAP simulations estimate an increase in Australia's real GDP of around 0.05 per cent, and an increase in national income of around US$360 million per year (measured in equivalent variation).

According to CIE (2004a), the estimated impact of reductions in trade barriers was larger in G-Cubed than in GTAP because:

- G-Cubed better captured the effects of induced investment (reducing trade barriers is assumed to increase returns to capital); and
- G-Cubed is more aggregated across sectors and regions, meaning that there are fewer tariff peaks. In some respects this could reduce the estimated gains from

reducing tariffs. However, it also leads to smaller differences between MFN and preferential tariffs, and hence, less trade diversion.

Figure D.1 **Estimated deviation in real gross national product as a result of the AUSFTA**
G-Cubed simulations



Source: CIE (2004a), p. 78.

Around 55 per cent of the estimated net gains to Australia (US$200 million) in the GTAP simulation were derived from bilateral reductions in merchandise trade barriers, even though Australian GNP was estimated to be approximately US$230 million less per year following the reduction of barriers on its own merchandise trade (a combination of trade diversion and terms of trade effects – see table D.4). There is a substantial amount of trade diversion with imports from the United States increasing by US$6.5 billion per year, and imports from other countries decreasing by US$3.7 billion per year. The loss to Australia from reducing its own barriers to merchandise trade is more than offset by a gain to Australia of US$430 million from reduced barriers to US merchandise trade, primarily due to a increase in Australia's terms of trade. Approximately 37 per cent of the estimated gain was estimated to be derived from reducing barriers to trade in services, while the remaining 8 per cent was attributed to access to the US government procurement market.

Output was estimated to increase in most sectors of the Australian economy, with the largest increases occurring in leather products (6 per cent), bovine meat products (3.2 per cent), and rice (1.5 per cent). Some sectors were estimated to contract. For example, wheat output is estimated to fall by 0.8 per cent, while output of plant-based fibres (which includes cotton) was estimated to fall by 1 per cent. The changes occur as land and other resources move into the beef and rice industries in response to US tariff reductions and higher world prices.

Table D.4 **Estimated effects of AUSFTA**

Welfare disaggregation, GNP, GTAP simulations

	Trade creation	*Trade diversion*	*Reduction in taxes*	*Terms of trade*	*Technical efficiency*	*Capital accum-ulation*	*Foreign income flows*	***Total***
	US$ m	US$ m	US$ m	US$ m	US$ m	US$ m	US$ m	US$ m
Reduced barriers to merchandise trade by:								
Australia	96	-141	-2	-258	0	104	-29	**-231**
United States	3	20	41	333	0	51	-17	**431**
Reduced barriers to services trade by:								
Australia	0	0	9	1	112	11	-4	**131**
United States	0	0	0	1	0	0	0	**1**
Government procurement:								
Access to US market	0	1	2	22	0	3	-1	**28**
Total	**100**	**-119**	**49**	**99**	**112**	**170**	**-51**	**359**

Source: CIE (2004a).

Sensitivity analysis

CIE (2004a) varied key assumptions and parameters, examining:

- the impact of other trade agreements;
- the impact of key GTAP parameters; and
- the impact of different shocks to productivity, exports and Australia's equity risk premium.

The simulations indicate that while Australian GNP could be reduced following the introduction of an American free trade zone (between the 34 countries involved in negotiations for a proposed Free Trade Area of the Americas), such an agreement would not noticeably change the net benefits to Australia from AUSFTA.

CIE (2004a) also conducted sensitivity analyses which examined the impacts of adjusting key parameters of the GTAP model including the Armington elasticities (which determine the substitutability of domestic and foreign products) and the investment response to changes in the return on capital. A triangular probability distribution was used in both cases, with the distribution centred on the standard values used in the main simulations. In the case of the Armington elasticities, the lower bound was half the standard value, and the upper bound was double the standard value. The parameters were varied independently, with the resulting simulations used to estimate confidence intervals. CIE (2004a) concluded that it was:

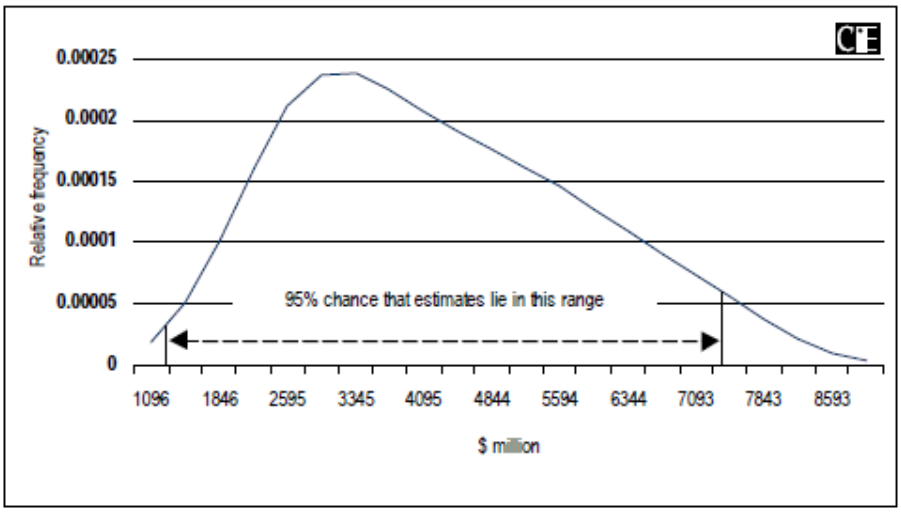
> … 95 per cent confident that the gain in Australian national income from the trade in merchandise and services liberalisation scenarios considered would lie between A$322 million and A$408 million per year, given the assigned probability distribution. (p. 97)

A similar procedure was used to estimate confidence intervals for:

- productivity improvements in the business services (other) sector (lower bound of zero, upper bound of 0.4, centred on 0.2);
- increase in Australian exports to the US government procurement market (lower bound of zero, upper bound of A$400 million, centred on A$200 million);
- dynamic productivity gains (lower bound of zero, upper bound of double the gains used in the main simulations, centred on the gains used in the main simulations); and
- reduction in the risk premium (lower bound of 2 basis points, upper bound of 20 basis points, centred on 5 basis points).

