INDUSTRY COMMISSION

SALTER
A General Equilibrium Model of the World Economy

Volume 2
Gains from Global Trade Liberalisation: An Illustrative Application of SALTER

A study undertaken by the Industry Commission
on behalf of the Department of Foreign Affairs and Trade

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PREFACE

In December 1988 the Department of Foreign Affairs and Trade approached the then Industries Assistance Commission to conduct an analysis of the economic effects of alternative trade liberalisation scenarios. The analysis was to be based on a version of the Organisation for Economic Co-operation and Development's WALRAS world trade model.

While the WALRAS model could provide valuable insights into the effects of trade liberalisation, to be of maximum policy relevance the country coverage and commodity detail contained in the original WALRAS model needed to be extended. In particular, given the Prime Minister's initiative to enhance the interchange of views between Australia and its near trading partners through the Asia-Pacific Economic Cooperation (APEC) Group, it was considered essential that any analysis of trade liberalisation also include the ASEAN region and the Republic of Korea. It was also considered necessary that the model identify commodities such as wheat and wool that are of special concern to Australia, and commodities such as rice and textiles that are important to Australia's regional partners.

The Department of Foreign Affairs and Trade commissioned the Industries Assistance Commission to develop a model which covered eight countries or groups of countries and up to 34 industries and commodities. The model was named SALTER (Sectoral Analysis of Liberalising Trade in the East Asian Region) after the distinguished Australian Economist Wilfred Salter.

This volume is second in a series. The first volume titled *SALTER: A General Equilibrium Model of the World Economy*, vol. 1, *Model Structure, Database and Parameters* provides a detailed introduction to the structure of the SALTER model, its parameters and provides summary measures of the model's database. This volume details the results of the first major application of the SALTER model. It deals with the important issue of gains from global liberalisation in international trade. Results highlight the difficulties encountered by negotiators when trade negotiations are conducted on a commodity by commodity basis. Factional interests expecting to loose when trade in a commodity is liberalised are able to prevent progress in such negotiations. This is despite the fact that all economies gain substantially when trade is liberalised. For these gains to be realised it is essential that trade negotiations focus on the economy wide gains that liberalisation will bring and every effort should be made to avoid negotiating trade liberalisation on a commodity by commodity basis. This negotiating model has failed to yield substantial benefits in the past and is unlikely to be more successful in the future.

The model's database and parameters are continuously upgraded as new information is made available. While this may affect some results or figures for individual regions modelled the general conclusions reached in this study are considered to be robust for any sensible selection of parameters.

The project's team owes Dr Thomas Hertel a great debt. Tom contributed significantly to forming the ideas contained in this volume. He also provided leadership and a remarkable eagerness to work with the team.

This volume was typed and laid out by Ms Roberta Wise, Ms Christine Hryhoriak and Ms Andrea Versteegen. The project's team thanks them for the precision in their work and their patience.

John Zeitsch

Project Leader

WILFRED EDWARD GRAHAM SALTER

Wilfred Salter was born in Western Australia in 1929. He graduated with first-class honours from the University of Western Australia in 1952, and gained his PhD from Clare College, Cambridge, in 1955 for his thesis *A Consideration of Technological Change with Special Reference to Labour Productivity*. His research continued at John Hopkins and the Australian National University, culminating in the publication in 1960 of his most important work, *Productivity and Technical Change* — 'one of the finest — and earliest — examples of the embodiment hypothesis' (Harcourt 1972). Also while at the Australian National University, he developed with T.W. Swan the dependent economy (small country) model of stabilisation policy, indicating the role played by changes in the real exchange rate (Salter 1959). In 1960 he left the University to become Assistant Secretary in the Economic Section of the Prime Minister's Department. Taking leave from the public service in 1962, he joined the Harvard Advisory Group as Economic Adviser to the Government of West Pakistan. He died in Lahore in 1963.

> The activities of the last four years of his life show Salter's view of what an economist should be. Not content with even the most thorough academic training, with spinning theories, or with analysing cold statistics, he believed that an economist should learn his trade by responsible experience in varied fields. His decisions to join the Commonwealth Service and to work in Pakistan were part of a deliberate plan to fit himself for an economist's job, whether his future might lie in academic or in government service. (Swan 1963)

> Salter's work [on productivity and technical change] is a model which all aspiring (and established) economists could profitably have before them. Its characteristics are a flair for formulating relevant theory which, clearly, neatly and excitingly expressed, is carried no further than the requirements of the problem in hand — and is immediately tested against the facts. (Harcourt 1972)

The world trade model developed for the Department of Foreign Affairs and Trade has been given the acronym SALTER (Sectoral Analysis of Liberalising Trade in the East Asian Region) in his honour.

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1 INTRODUCTION AND MOTIVATION

The Uruguay Round of multilateral trade negotiations is currently in its eleventh hour. It was initiated in September, 1986, at Punta del Este, with the hope of further strengthening the liberal economic order which the General Agreement on Tariffs and Trade (GATT) has helped foster over the last four decades. One important objective of this round of negotiations has been to bring agriculture and textiles 'into the GATT'. Trade in these products has become increasingly distorted, as many industrialised economies have attempted to protect domestic producers in the face of eroding comparative advantage. In addition, the Uruguay Round was designed to extend GATT principles into new areas including trade in services, intellectual property rights, and national rules for foreign investment. As such, this has been perhaps the most ambitious of the eight GATT rounds (Oxley 1990).

Unfortunately, at this critical juncture the trade talks have stumbled. A major area of contention has been liberalisation of conditions under which agricultural products are produced and traded. Accordingly, this report pays particular attention to the problem of obtaining an agreement in agriculture. It will be argued that such an agreement is only likely to be forthcoming if significant pressure is applied by non-agricultural interest groups. While agricultural policy in many countries has traditionally been left to farm groups and national treasuries, the December 1990 breakdown of the GATT negotiations indicates that other areas can no longer afford to ignore agriculture. Farm and non-farm trade policies have become fundamentally intertwined. This report represents one attempt to quantify the extent of this mutual interest in reform.

The evaluation of reforms is based in large part on the use of the SALTER model, a multi-country general equilibrium model of world trade. The model accounts for trade among nine regions.[1] Appendix A provides a brief outline of the model's structure and more comprehensive documentation is found in Jomini, Zeitsch, McDougall, Welsh, Brown, Hambley and Kelly (1991).

[1] The regions are Australia, New Zealand, Canada, the United States, Japan, the Republic of Korea, the European Community, the member countries of ASEAN and a rest of the world aggregate. The European Community includes the United Kingdom, France, the Federal Republic of Germany, Italy, Belgium, Netherlands, Luxemburg, Denmark, Ireland, Greece, Spain and Portugal; ASEAN is composed of Indonesia, Thailand, Singapore, Malaysia, the Philippines and Brunei; the Republic of Korea is abbreviated to 'Korea' in the remainder of this report.

A high profile for agriculture

Given the current interest of United States trade negotiators in the liberalisation of agricultural trade, it is somewhat ironic that the United States had a great deal to do with the original exemption of agriculture from GATT disciplines (Stoeckel, Pearce and Banks 1990). The rationale for such exemptions evolved in an era when exports were a relatively less important outlet for United States farm produce. Farm groups strongly resisted the notion that agricultural policies could be 'written in Geneva'. Quantitative restrictions on farm imports were justified as a necessary tool to implement domestic policies.

By the 1980s this tradition of ignoring the international implications of farm policies had become unsustainable. With the European Community moving into a surplus position in a great number of products, large export subsidies were required in order to dispose of the excess production on world markets. In 1988 for example, of farm income received for 10 commodities, assistance accounted for 36 per cent of receipts in the United States, 48 per cent in the European Community and 80 per cent in Japan (OECD 1990b). The large budgetary outlays implied by these support levels did a great deal to encourage the high profile for agriculture in the Uruguay Round.

There are further reasons to be especially concerned about bringing agriculture into the GATT. As will be demonstrated later in this report, the global welfare gains from liberalisation of trade in farm and food products appear to exceed those from liberalisation of *all trade* in non-food manufactures. Thus the current distortions in agriculture are not only large relative to sectoral output, they are also large in an absolute sense.

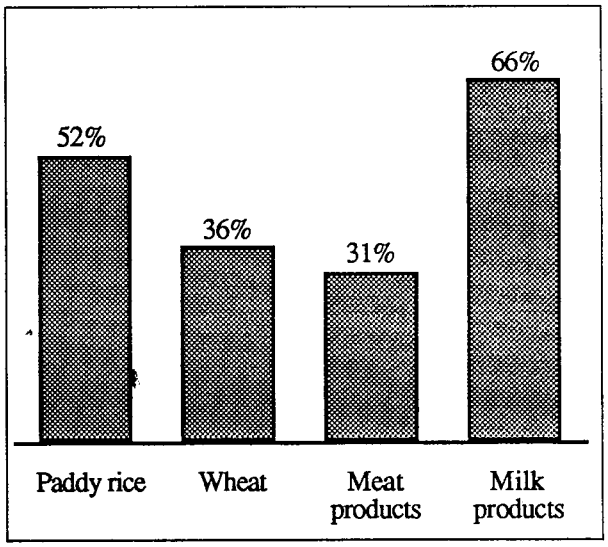
Even more important than the welfare costs of current agricultural distortions is their potential for generating crises in international economic relations. Farmers have a special place in the perceived social fabric of many industrialised economies and food policy issues have traditionally played a large role in national security and human health debates. These factors combine to make agricultural policy a particularly volatile topic in many countries. Consequently, the intensity of disagreements over trade in beef, rice, or wheat, for example, tends to be vastly out of proportion with the overall role of these sectors in particular economies. The fact that the entire round of GATT negotiations could break down due to the European Community's unwillingness to compromise on farm export subsidies is only one in a long line of agricultural trade crises illustrating this principle.

The importance of linking agricultural and non-agricultural reforms

In retrospect, the collapse of the GATT talks on agriculture is hardly surprising. Domestic farm policies in the industrialised countries have proven extremely resilient. For example, the United States has had the same basic set of institutions and policies in place since 1933. Periodic attempts at reform have generally amounted to minor variations on the same basic theme. Agricultural interest groups have been effective lobbyists and they have generally enjoyed disproportionate representation in the legislatures of many industrialised countries. Consequently, any proposal for wholesale elimination of farm subsidies was bound to meet stiff opposition.

There was some hope that a multilateral reduction in support, that is 'mutual disarmament' of agricultural protection, would be more palatable than unilateral reform. There is every indication that this would indeed be the case. As discussed later in this report, world prices are projected to rise substantially if the industrialised economies were to collectively remove support provided to their agricultural sectors — figure 1. However, in countries with highly protected agricultural sectors these price rises were insufficient to offset the decline in transfers from government and consumers. Consequently farm returns and farm asset values in these countries were simulated to fall, indicating that farm lobbies in most countries have a considerable incentive to oppose trade liberalisation.

Figure 1: **Increase in world prices due to a removal of agricultural support in SALTER countries**

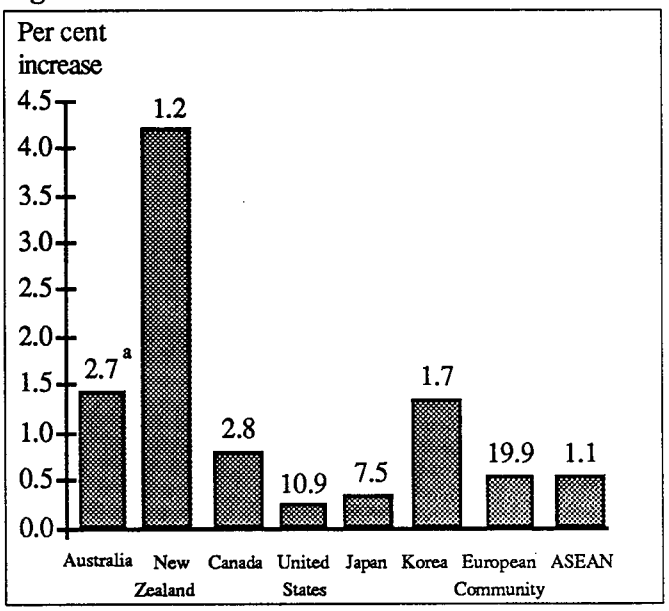


Source: SALTER simulations

But national income is simulated to rise in every region following global agricultural liberalisation — figure 2. Thus the non-farm sector should be able to compensate farmers and still be better off. However, this would require 'decoupled payments' to farmers that would look disturbingly like simple transfer payments. In a budget-conscious era such transfers would be far less resilient than transfers from consumers via inflated market prices. Furthermore, the distribution of benefits from the current farm programs is generally in proportion to output,

with the largest producers receiving the lion's share of the benefits. Since any transfer payments would very likely be subjected to wealth and income tests, compensation in this form would surely imply a radical redistribution of payments among farms. This would work to the detriment of the largest farms which are also the most influential lobbyists. In sum, most of OECD agriculture is unlikely to submit itself to reform without considerable outside pressure. This is especially the case for the European Community (Sturgess 1991).