The welfare effects were analysed by 'scaling and adding' the effects of reductions in trade barriers and government procurement from GTAP with the effects of reductions in investment barriers and dynamic productivity gains projected in the G-Cubed model. Ten-thousand combinations were sampled and a frequency distribution of welfare changes was estimated (figure D.2). The frequency distribution was used to estimate a 95 per cent confidence interval with a lower bound welfare change of A$1.1 billion (2002 dollars) per year and an upper bound of A$7.4 billion (2002 dollars) per year for the scenarios considered.

Figure D.2 **Simulated effects of AUSFTA on Australia's real GNP**
Calculations based on GTAP and G-Cubed simulations, 2002 AUD$ m



Source: CIE (2004a), p. 99.

Dee's analysis of the Australia–United States Free Trade Agreement

In June 2004, Dr. Philippa Dee from the Australian National University submitted a research paper to the Senate Committee on the Free Trade Agreement between Australia and the United States. Among other things, the paper commented on the modelling undertaken by CIE (2004a).

Dee (2004) argued that 'the G-Cubed model [used in CIE (2004a)] is simply too aggregated to be an appropriate tool for quantifying the trade effects of preferential trade agreements' (p. 27), and that the problem is exacerbated by using trade weights for the calculation of tariff scenarios. This means that 'product-by-product variation in import sourcing' and tariff peaks cannot be fully represented in the model, causing the estimates of trade diversion to be understated.

Dee (2004) also criticised the treatment of rules of origin. CIE (2004a) models the effects of rules of origin on Australian exports of textiles and clothing, but it was assumed that rules of origin did not affect other sectors. According to Dee (2004):

> … the [CIE] study has not reflected the experience of other preferential trade agreements, which is that as a result of the rules themselves and the transactions costs of proving compliance, the proportion of total trade that takes place at preferential rates can be much less than 50 per cent across the board. (p. 28)

In relation to services trade, Dee (2004) argued that by assigning half of the increase in the price of services to an increase in costs (when Dee (2004) argued there should be no increase in costs, only rents), CIE (2004a) overstates the net benefits of reducing barriers to services trade. Dee (2004) argued that if the criticism were valid, some of the apparent gains observed in the CIE (2004a) modelling of reductions in barriers to services are largely transfers from producers to consumers, rather than a genuine increase in aggregate income.

In relation to investment rules, Dee (2004) argued that Foreign Investment Review Board screening requirements are a source of transaction costs, not risk. In terms of the effect on investment, Dee (2004) argued that '… screening has an unknowable, but probably small, deterrent effect on a few particular investments, but nothing like the number of investments that would be affected by a generalised change in the risk premium' (p. 30).

Dee (2004) contended that CIE (2004a) overestimated the likely value of Australian exports to the US government procurement market by a factor of seven. CIE (2004) assumed that as a result of AUSFTA, Australia could export around 30 per cent as much to the US government procurement market as is exported by Canada (through

the Canadian Commercial Corporation). According to Dee (2004), 'empirical studies that correct for country size and distance between countries suggest that the figure is more likely to be 4 per cent' (p. 30).

CIE (2004a) did not quantify the effects of changes to intellectual property rights. Dee (2004) estimated that Australian royalty payments (to overseas residents) could increase by US$88 million per year as a result of changes to copyright protection under AUSFTA.

Finally, Dee (2004) suggested that the existence of '… [significant] effects of tariff cuts on productivity has been hotly debated. Conservative evaluations might note their possible existence, but … not include them in the quantitative analysis' (p. 32).

Dee (2004) made a series of adjustments to the modelling undertaken in CIE (2004) to account for different assumptions regarding:

- trade parameters;
- rules of origin;
- the effects of reduced barriers to trade in services on technical efficiency;
- government procurement;
- intellectual property; and
- ongoing administration costs and costs to the sugar industry.

Under this alternative scenario, the estimated gains from AUSFTA, with respect to the components modelled, were reduced from US$359 million to US$53 million per year (table D.5).

Dee (2004) concluded that the estimated gains of the AUSFTA agreement (CIE 2004a):

> … may be overstated because they exaggerate the gains from some parts of the agreement and ignore the costs of other parts. (p. 40)

Table D.5 **Alternative assessment of AUSFTA in Dee (2004)**
Impact on national income, GTAP simulations

Criticism	*Adjustment by Dee (2004), relative to CIE (2004a)*	*Impact*
		US$ m per year
	CIE (2004a) estimated impact	**359**
Trade parameters too inelastic, rules of origin not considered outside TCF	More elastic trade parameters. Gains from reducing barriers to merchandise trade multiplied by 0.44 to account for rules of origin.	-73
Technical efficiency gains associated with reductions in barriers to trade in services too speculative	Technical efficiency gains set to zero	-112
Government procurement gains overestimated	Gains from government procurement changes multiplied by 0.13.	-25
Cost of intellectual property rules not accounted for	Additional cost of US$88 million per year	-88
Cost of administration and sugar package not accounted for	Additional cost of US$2 million per year for administration, and US$5 million per year for sugar package	-7
	Dee (2004) adjusted impact	**53**

Source: Dee (2004).

ACIL analysis of the Australia–United States Free Trade Agreement

In 2003, ACIL consulting was commissioned by the Australian Rural Industries Research and Development Corporation to assess the benefits and costs of AUSFTA from the perspective of the Australian farm sector. The analysis is partly a response to CIE (2001), the initial AUSFTA scoping study. ACIL (2003) contended that:

> … in our opinion, the CIE report does not acknowledge all its limitations. To address some of these and in particular to explore some broader issues not covered by the CIE, during this study we commissioned some quantitative analysis of our own … (p. 37)

Modelling

ACIL (2003) uses the Tasman-Global model, which is based on GTAP but has been expanded to include dynamics, such as capital accumulation and debt accumulation, and international capital mobility.

The Tasman-Global model uses the GTAP database, with 1997 as the base year. There are 10 regions, including Australia and the United States, and 34 commodities.