Figure 2: **Change in real national consumption due to global removal of agricultural assistance**



[a] US$billion; figures in the graph represent the absolute amount by which real national consumption changes; this corresponds to the percentage changes indicated by the length of the bar in the graph as measured along the left hand axis.

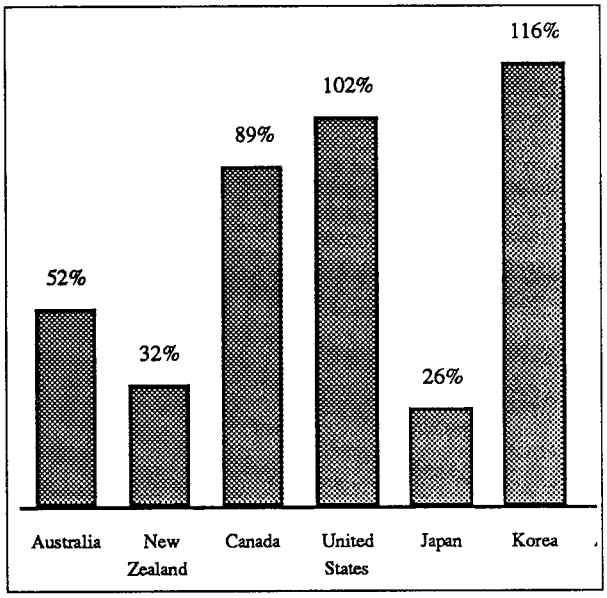
Source: SALTER simulation

The Cairns Group, comprising countries with a strong interest in agricultural exports, has recognised this 'structural' problem. It is led by Australia, which is one of the few industrialised countries whose farmers would be better off following liberalisation of farm policies in the industrialised economies. This group, which seeks to bring agriculture under GATT discipline, has asserted that little progress can be made in other areas if the agricultural problem is not addressed (Oxley 1990). By linking progress in other areas to progress in agriculture, these countries are simply applying a basic principle of multilateral trade negotiations. While individual countries have widely divergent views on the need to liberalise trade in individual areas, all countries stand to gain from mutual, multilateral reductions in protection. If, for example, members of the Asia Pacific Economic Cooperation (APEC) group, which comprises some members of the Cairns Group, ASEAN member countries and Korea, were to reduce trade barriers by 50 per cent, most countries would be able to appropriate more than half of their real national consumption gains from full global liberalisation — figure 3.

Unfortunately, the GATT negotiations on agriculture were not set up to allow the logic of mutual multilateral cuts in protection to weigh heavily on the agricultural liberalisation debate. With a specific Negotiating Group on Agriculture handling agriculture in the Uruguay Round, these multilateral talks fell prey to the same problem encountered in domestic farm policy. By

focusing exclusively on agriculture, there is little common ground for negotiations between countries such as Australia and Japan. Any import access 'given up' by Japan translates directly into downward pressure on farm returns, and heightened pressure on Japanese politicians. The fact that the recent Japanese reforms in beef imports came about largely due to threats of United States retaliation on manufactured imports provides a striking illustration of the benefits to be had from casting agricultural reform in a broader context.

Figure 3: **Proportion of the gain in real national consumption from global removal of protection achievable by a 50 per cent reduction in protection in APEC countries**



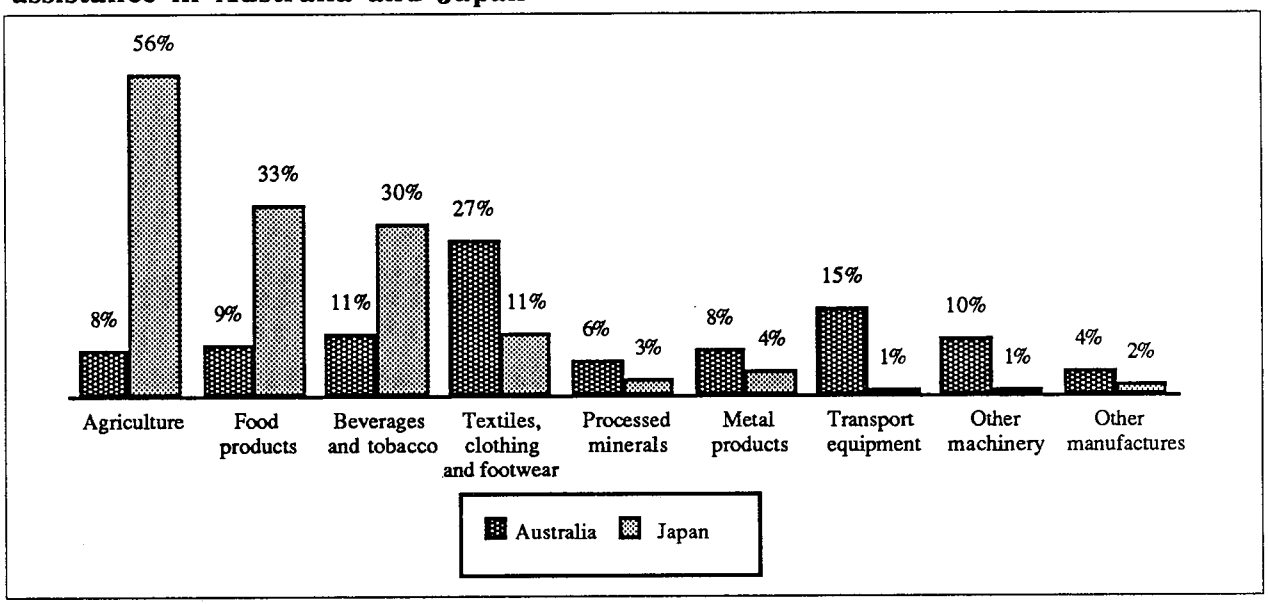
Source: SALTER simulation results.

Trading off agricultural and non-agricultural protection

Figure 4 presents summary measures of transfers afforded agricultural and manufacturing sectors in Australia and Japan. These two countries have fundamentally different patterns of comparative advantage. Australia has abundant natural resources, while Japan has a comparative advantage in manufactures, as a result of a relative abundance of skilled labour. This pattern of resource endowments suggests that Australia would export agricultural and mining products to Japan, while importing Japanese manufactures. While this is the case, these two countries are reluctant to let comparative advantage work to its full effect. As indicated in figure 4, Japan provides massive support to its farm sector, while Australia has maintained relatively high import barriers on manufactured products.

Given the pattern of protection displayed in figure 4, it makes little sense to put Australia and Japan in a room and force them to talk exclusively about agricultural liberalisation. Yet this is precisely the negotiating model used by the GATT when the Negotiating Group on Agriculture was formed. All of the lobbies that work to keep Japanese farm policies in place are keenly focused on the enormous discrepancy in relative levels of farm support, and the anticipated decline in output and farm incomes. By contrast, a more complete analysis would draw out the simultaneous gains in manufacturing exports as trade barriers facing Japanese industry are

Figure 4: **Proportion of income in various industry groups resulting from assistance in Australia and Japan**



Source: SALTER database

reduced. Ultimately such a mutual liberalisation of trade may be expected to result in lower consumer prices, on average, and higher real incomes in Japan. It also accentuates the stake which Japanese manufacturers have in trade reform.

2 MULTILATERAL TRADE LIBERALISATION: AN OVERVIEW

To demonstrate the need to link agricultural and non-agricultural reforms and to demonstrate the gains from trade liberalisation, simulations were undertaken with the SALTER model of the world economy. This model is a computable general equilibrium framework which models production, consumption and trade in thirty-four commodities. Trade between nine regions is accounted for.

An important aspect of any application of the SALTER model is the specification of the economic environment in which the simulations are to be carried out. This specification is known as the 'closure' of the model. In this application of the model a medium run economic environment is used. This represents a time period long enough for primary factors to be reallocated between industries, but not long enough for aggregate factor endowments to substantially affect the composition of the world economy. The main features of this closure are as follows.

- The employment rate in each economy is fixed, and the wage rate varies so that the aggregate quantity of labour demanded grows at the same rate as the quantity supplied.
- The aggregate capital stock in each economy is fixed, and the rental price of capital varies so that the aggregate quantity of capital demanded remains equal to the available stock.
- Capital use by individual industries varies, so as to maintain fixed relative rates of return across industries.
- Aggregate real investment in each economy is fixed.
- In each economy, household savings adjust to maintain a fixed ratio between the balance of trade and net domestic product.
- In each economy, real aggregate government consumption, and transfer payments move in line with movement in real net domestic product.
- In each economy, the income tax rate adjusts to maintain a fixed ratio between the government budget deficit and net domestic product.
- Currency exchange rates are fixed.
- Fob prices of exports from the rest of the world are fixed.

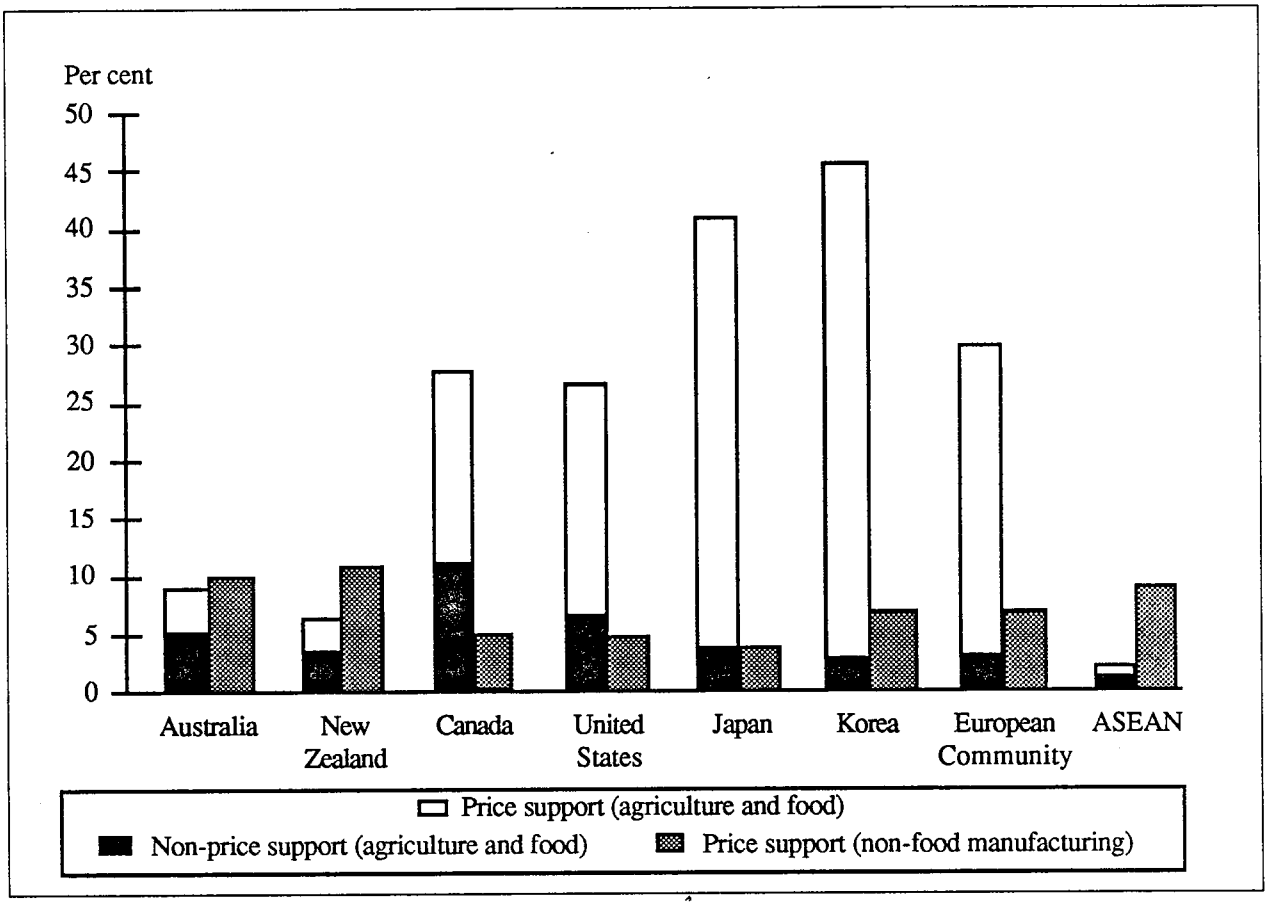
The economic effects of global liberalisation in agricultural and manufacturing protection were assessed in this economic environment. Results are presented in three sections. The first section discusses results pertaining to the global liberalisation of all trade barriers by SALTER countries. In keeping with the object of linking agricultural and non-agricultural trade liberalisation, the relative contributions of these two sets of measures are assessed. A regional breakdown is also examined. The problem of agricultural trade liberalisation is considered in more detail in the second section. The third section considers the impact of a 50 per cent cut in all trade barriers in the Asia Pacific Economic Cooperation group region alone. This is followed by a brief summary of the report's most salient findings.