Scenarios

The baseline scenario used by ACIL (2003) assumed a 'continuation of existing policy through to 2010' (p. 39).[4] The alternative scenario assumed the removal of almost all standard GTAP tariffs and non-tariff barriers between Australia and the United States.[5]

This scenario captured the bilateral removal of merchandise trade barriers, but did not model the bilateral removal of barriers to trade in services.

ACIL (2003) was critical of the treatment of services in the initial CIE report:

> Unlike the CIE, we made no presumption that free trade would, of itself, result in a productivity increase in Australia's service sector through greater awareness of US managerial methods. … The wisdom of the CIE's assumptions seems to us to be a matter of opinion. We can see no reason why an FTA per se would provide Australian businesses with any more awareness of US methods than it has already. (p. 41)

In contrast to CIE (2004a), ACIL (2003) did not quantify the effects of changes to foreign investment rules, government procurement regulations, or dynamic productivity gains associated with reductions in barriers to trade and investment. According to ACIL (2003), the differences in the content of alternative scenarios explain a large part of the divergence in results between their report and CIE (2001).

Results

ACIL (2003) stated that 'our modelling exercise casts doubt on the CIE's main finding … that an FTA with the US would raise aggregate Australian welfare' (p. 23). ACIL (2003) estimated that AUSFTA would reduce Australia's GNP by around 0.1 per cent in 2010 (table D.6), attributing the negative result to trade diversion and a small decline in terms of trade.

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4 However, there is no additional detail on whether trade agreements or unilateral reductions in trade barriers, scheduled for between 2003 and 2010, were reflected in the baseline to which these changes were applied.

5 These barriers were modelled as being reduced between 2005 and 2010. The exceptions were agricultural subsidies and quarantine arrangements, which were assumed to remain unchanged.

ACIL (2003) also modelled the effects of unilateral and worldwide reductions in barriers to trade. The worldwide multilateral scenario was estimated to increase Australian real GNP by 0.13 per cent, while the unilateral scenario was estimated to reduce Australian real GNP by 0.61 per cent. ACIL (2003) did not explain why unilateral reductions in barriers to trade are estimated to reduce Australian income, but the result is possibly due to a 1.26 per cent reduction in Australia's terms of trade.

Table D.6 **Estimated changes under various trade scenarios**
Calculations based on Tasman-Global simulations

	Bilateral	*Unilateral*	*Multilateral*
	%	%	%
Real GNP	-0.09	-0.61	0.13
Terms of trade	-0.04	-1.26	1.19

Source: ACIL (2003).

Following the publication of the ACIL (2003) study, the CIE published an analysis (CIE 2004c) of the differences between the ACIL results and those in the CIE study. Among other things, the CIE identified ACIL's use of a less elastic demand for Australian exports as a primary driver of the difference between the results.

Thailand–Australia Free Trade Agreement

Negotiations for the Thailand–Australia Free Trade Agreement (TAFTA) concluded in October 2003. The CIE was commissioned by the Department of Foreign Affairs and Trade to analyse the benefits and costs of reducing trade barriers under the agreement. The study was released in March 2004.

There are similarities between this analysis (CIE 2004b) and the analysis of AUSFTA (CIE 2004a). However, the TAFTA analysis does not include changes in Australian foreign investment rules or Thai government procurement regulations. Another important difference from the AUSFTA analysis was that 'dynamic productivity gains' were not modelled.

It was also not clear from the analysis whether or not the effects of any developing country preferences on applied rates prevailing in Australia on imports from Thailand were taken into account.

Model

CIE (2004b) used the Asia-Pacific version of the G-Cubed model (APG-Cubed), which features 18 regions and 6 sectors — energy, mining, agriculture, non-durable manufacturing, durable manufacturing and services. The database was updated to make 2002 the base year. Unlike CIE (2004a), the GTAP model was not used, resulting in less sectoral details.

Simulations

Tariffs were estimated at the sectoral level using a combination of arithmetic and production weights. First, MFN tariff lines (at the 6 or 8 digit harmonised system level) were mapped to GTAP sectors, and arithmetic averages estimated. Second, production weights obtained from the GTAP database were used to aggregate tariffs from the GTAP level to APG-Cubed.

In Thailand, some commodities attract either a tariff or specific duty, whichever is higher. CIE (2004b) assumed that tariffs are always higher than specific duties.

The baseline simulation included announced unilateral tariff reductions in Australia's TCF and PMV sectors. However, it excluded future reductions in trade barriers under the WTO and under the Bogor Declaration. Australia's preferential trade agreements with the United States and Singapore, and Thailand's other preferential trade agreements, were not modelled.

The alternative simulation used by CIE (2004b) represented a gradual reduction in barriers to merchandise trade between Australia and Thailand, as agreed under TAFTA (Australia phasing out all tariffs on Thai imports by 2015 and Thailand phasing out all tariffs on Australian imports by 2025).

According to CIE (2004b), the additional reduction in barriers to trade in services that Australia committed to under TAFTA was minimal, and was not quantified. The additional reduction in barriers to trade in services in Thailand's services markets under the agreement were centred around foreign ownership rules and labour market regulations.

CIE (2004b) assumed that allowing Australian business to compete, without restriction, in Thailand's telecommunications market would lower the price of telecommunication services in Thailand by around 5 per cent. Since TAFTA only required the partial removal of barriers — for example, Australian businesses will be unable to own more than 40 per cent of the equity of registered Thai telecommunication suppliers — it was assumed that only 10 per cent of the

potential costs savings would be realised. Thus, CIE (2004b) attributed a 0.5 per cent cost reduction in Thailand's telecommunications market to TAFTA.

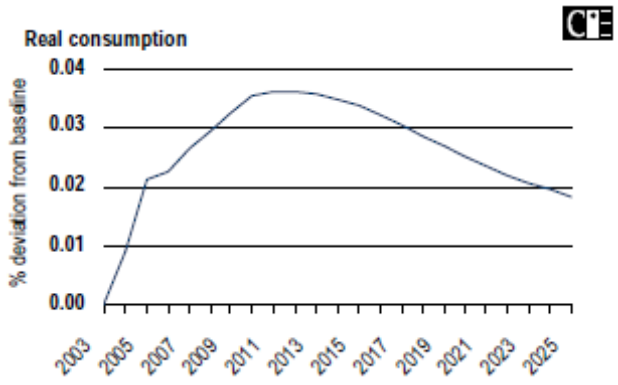
An earlier report, CIE (2002), used the Productivity Commission restrictiveness index (discussed above) to estimate the impact of reducing barriers in Thailand's business services market on the cost of those services. It was assumed that TAFTA would reduce the cost of business services in Thailand by around 2 per cent. That estimate was retained for CIE's 2004 analysis.