Agricultural protection and trade

It is useful to begin the analysis by briefly reviewing the initial pattern of trade and protection embodied in the 1988 base data set. The protection data base embodied in the SALTER model is summarised in figure 5. The first bar in figure 5 presents estimates of the proportion of food and agricultural receipts derived from farm and food policy transfers in the regions covered by the SALTER model. ASEAN, Australia and New Zealand stand out as relative 'free traders' where agriculture is concerned. By contrast, transfers to the farm and food sector in Korea and Japan amount to almost half of total sector receipts. This is followed by the European Community, Canada and the United States. If food and agricultural policies alone were liberalised we would accordingly expect a general reallocation of productive agricultural capacity away from the regions where it is currently heavily supported, towards the regions in which it is less heavily supported. That is, towards ASEAN, Australia and New Zealand.

The degree to which agriculture in any one of the regions contracts or expands depends also on the initial trade shares. Thus if Australia exports a large share of its farm products into a heavily protected market, such as Japan, then an expansion of Japanese imports will translate into a relatively large expansion in the Australian farm sector. Table 1 presents trade patterns for all farm and food products combined. The rows of this table correspond to exporters and the columns to importers. Note that intra-region trade flows have been eliminated from the trade matrix in table 1, except in the case of the rest of the world. On this basis, SALTER trade flows account for roughly one half of global farm and food trade. In the case of some specific flows this share is much larger. For example, about 85 per cent of European Community farm and food exports represent sales to the rest of the world. This figure is roughly 50 per cent for United States exports and 35 per cent for Australian farm and food sales abroad. Countries

Figure 5: **Proportion of income in the agricultural and food industries derived from assistance**



Source: SALTER database

included in the SALTER model thus trade heavily with countries not explicitly modelled. Since supply prices in the rest of the world do not change in the policy simulations reported in this document, it is expected that the rest of the world would gain export shares, as other countries' food and agriculture export prices rise following liberalisation.

Returning to a discussion of the trade flows between SALTER countries, examination of the first row of table 1 indicates that US$2.5 billion, or about one fifth of Australia's US$11.4 billion estimated farm and food exports went to Japan in 1988. Japanese imports are also particularly important for the United States, as can be seen by going down the column headed 'Japan'. The US$7.8 billion estimate in table 1 is slightly more than one fifth of total United States farm and food exports. Hence the keen interest of United States (and Australian) farmers in liberalisation of the Japanese market.

Table 1: **Trade in farm and food products, by source and destination: 1988**

Exporter	*Australia* US$b	*New Zealand* US$b	*Canada* US$b	*United States* US$b	*Japan* US$b	*Korea* US$b	*European Community* US$b	*ASEAN* US$b	*Rest of the world* US$b	*All regions* US$b	*Net exports* US$b
Australia	–	0.2	0.3	1.1	2.5	0.4	1.8	1.1	4.1	11.4	9.7
New Zealand	0.3	–	0.1	0.7	0.5	0.1	1.2	0.4	2.0	5.3	4.8
Canada	0.1	..	–	2.5	1.5	0.2	0.8	0.2	3.7	8.8	3.2
United States	0.1	..	3.0	–	7.8	1.6	4.3	1.0	18.1	35.9	15.6
Japan	..	..	0.1	0.2	–	..	0.2	0.2	0.4	1.2	-22.0
Korea[a]	..	..	..	0.1	0.9	–	..	0.1	0.2	1.4	-2.5
European Community	0.3	..	0.4	1.9	1.4	0.3	–	0.6	30.1	35.0	-14.7
ASEAN	0.4	0.1	0.3	2.9	3.1	0.6	4.2	–	7.3	18.8	12.6
Rest of the World	0.4	0.1	1.5	10.9	5.6	0.8	37.3	2.6	66.6	125.8	-6.7
All regions	1.7	0.5	5.6	20.3	23.2	3.9	49.7	6.2	132.5	243.6	0.0

.. Less than US$50 million.

Source: SALTER database

The 'all regions' column in table 1 provides an estimate of each region's total exports of farm and food products. United States and European Community farm and food exports were roughly equal in 1988 and amounted to about US$35 billion each. This was followed by ASEAN, Australia, Canada and New Zealand. In contrast, the total import figure given in the bottom row of table 1 indicates that, among the eight SALTER regions, the European Community dominates the picture, with almost US$50 billion of food imports. This means that increased access to this market is particularly important from the point of view of global food exporters.