Using production weights derived from GTAP, the impacts on the telecommunications and business services markets were aggregated and modelled as a 0.2 per cent productivity improvement in the APG-Cubed services sector.

Results

CIE (2004b) reported that TAFTA, as negotiated, would increase Australia's real consumption by slightly more than 0.035 per cent relative to the baseline in 2012 (figure D.3). At the sectoral level, output was estimated to increase across all sectors, including an estimated increase in the capital stock and productivity of the services sector (which increased the productive capacity across the economy). The largest estimated increases in output were in the durable and non-durable manufacturing sectors, which were expected to experience an increase in output of around 0.11 per cent in 2025 as a result of the agreement. Real consumption was also estimated to increase in Thailand, peaking at around 0.85 per cent above the baseline in 2020.[6]

Figure D.3 **Deviation in Australian real consumption as a result of TAFTA**
APG-Cubed simulations



Source: CIE (2004b), p. 21.

6 It is noted that, under this treatment, the results taper off after reaching their maximum level.

E Detailed results tables

The supplement paper draws on the results of several sets of simulations including sensitivity tests. Table E.1 lists all the simulations that were run and indicates whether any further results are contained in this appendix.

Table E.1 **List of simulations used in this study**

Scenario	*Description*	*Detailed results*
Trade liberalisation		
T1	Australia and a small country remove bilateral *tariffs* preferentially	✓
S1	Additional RoO costs: exporting industries in partners incur additional costs in the form of rents that accrue to factors used	
S2	Tariff reductions are not passed through to duty paid prices: exporters raise prices by the amount of the margin of preference and receive a rent that increases their income	
T2	Australia and a large country remove bilateral tariffs preferentially	✓
S3	Additional RoO costs: exporting industries in partner countries incur additional costs in the form of rents that accrue to factors used	
S4	Tariff reductions are not passed through to duty paid price: exporters raise prices by the amount of the tariff reduction and receive a rent that increases their income	
S5	Importers do not avail themselves of available preferential rates (partial utilisation)	
T3	Australia removes tariffs on imports from all sources, non-preferentially	✓
T4	APEC member countries remove tariffs on imports from all countries, non-preferentially	✓
T5	All countries remove tariffs on imports	✓
Regional tariff reductions with and without Australia		
R1	Australia removes tariffs bilaterally with China, Korea, Japan and the United States	
R2	R1 plus China, Korea, Japan and the United States remove tariffs bilaterally with each other	
R3	China, Korea, Japan and the United States remove tariffs bilaterally	
S6	R3 with increased flexibility in the export sector modelled as a higher elasticity for land supply in Australia	
S7	R3 with increased flexibility in the export sector modelled as an endogenous increase in the supply of land in Australia	
R4	R3 plus Australia removes tariffs on imports from all countries	

(continued next page)

Table E.1 **(continued)**

Scenario	*Description*	*Detailed results*
Trade facilitation I		
F1	1 per cent reduction in the cost of imports between Australia and a large country	✓
F2	1 per cent reduction in the cost of all imports into Australia and a large country	✓
F3	1 per cent reduction in the cost of world imports	✓
F4	T5 plus F3	✓
Trade facilitation II		
S8	5 per cent reduction in transport costs on trade between Australia and a large country	
S9	5 per cent reduction in transport costs on all imports into Australia and a large country	
S10	5 per cent reduction in transport costs on world trade	
Foreign investment liberalisation		
V1	a 5 basis point reduction in the risk premium on bilateral FDI originating from the partner country in Australia and a large country — preferential	✓
V2	a 5 basis point reduction in risk premium on all FDI in Australia and a large country — non preferential	✓
V3	V1 plus a 5 per cent induced productivity improvement on the corresponding FDI	✓
V4	V2 plus a 5 per cent induced productivity improvement on the corresponding FDI	✓

E.1 Trade liberalisation simulations

Scenario T1: Australia – small country bilateral reduction in import tariffs

Table E.2 Scenario T1: industries with largest project decreases in output

Industry	*Change in output*
	%
Australia	
Leather products	-0.600
Wearing apparel	-0.250
Wool, silk-worm cocoons	-0.221
Textiles	-0.164
Small country	
Bovine meat products	-2.205
Bovine cattle, sheep and goats, horses	-1.102
Plant based fibres	-0.270
Transport equipment nec	-0.113

Source: Simulation results.

Table E.3 Scenario T1: industries with largest projected increases in output

Industry	*Change in output*
	%
Australia	
Wheat	0.712
Crops nec	0.601
Ferrous metals	0.555
Plant based fibres	0.532
Chemical, rubber, plastic products	0.436
Small country	
Wheat	5.619
Motor vehicles and parts	1.774
Machinery and equipment nec	1.454
Leather products	1.264
Metal products	1.113

Source: Simulation results.

Table E.4 **Scenario T1: projected change in bilateral trade volumes[a]**

Imp → Exp ↓	***Australia***	*China*	*Japan*	*USA*	*European Union*	*Rest of APEC*	*Rest of World*	***Thailand***
	%	%	%	%	%	%	%	%
Australia	**-**	**-0.49**	**-0.40**	**-0.49**	**-0.44**	**-0.48**	**-0.63**	**38.20**
China	**-0.66**	-	0.01	0.01	0.01	0.01	0.01	**-0.12**
Japan	**-0.77**	0.01	-	0.01	0.01	0.01	0.01	**0.13**
USA	**-0.23**	0.01	0.01	-	0.00	0.00	0.02	**-0.73**
European Union	**-0.33**	-0.01	0.00	0.00	-	0.00	0.00	**0.06**
Rest of APEC	**-0.16**	0.00	0.01	0.00	0.00	-	0.01	**-0.22**
Rest of World	**-0.16**	0.00	0.00	-0.01	-0.01	0.00	-	**0.04**
Thailand	**31.14**	**-0.04**	**0.06**	**0.03**	**-0.06**	**-0.01**	**-0.03**	**-**

a Changes in the exports of transport margin commodities are not calculated bilaterally, and therefore excluded.