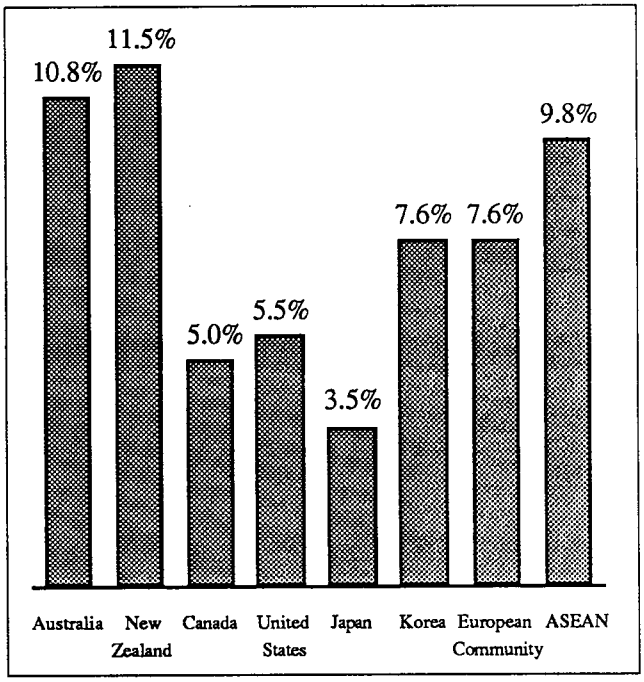
Protection and trade in manufactured products

Figure 6 summarises the pattern of protection in the aggregated (non-food) manufacturing sectors in each of the SALTER regions. Since information on non-tariff barriers is very limited most of the measured assistance is due to tariffs on imports or subsidies in production. Whereas Australia and New Zealand are *relatively* free traders in agriculture, they are among the most protectionist OECD countries when it comes to manufacturing activity. Thus it is expected that multilateral liberalisation of trade in manufactures would lead to a contraction in these two countries' share of global manufacturing production. Note that when combined with liberalisation of food and agricultural trade, this reinforces the tendency for the agricultural sectors in New Zealand and Australia to expand. Given fixed domestic factor endowments, an expansion of one sector must come at the cost of others. If multilateral trade liberalisation

simultaneously sends a signal for manufacturing to contract while stimulating the agricultural sector, the resultant reallocation of activity towards agriculture will be even more dramatic.

As in the case of agricultural liberalisation, the degree to which individual economies expand manufacturing when protection is reduced, depends on the initial pattern of trade. Table 2 presents the export–import matrix for trade in non-food manufactures. For example, the European Community, Japan, the rest of the world and the United States supply a large proportion of Australia's US$34 billion imports of non-food manufactures. These countries would thus expect to achieve a large absolute increase in exports to Australia following liberalisation of non-food manufacturing in Australia.

Figure 6: **Nominal rates of assistance for the non-food manufacturing sector in SALTER countries**



Source: Brown 1991, SALTER database

Among the eight SALTER regions, the United States is the largest importer of non-food manufactures with an estimated total import bill of US$343 billion. Ninety-seven billion of this

Table 2: **Trade in non-food manufactures, by source and destination: 1988**

Exporter	*Australia* US$b	*New Zealand* US$b	*Canada* US$b	*United States* US$b	*Japan* US$b	*Korea* US$b	*European Community* US$b	*ASEAN* US$b	*Rest of the world* US$b	*All regions* US$b	*Net exports* US$b
Australia	–	1.3	0.3	1.6	3.8	0.7	1.8	2.3	4.5	16.3	–17.7
New Zealand	1.1	–	..	0.4	0.7	0.1	0.3	0.2	0.6	3.3	–2.2
Canada	0.8	0.1	–	64.0	3.0	0.5	5.7	0.9	7.9	82.9	–1.0
United States	6.1	0.9	58.6	–	22.9	6.8	43.0	16.7	97.3	252.3	–90.9
Japan	7.6	0.9	5.9	80.8	–	13.1	37.4	25.5	82.0	253.2	162.3
Korea[a]	0.9	0.1	1.6	16.1	6.1	–	5.6	3.2	11.5	45.1	11.6
European Community	8.0	1.0	10.1	62.2	17.2	4.6	–	14.7	386.7	504.5	187.8
ASEAN	2.0	0.2	0.7	21.0	8.9	1.9	10.4	–	17.1	62.3	–18.7
Rest of the World	7.5	0.9	6.6	97.2	28.3	5.6	212.7	17.4	411.2	787.5	–231.2
All regions	34.0	5.5	83.9	343.2	90.9	33.5	316.8	80.9	1018.7	2007.4	0.0

.. Less than US$50 million.

Source: SALTER database

comes from non-SALTER countries. Japanese exporters have about a quarter of the United States market, followed by Canada and the European Community. The special relationship between Canada and the United States where the two economies share a very long and relatively open border, shows up clearly in table 2. Canada exports US$64 billion worth of non-food manufactures to the United States, while importing US$59 billion. This pattern of relatively balanced trade is also evident at the individual industry level where a great deal of two-way trade across the border exists.

Another interesting aspect of table 2 is the strength of the ties between the European Community and non-SALTER regions. Three quarters of the US$500 billion of European Community non-food manufactured exports are shipped to the rest of the world. This reflects the importance of old colonial ties, as well as the relative significance of trade with other European countries and the Soviet Union. This trading relationship is also the source of almost all of the European Community's US$188 billion surplus in non-food manufactured exports.

Results

Table 3 presents a summary of some key results pertaining to the effects of multilateral trade liberalisation, as projected by the SALTER model. The entries in each of the rows correspond to the expected change in the selected variable. The total (and percentage) change in each of these variables, under full multilateral liberalisation, is reported in the column labelled 'total effect'. All other entries in the table refer to some percentage of this total change. These percentages must always sum to 100 per cent, hence the series of 100 entries in the 'all assistance' column. This particular formulation of table 3 permits the reader, at a quick glance, to assess both the total expected change in a variable, as well as the component parts of this change.

Two types of variables are reported in table 3, the change in real national consumption[2] and the change in the terms of trade facing each country. The change in real national consumption represents a measure of the change in national well-being. There are two sources from which such changes may flow in the SALTER model: changes in the country's terms of trade, and resource allocation gains.

[2] Real national consumption is defined as an index of public and private domestic consumption in the model. Since the model forces the share of aggregate expenditure on these two activities to remain constant, a change in the relative cost of public versus private consumption will generate an equal (and offsetting) change in relative quantities.