Source: Simulation results.

Table E.5 **Scenario T1: projected change in import and export prices**

Region	*Export prices*	*Import prices*	*Terms of trade*
	%	%	%
Australia	**0.105**	**-0.002**	**0.107**
China	-0.003	0.001	-0.004
Japan	-0.003	0.003	-0.006
USA	-0.001	0.000	-0.001
European Union	0.000	0.000	-0.001
Rest of APEC	0.000	0.002	-0.002
Rest of World	0.003	0.001	0.001
Thailand	**0.002**	**0.003**	**-0.001**

Source: Simulation results.

Table E.6 **Scenario T1: projected change in real GDP and real GNP**

	real GDP	*real GNP*
	%	%
Australia	**0.054**	**0.045**
China	-0.002	-0.002
Japan	-0.001	0.000
USA	0.000	0.001
European Union	0.000	0.000
Rest of APEC	-0.001	-0.001
Rest of World	0.000	0.000
Thailand	**0.418**	**0.367**

Source: Simulation results.

Scenario T2: Australia – large country bilateral reduction in import tariffs

Table E.7 Scenario T2: industries with largest projected decreases in output

Industry	*Change in output*
	%
Australia	
Machinery and equipment nec	-1.446
Metals nec	-1.022
Meat products nec	-0.935
Ferrous metals	-0.684
Wheat	-0.507
Large country	
Bovine meat products	-0.891
Sugar	-0.865
Sugar beet	-0.854
Bovine cattle, sheep and goats, horses	-0.783
Cereal grains nec	-0.161

Source: Simulation results.

Table E.8 Scenario T2: industries with largest projected increases in output

Industry	*Change in output*
	%
Australia	
Sugar	16.023
Bovine meat products	12.014
Bovine cattle, sheep and goats, horses	4.824
Sugar cane	2.715
Textiles	2.667
Large country	
Leather products	0.400
Wool, silk-worm cocoons	0.311
Motor vehicles and parts	0.106
Machinery and equipment nec	0.087
Wearing apparel	0.087

Source: Simulation results.

Table E.9 **Scenario T2: projected change in bilateral trade volumes[a]**

Imp → Exp ↓	***Australia***	*China*	*Japan*	***USA***	*European Union*	*Rest of APEC*	*Rest of World*
	%	%	%	%	%	%	%
Australia	**-**	**-1.02**	**-1.10**	**18.06**	**-1.03**	**-1.16**	**-1.18**
China	**-1.49**	-	0.02	**0.03**	0.02	0.03	0.02
Japan	**-2.35**	0.02	-	**0.06**	0.02	0.03	0.03
USA	**14.50**	**-0.10**	**-0.06**	**-**	**-0.11**	**-0.07**	**-0.08**
European Union	**-1.73**	0.00	0.02	**0.01**	-	0.02	0.01
Rest of APEC	**-0.89**	0.00	0.04	**-0.03**	0.01	-	0.02
Rest of World	**-0.72**	0.01	0.02	**-0.06**	0.00	0.02	-

a Changes in the exports of transport margin commodities are not calculated bilaterally, and therefore excluded.

Source: Simulation results.

Table E.10 **Scenario T2: projected change in import and export prices**

	Export prices	*Import prices*	*Terms of trade*
	%	%	%
Australia	**0.260**	**-0.007**	**0.267**
China	-0.009	-0.002	-0.007
Japan	-0.010	0.006	-0.016
USA	**0.010**	**-0.005**	**0.016**
European Union	-0.007	-0.005	-0.002
Rest of APEC	-0.008	0.002	-0.010
Rest of World	-0.005	-0.002	-0.003

Source: Simulation results.

Table E.11 **Scenario T2: projected change in real GDP and real GNP**

	real GDP	*real GNP*
	%	%
Australia	**0.117**	**0.097**
China	-0.005	-0.005
Japan	-0.002	-0.002
USA	**0.003**	**0.003**
European Union	-0.001	-0.001
Rest of APEC	-0.006	-0.004
Rest of World	-0.002	-0.001

Source: Simulation results.

Scenario T3: Australian unilateral reduction in import tariffs

Table E.12 Scenario T3: industries with largest projected changes in output

Industry	*Change in output*
	%
Increase	
Metals nec	6.320
Electronic equipment	4.366
Transport equipment nec	3.821
Bovine meat products	2.254
Sugar	2.039
Decrease	
Wearing apparel	-14.715
Textiles	-9.814
Motor vehicles and parts	-2.508
Leather products	-2.462
Metal products	-0.940

Source: Simulation results

Table E.13 Scenario T3: projected change in bilateral trade volumes[a]

Imp → Exp ↓	***Australia***	*China*	*Japan*	*USA*	*European Union*	*Rest of APEC*	*Rest of World*
	%	%	%	%	%	%	%
Australia	**-**	**4.60**	**3.15**	**6.84**	**5.65**	**5.47**	**6.57**
China	**17.08**	-	-0.22	-0.26	-0.26	-0.32	-0.33
Japan	**9.08**	-0.05	-	-0.16	-0.14	-0.18	-0.25
USA	**0.64**	0.12	0.02	-	0.01	-0.02	-0.04
European Union	**2.88**	0.09	0.00	-0.03	-	-0.08	-0.06
Rest of APEC	**-0.01**	0.08	0.02	0.02	0.03	-	-0.02
Rest of World	**-0.20**	0.04	-0.02	0.02	0.03	-0.04	-

[a] Changes in the exports of transport margin commodities are not calculated bilaterally, and therefore excluded.

Source: Simulation results

Table E.14 **Scenario T3: projected change in import and export prices**

	Export prices	*Import prices*	*Terms of trade*
	%	%	%
Australia	**-1.006**	**0.018**	-1.024
China	0.074	0.021	0.053
Japan	0.056	0.009	0.047
USA	0.029	0.026	0.003
European Union	0.033	0.028	0.005
Rest of APEC	0.025	0.014	0.011
Rest of World	0.023	0.018	0.004

Source: Simulation results.

Table E.15 **Scenario T3: projected change in real GDP and real GNP**

	real GDP	*real GNP*
	%	%
Australia	**0.559**	**0.482**
China	0.025	0.024
Japan	0.006	0.008
USA	0.000	0.003
European Union	0.002	0.003
Rest of APEC	0.006	0.007
Rest of World	0.001	0.002

Source: Simulation results.

Scenario T4: Unilateral reduction in import tariffs by APEC members

Table E.16 Scenario T4: industries with largest projected change in output

Industry	*Change in output*
	%
Increase	
Bovine meat products	31.709
Processed rice	30.027
Paddy rice	25.075
Wool, silk-worm cocoons	17.461
Bovine cattle, sheep and goats, horses	13.704
Decrease	
Wearing apparel	-17.905
Leather products	-12.703
Textiles	-11.512
Motor vehicles and parts	-4.900
Machinery and equipment nec	-4.084

Source: Simulation results.

Table E.17 Scenario T4: projected change in bilateral trade volumes[a]

Imp → Exp ↓	***Australia***	*China*	*Japan*	*USA*	*European Union*	*Rest of APEC*	*Rest of World*
	%	%	%	%	%	%	%
Australia	**-**	**22.60**	**14.74**	**5.45**	**-1.21**	**3.82**	**-0.99**
China	**26.06**	-	12.81	13.29	8.21	26.71	7.23
Japan	**7.11**	18.59	-	0.10	-1.04	12.52	-1.44
USA	**6.71**	17.61	10.43	-	5.96	-1.09	5.09
European Union	**1.63**	14.37	3.57	-1.40	-	9.92	-1.54
Rest of APEC	**5.57**	18.60	9.87	3.21	5.21	-	6.08
Rest of World	**-1.05**	4.43	0.07	-0.55	-0.75	4.23	-

a Changes in the exports of transport margin commodities are not calculated bilaterally, and therefore excluded.

Source: Simulation results.

Table E.18 **Scenario T4: projected change in import and export prices**

	Export prices	*Import prices*	*Terms of trade*
	%	%	%
Australia	**1.377**	**0.229**	**1.145**
China	-0.538	0.363	-0.898
Japan	0.645	0.338	0.306
USA	-0.346	0.173	-0.518
European Union	0.819	0.635	0.183
Rest of APEC	-0.269	0.242	-0.511
Rest of World	1.180	0.551	0.629

Source: Simulation results.

Table E.19 **Scenario T4: projected change in real GDP and real GNP**

Region	*real GDP*	*real GNP*
	%	%
Australia	**0.862**	**0.782**
China	2.685	2.610
Japan	0.533	0.574
USA	0.075	0.136
European Union	0.089	0.117
Rest of APEC	2.679	2.499
Rest of World	0.205	0.208

Source: Simulation results.

Scenario T5: Global MFN tariff reductions

Table E.20 Scenario T5: Australian industries with largest projected changes in output

Industry	*Change in output*
	%
Increase	
Processed rice	33.391
Bovine meat products	30.632
Paddy rice	25.144
Wool, silk-worm cocoons	21.347
Dairy products	21.264
Decrease	
Wearing apparel	-16.603
Leather products	-16.570
Textiles	-10.472
Motor vehicles and parts	-6.730
Machinery and equipment nec	-5.319

Source: Simulation results

Table E.21 Scenario T5: projected change in bilateral trade volumes[a]

Imp → Exp ↓	***Australia***	*China*	*Japan*	*USA*	*European Union*	*Rest of APEC*	*Rest of World*
	%	%	%	%	%	%	%
Australia	**-**	**23.13**	**13.72**	**3.06**	**1.82**	**3.32**	**1.08**
China	**18.38**	-	8.18	5.07	15.39	20.05	35.24
Japan	**2.33**	16.73	-	-4.38	8.06	9.30	10.34
USA	**5.23**	20.07	11.18	-	7.54	-1.49	7.82
European Union	**8.83**	27.00	12.72	4.67	-	18.00	9.93
Rest of APEC	**2.04**	17.93	8.30	1.19	6.52	-	17.16
Rest of World	**11.01**	14.38	6.08	9.54	14.20	13.18	-

[a] Changes in the exports of transport margin commodities are not calculated bilaterally, and therefore excluded.

Source: Simulation results.

Table E.22 **Scenario T5: projected changes in import and export prices**

Region	*Export prices*	*Import prices*	*Terms of trade*
	%	%	%
Australia	**2.527**	**0.566**	**1.949**
China	1.075	0.945	0.129
Japan	1.824	0.929	0.887
USA	0.369	0.406	-0.037
European Union	0.096	0.335	-0.237
Rest of APEC	0.723	0.720	0.002
Rest of World	0.344	0.408	-0.064

Source: Simulation results.

Table E.23 **Scenario T5: projected changes in real GDP and real GNP**

	real GDP	*real GNP*
	%	%
Australia	**0.940**	**0.881**
China	2.936	2.857
Japan	0.588	0.662
USA	0.110	0.255
European Union	0.484	0.572
Rest of APEC	2.909	2.715
Rest of World	3.846	3.599

Source: Simulation results.

E.2 Trade facilitation simulations

Scenario F1: Reduction in costs of imports between Australia and a large country

Table E.24 **Scenario F1: projected change in bilateral trade volumes[a]**

Imp → Exp ↓	*Australia*	*China*	*Japan*	*USA*	*European Union*	*Rest of APEC*	*Rest of World*
	%	%	%	%	%	%	%
Australia	**-**	**-0.172**	**-0.278**	**3.253**	**-0.178**	**-0.202**	**-0.188**
China	**-0.530**	-	0.007	**0.014**	0.005	0.010	0.009
Japan	**-0.524**	0.003	-	**0.014**	0.005	0.007	0.008
USA	**3.912**	**-0.046**	**-0.033**	**-**	**-0.046**	**-0.031**	**-0.038**
European Union	**-0.650**	0.001	0.006	**0.007**	0.002	0.007	0.005
Rest of APEC	**-0.463**	0.000	0.012	**-0.001**	0.002	0.005	0.006
Rest of World	**-0.240**	0.002	0.018	**-0.009**	-0.001	0.004	0.003

a Changes in the exports of transport margin commodities are not calculated bilaterally, and therefore excluded.