Table 3: **Estimated contributions of liberalisation of assistance to the total effect of global trade liberalisation on measures of welfare and terms of trade**

	Contribution of liberalisation through					
	Agricultural assistance	*Non-food manufacturing assistance*	*Interaction factor*	*All assistance*	*Total effect*	
	%	%	%	%	US$b	%
Australia						
Real national consumption	83.53	15.88	0.59	100	3.21	1.70
Terms of trade[a]	119.54	–36.78	17.24	100	1.56	3.48
New Zealand						
Real national consumption	89.77	10.23	0.00	100	1.34	4.69
Terms of trade	78.71	–1.62	22.91	100	1.34	11.13
Canada						
Real national consumption	106.76	–2.70	–4.04	100	2.68	0.74
Terms of trade	340.91	–84.09	–156.82	100	0.40	0.44
United States						
Real national consumption	144.44	–50.00	5.56	100	7.41	0.18
Terms of trade	266.67	–139.68	–26.99	100	4.89	0.63
Japan						
Real national consumption	80.95	19.05	0.00	100	9.18	0.42
Terms of trade	94.78	–13.81	19.03	100	–8.28	–2.68
Korea						
Real national consumption	87.58	20.92	–8.50	100	1.93	1.53
Terms of trade	28.90	27.76	43.34	100	–2.08	–3.53
European Community						
Real national consumption	158.83	–70.59	11.76	100	12.32	0.34
Terms of trade	–58.79	91.76	67.03	100	–13.51	–1.82
ASEAN						
Real national consumption	94.83	10.34	–5.17	100	1.15	0.58
Terms of trade	–200.00	2700.00	–2400.00	100	0.06	–0.04
All model regions						
Real national consumption	121.89	–25.02	3.13	100	39.21	0.36
Terms of trade	–5.19	107.17	–1.98	100	–15.62	–0.84
World						
Total identified gains	85.68	12.64	1.68	100	54.83	–

[a]Terms of trade change reflects change in purchasing power evaluated at initial equilibrium trade quantities.

Source: SALTER simulations and database

An improvement in the terms of trade permits a country to purchase more imports, thereby raising consumption, at a given level of exports and trade balance.

Resource allocation gains reflect the positive effect of improving the utilisation of a fixed supply of domestic factors of production. In particular, by removing trade distortions, the liberalisation experiment aligns relative prices in the domestic economy more closely with those in the world market. The latter prices reflect the opportunity cost of importing a given product rather than

producing it domestically. By aligning domestic incentives with global opportunity costs, an economy can increase the value of its endowments, hence increasing real consumption.

There are other possible mechanisms by which a region can increase its level of consumption. Economic growth due to factor accumulation or technical change is one of these. These effects have been abstracted from in this *comparative-static* analysis. Another possibility would be for the country in question to increase overseas borrowing to finance additional current consumption. This too has been ruled out in the current analysis, since a constant ratio of net international capital flows to net domestic product has been imposed. Finally, it is possible to envision a country increasing current consumption by reducing domestic investment, hence lessening the need for domestic savings. This too has been ruled out by fixing the level of real investment in each simulation.[3]

In summary, the changes in real national consumption reported in table 3 are a limited measure of the potential change in national welfare. Furthermore, since one country's terms of trade gains are another country's terms of trade losses, it is the resource allocation gains which reflect the potential for improved global welfare due to an *improvement in the global allocation of existing resource endowments.*

The first three columns of table 3 partition the total changes in welfare and the terms of trade into the component owing to multilateral liberalisation of agricultural policies, that attributable to non-agricultural liberalisation across all regions in the SALTER model and an interaction term. In all countries the welfare gains engendered by multilateral agricultural trade liberalisation greatly exceed those stemming from the liberalisation of trade in non-food manufactures. Furthermore, note that if trade in non-food manufactures alone is liberalised, real consumption in the United States would *fall.* This reflects the fact that the initial misallocation of resources within the United States is strongly biased towards the farm and food sector. Thus when non-food manufacturing assistance levels are eliminated, resources relocate into the highly assisted farm and food sectors. This exacerbates the misallocation of resources in the United States, driving down real consumption.

[3] An additional, although rather more subtle source of change in regional real income and consumption has to do with the method of financing the government deficit. Since this deficit is constrained to remain constant throughout the simulation exercises reported here, the marginal income tax rate must be varied to accommodate changes in government spending. In practice the pattern of income taxation is invariably distortionary. That is, by discouraging labour and savings effort, and by distorting the pattern of resource allocation across activities, the productivity of the economy as a whole is diminished. However in the SALTER model, aggregate factor supplies are fixed and the income tax applies uniformly over all sources of income. For this reason adjustment of the factor tax rate does not induce indirect changes in aggregate real consumption possibilities.

Table 4: **Changes in sectoral output following multilateral non-food manufacturing trade liberalisation**

	Australia %	*New Zealand* %	*Canada* %	*United States* %	*Japan* %	*Korea* %	*European Community* %	*ASEAN* %
Paddy rice	3.41	..	..	3.24	–0.66	–0.38	1.99	–1.77
Non-grain crops	1.47	1.82	0.49	1.08	–0.93	–0.53	1.41	–2.10
Wheat	2.21	0.11	0.81	1.03	–7.38	–4.81	1.08	..
Other grains	2.36	0.22	0.08	0.92	–7.62	–5.21	0.99	–1.11
Wool	1.02	1.37	..	0.77	..	4.31	0.69	..
Other livestock products	1.54	1.07	–0.40	0.46	–0.98	0.79	0.46	–1.58
Meat products	1.57	1.70	–0.43	0.48	–1.11	–0.31	0.55	–2.02
Milk products	1.42	1.46	–0.14	0.36	–1.01	0.05	0.81	–5.49
Other food products	2.53	1.01	0.09	0.53	–0.37	–0.35	0.88	–1.73
Textiles, clothing and footwear	–18.61	–0.44	–8.59	–7.33	–4.65	31.32	–1.07	41.55
Transport equipment	–24.42	–13.24	1.03	–2.30	28.66	–10.22	–3.19	–21.76
Other machinery and equipment	–6.33	–9.62	0.33	1.61	–2.08	–1.08	–0.65	22.57
Other manufacturing[a]	1.89	–0.42	1.13	0.09	–0.87	–2.05	0.30	–2.99
Other primary industries[a]	6.81	2.43	0.14	0.52	–2.19	–3.15	1.38	–6.68
Services[a]	0.05	0.58	–0.14	0.03	–0.30	–0.89	0.01	–0.77

[a] These represent aggregates of SALTER sectors. .. Between -0.005 and 0.005 per cent.