Source: Simulation results.

Scenario F2: Reduction in costs of all imports into Australia and a large country

Table E.25 **Scenario F2: projected change in bilateral trade volumes[a]**

Imp → Exp ↓	*Australia*	*China*	*Japan*	*USA*	*European Union*	*Rest of APEC*	*Rest of World*
	%	%	%	%	%	%	%
Australia	**-**	**0.684**	**0.307**	1.364	**0.563**	**0.781**	**0.754**
China	**0.353**	-	-0.219	0.850	-0.241	-0.294	-0.264
Japan	**0.135**	-0.084	-	0.816	-0.185	-0.232	-0.207
USA	**1.676**	**1.532**	**1.156**	-	**1.293**	**1.187**	**1.205**
European Union	**0.343**	0.041	-0.067	0.704	-0.047	-0.119	-0.073
Rest of APEC	**0.323**	-0.020	-0.137	0.634	-0.116	-0.169	-0.159
Rest of World	**0.675**	0.027	-0.050	0.414	-0.026	-0.075	-0.063

a Changes in the exports of transport margin commodities are not calculated bilaterally, and therefore excluded.

Source: Simulation results.

Scenario F3: 1 per cent reduction in costs of world imports

Table E.26 **Scenario F3: projected change in bilateral trade volumes[a]**

Imp → *Exp ↓*	*Australia*	*China*	*Japan*	*USA*	*European Union*	*Rest of APEC*	*Rest of World*
	%	%	%	%	%	%	%
Australia	-	1.242	0.047	0.942	0.724	1.186	0.741
China	0.870	-	1.548	1.583	1.678	1.810	1.032
Japan	0.124	1.643	-	0.739	0.853	1.394	0.537
USA	0.741	1.822	1.286	-	1.344	1.412	1.184
European Union	0.869	1.947	1.363	1.211	1.450	1.510	1.097
Rest of APEC	1.043	2.243	1.579	1.339	1.011	2.324	1.181
Rest of World	1.364	1.155	0.063	0.993	1.294	1.313	1.552

a These changes do not include changes in the exports of transport margin commodities. This is because transport margin exports are not calculated bilaterally.

Source: Simulation results.

Table E.27 **Scenario F1, F2 and F3: projected changes in terms of trade**

Region	*Australia—large country - bilateral (Scenario F1)*	*Australia—large country - all partners (Scenario F2)*	*World trade facilitation (Scenario F3)*
	%	%	%
Australia	**0.042**	**-0.086**	0.121
China	-0.002	0.050	0.050
Japan	-0.004	0.054	0.033
USA	**0.008**	**-0.242**	0.013
European Union	-0.001	0.015	0.002
Rest of APEC	-0.003	0.079	-0.012
Rest of World	-0.001	0.008	-0.037

Source: Simulation results.

Table E.28 **Scenario F1, F2 and F3: projected changes in real GDP**

Region	*Australia—large country - bilateral (Scenario F1)*	*Australia—large country - all partners (Scenario F2)*	*World trade facilitation (Scenario F3)*
	%	%	%
Australia	0.067	0.368	0.417
China	-0.001	0.030	0.863
Japan	0.000	0.007	0.233
USA	0.002	0.202	0.234
European Union	0.000	0.010	0.789
Rest of APEC	-0.002	0.073	1.114
Rest of World	0.000	0.015	0.881

Source: Simulation results.

E.3 Investment barrier reduction simulations

Scenario V1 and V2: Reduction in risk premia for capital from partner, Australia and a illustrative large country — preferential (V1) and non-preferential (V2)

Table E.29 **Scenario V1 and V2: projected changes in real GDP and real GNP**

	Preferential (Scenario V1)		*Non-preferential (Scenario V2)*	
Region	*real GDP*	*real GNP*	*real GDP*	*real GNP*
	%	%	%	%
Australia	0.009	0.035	0.062	0.039
China	0.000	0.001	-0.001	-0.004
Japan	0.000	0.000	0.000	-0.008
USA	0.000	-0.002	0.051	0.018
European Union	0.000	0.000	0.002	-0.009
Rest of APEC	0.000	0.000	0.003	0.003
Rest of World	0.000	0.000	0.002	0.004

Source: Simulation results.

Scenario V3 and V4: Scenario V1 and V2 combined with a 5 per cent productivity improvement for FDI capital from both countries

Table E.30 **Scenario V3 and V4: projected changes in real GDP and real GNP**

	Preferential (Scenario V3)		*Non-preferential (Scenario V4)*	
Region	*real GDP*	*real GNP*	*real GDP*	*real GNP*
	%	%	%	%
Australia	0.022	0.030	0.080	0.032
China	0.000	0.001	-0.001	-0.004
Japan	0.000	0.000	0.000	-0.008
USA	0.001	-0.002	0.055	0.017
European Union	0.000	0.000	0.002	-0.009
Rest of APEC	0.000	0.000	0.003	0.004
Rest of World	0.000	0.000	0.002	0.005

Source: Simulation results.

F Tariff barriers to merchandise trade

Table F.1 contains trade weighted average ad valorem equivalent bilateral tariff rates from each source region to destination region.

Table F.1 Bilateral tariffs rates[a] (per cent) from source region (rows) to destination region (columns)

	AUS	*NZL*	*CHN*	*HKG*	*JPN*	*KOR*	*TWN*	*IDN*	*MYS*	*PHL*	*SGP*	*THA*	*BGD*	*IND*	*ROA*	*CAN*	*USA*	*MEX*	*BRA*	*ROM*	*EUN*	*RUS*	*ROE*	*ZAF*	*ROF*
AUS	0.0	0.2	6.0	0.0	9.8	7.8	3.7	3.2	3.8	4.3	0.0	5.6	10.1	17.1	5.4	1.7	2.8	9.9	2.4	4.1	1.9	4.9	3.7	2.7	6.6
NZL	0.0	0.0	8.9	0.0	7.4	12.5	13.5	3.8	2.4	4.5	0.0	11.7	19.9	11.4	10.6	19.5	5.7	35.2	4.2	11.2	7.5	9.5	13.2	9.2	10.5
CHN	7.0	5.9	0.0	0.0	4.0	8.1	3.2	5.4	7.5	5.3	0.0	11.3	21.7	12.7	12.0	4.4	3.1	9.9	10.8	10.2	3.4	14.0	6.2	14.1	19.7
HKG	0.5	0.3	5.6	0.0	0.3	0.9	2.4	0.7	1.5	1.9	0.0	2.1	9.9	3.3	3.7	2.1	2.4	5.8	0.4	1.1	1.1	1.4	0.3	0.8	1.4
JPN	6.1	6.3	7.2	0.0	0.0	4.7	4.0	6.3	10.2	3.1	0.0	12.8	15.6	13.6	8.7	3.1	1.6	11.6	10.6	13.6	3.2	10.2	2.4	10.7	10.7
KOR	4.1	3.4	6.5	0.0	1.8	0.0	2.3	5.6	9.8	2.8	0.0	11.8	20.5	10.2	11.2	4.6	1.8	10.2	10.3	12.5	3.1	10.4	4.6	9.1	7.0
TWN	2.7	4.0	6.3	0.0	0.9	2.2	0.0	5.1	4.1	2.7	0.0	11.6	20.4	9.3	11.8	3.2	2.0	10.2	9.2	8.5	1.9	6.5	2.0	5.9	12.7
IDN	2.2	2.2	5.6	0.0	1.1	4.4	2.3	0.0	5.7	2.7	0.0	5.0	22.8	59.1	10.2	3.1	4.0	15.4	11.1	9.7	3.3	5.7	4.3	8.5	17.5
MYS	1.8	1.6	4.0	0.0	0.6	2.8	1.8	1.9	0.0	1.5	0.0	3.8	21.6	21.4	9.6	1.5	0.9	6.8	8.0	8.0	1.3	7.2	4.4	5.5	14.8
PHL	2.4	1.4	2.3	0.0	1.2	3.5	2.3	1.3	0.9	0.0	0.0	6.6	15.3	8.4	8.9	2.4	3.1	3.8	3.6	8.8	1.1	4.2	1.4	4.6	6.6
SGP	1.0	0.0	4.2	0.0	0.9	1.7	1.9	1.8	1.6	1.2	0.0	3.9	18.1	8.5	7.5	0.6	0.4	3.8	4.3	3.5	0.5	2.9	0.7	3.0	8.5
THA	3.9	3.0	6.6	0.0	6.1	14.2	12.1	6.3	2.2	3.6	0.0	0.0	22.2	12.5	9.8	2.8	2.4	7.3	9.7	9.3	4.2	7.5	3.8	5.9	19.2
BGD	2.9	0.1	5.8	0.0	0.2	4.4	2.8	4.6	11.7	3.6	0.0	20.4	0.0	11.6	8.7	0.0	8.9	26.9	6.9	6.4	0.1	8.1	3.0	13.3	13.4
IND	3.9	2.2	3.2	0.0	1.6	9.4	4.1	2.6	4.7	6.0	0.0	7.6	17.1	0.0	6.2	4.7	2.7	14.3	5.5	8.2	2.8	7.7	4.0	8.2	16.4
ROA	1.0	0.9	2.6	0.0	0.6	5.5	6.5	0.9	4.9	5.4	0.0	2.4	23.9	11.5	7.1	2.1	2.3	8.2	1.9	9.6	1.4	2.2	3.0	1.3	10.4
CAN	1.5	1.0	3.8	0.0	10.4	4.6	2.5	1.3	1.9	4.2	0.0	9.9	8.3	11.4	3.5	0.0	0.2	0.3	4.2	7.4	1.3	5.4	2.8	2.1	8.6
USA	2.1	2.2	5.1	0.0	5.0	4.7	2.6	2.4	2.9	3.2	0.0	7.3	6.4	9.2	4.2	0.5	0.0	0.1	8.1	7.8	1.4	4.8	2.2	3.8	6.5
MEX	3.4	3.8	4.0	0.0	7.8	4.3	2.5	1.4	2.5	2.0	0.2	5.9	4.4	9.2	4.1	0.0	0.1	0.0	5.5	6.5	0.3	10.8	5.3	3.3	2.2
BRA	3.0	1.4	2.4	0.0	4.2	7.0	2.3	2.5	16.5	5.9	0.0	12.3	19.8	63.0	7.6	2.6	2.3	5.8	0.0	3.7	8.4	20.0	18.6	11.2	15.5
ROM	1.4	3.0	2.6	0.0	2.4	3.7	2.2	1.0	1.9	2.7	0.0	13.3	15.9	17.4	5.5	1.1	2.0	4.8	1.1	5.0	6.4	8.6	4.1	5.4	11.1
EUN	3.0	3.4	6.5	0.0	3.0	5.7	5.0	2.6	5.5	2.7	0.1	7.8	9.8	9.9	6.0	2.8	1.4	4.7	7.7	5.8	0.0	9.2	2.8	4.9	12.2
RUS	0.9	1.9	4.4	0.0	1.1	2.9	2.2	1.0	6.4	2.6	0.0	4.9	10.4	13.9	3.7	0.3	0.9	7.4	3.5	9.5	0.6	0.0	1.6	1.0	11.7
ROE	1.7	1.6	4.8	0.0	1.2	3.9	3.1	1.7	7.0	2.0	0.0	5.4	4.0	12.9	7.2	1.9	1.7	7.9	5.6	5.6	0.6	2.3	4.8	4.4	13.0
ZAF	5.2	4.9	3.1	0.0	1.8	3.6	2.1	2.2	5.8	2.9	0.0	6.7	10.1	15.0	4.8	1.0	0.2	6.9	6.7	5.8	1.0	4.4	3.7	0.0	6.7
ROF	0.9	2.6	0.9	0.0	0.6	8.7	4.0	0.4	4.0	1.0	0.1	6.0	7.1	10.5	4.7	0.5	0.4	5.9	0.6	4.5	1.5	3.4	2.0	0.5	7.7

a These are trade weighted average ad valorem equivalent tariff rates.

Source: GTAP database.

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