Source: SALTER simulation results and database

Consider what happens when trade in non-food manufactured products is liberalised, but farm and food programs are left in place. The primary effect is to reallocate global production of those products with the highest rates of protection, and the greatest differential protection across SALTER regions. The transport equipment industry, as well as textiles and clothing, experience significant changes — table 4. But what happens to the overall production of non-food manufactures, relative to other sectors? In the European Community this sector contracts, while the farm and food sector expands! This is particularly perverse, given the high level of support for agriculture. When combined with a terms of trade loss, the subsequent welfare costs show up in table 3 as a decline in aggregate real consumption.

The opposite is true in Australia and New Zealand, where non-food manufacturing is also heavily protected relative to other SALTER regions, but in addition it is protected *relative to the food sector* in these two countries. Consequently the decline in non-food output, when accompanied by a reallocation of resources towards food production, represents an improvement in the allocation of resources. This resource allocation gain dominates the terms of trade losses, and real consumption in Australia and New Zealand rise.

The proportionate gains from complete multilateral liberalisation are by far the largest for the New Zealand economy, which experiences a dramatic improvement in its terms of trade following farm and food liberalisation. This provides graphic evidence of the costs to a small, food exporting nation of the current level of farm and food subsidies in the industrialised market economies. Australia also experiences significant gains for similar reasons. In contrast, Korea is able to raise real national consumption following full liberalisation, despite a deterioration in its terms of trade. This is evidence of the large initial distortions in the Korean economy.

Table 5 partitions the total change in real consumption and the change in the terms of trade gain into that portion attributable to unilateral actions of each of the countries engaged in the

Table 5: **Estimated contribution of liberalisation by individual regions to effects of global trade liberalisation**[a]

	Australia	*New Zealand*	*Canada*	*United States*	*Japan*	*Korea*	*European Community*	*ASEAN*	*Total effect*[b]
	%	%	%	%	%	%	%	%	%
Australia									
Real national consumption	53.72	2.86	5.01	12.30	14.60	3.43	3.16	4.93	1.70
Terms of trade	–88.70	7.68	18.88	55.41	33.86	8.34	52.36	12.17	3.48
New Zealand									
Real national consumption	15.60	18.44	4.13	17.80	3.65	1.76	36.61	2.00	4.69
Terms of trade	16.82	–10.77	6.58	25.71	4.00	2.61	52.63	2.41	1.13
Canada									
Real national consumption	–0.60	–0.29	104.77	18.17	–11.86	–0.16	–9.58	–0.45	0.74
Terms of trade	1.48	0.13	–89.64	188.45	–39.78	4.50	34.66	0.20	0.44
United States									
Real national consumption	–0.61	–0.27	11.87	92.82	–4.37	3.21	–9.22	6.58	0.18
Terms of trade	3.20	0.30	55.88	–48.86	1.60	17.40	52.17	18.31	0.63
Japan									
Real national consumption	8.73	0.65	–15.45	–100.39	237.81	–8.11	–28.05	4.81	0.42
Terms of trade	–12.11	–0.96	11.90	49.35	38.54	1.50	16.47	–4.69	2.68
Korea									
Real national consumption	1.73	–0.20	–3.51	–19.41	–4.27	129.64	–4.15	0.18	1.53
Terms of trade	–7.28	0.16	7.24	10.61	–9.43	102.65	–3.25	–0.72	3.53
European Community									
Real national consumption	–0.27	–0.19	–1.70	–4.68	–3.04	–0.35	109.64	0.58	0.34
Terms of trade	–14.44	–1.16	–4.06	–55.72	34.62	2.09	151.73	–13.06	1.82
ASEAN									
Real national consumption	–9.57	–0.51	–3.63	57.50	59.71	10.22	49.12	–62.83	0.58
Terms of trade	10.04	0.47	4.02	–52.77	–55.92	–9.94	–53.02	257.13	0.04

[a] The first eight columns in each row add up to 100 per cent, the total effect. [b] This corresponds to the percentage change in the last column of table 3.

Source: SALTER simulations and database

multilateral liberalisation.[4] Note that, particularly for the larger economies, unilateral reform provides most of the aggregate consumption benefits to be had from trade liberalisation. In a few cases, most notably Japan, the real consumption gains are *dampened* by multilateral reform. This is because *Japanese manufacturers are relatively more competitive when Japanese agriculture is reformed but its main competitors leave existing farm and food policies in place.*

As noted previously by numerous authors, existing farm and food policies represent an implied tax on non-food manufacturing exports.[5] When Japanese agriculture is reformed, its manufacturing sector becomes more competitive and expands. If the United States, the European Community and others fail to simultaneously implement such reforms, then their exporters remain subject to this implicit tax. Consequently they are placed at a competitive disadvantage. This is why the Japanese terms of trade actually deteriorate more under multilateral liberalisation than under unilateral liberalisation.

For all of the other regions represented in table 5 except Korea, multilateral liberalisation brings with it an improvement in the terms of trade, *relative to what would have been the case under unilateral liberalisation.* This is particularly striking for New Zealand, where unilateral liberalisation results in a dramatic worsening of its terms of trade and only a small welfare improvement. In contrast, multilateral liberalisation brings an equally dramatic terms of trade gain for this economy. Once again, Australia exhibits a similar phenomenon, only the percentage changes are less marked.

The final aspect of table 5 which deserves mention is the effect which unilateral liberalisation in one economy has on its trading partners. This depends on the importance of bilateral trade with the liberalising economy, in the overall trading picture for a given (non-liberalising) economy. It also depends on the levels of protection in the liberalising economy. If one country trades heavily with another country and that country has a heavily protected economy, then there is substantial potential for significant welfare changes in the exporting economy. For example, recall from table 1 that the main destinations from New Zealand's farm and food exports

[4] This method of partitioning the total change into various additive components works exactly for small changes in policies. Technically speaking, this is a property of the solution to a 'linearised' model. Indeed this is how the percentage components in this table were generated. This is why there is no column labelled 'interaction factor'. However the entry in the total change column corresponds to the nonlinear solution to a large change in policies. The total change predicted by the two approaches differs, with the former representing an approximation to the latter. Thus the fractions in this table are best interpreted as that proportion of a small move toward full liberalisation, owing to a particular policy shock.

[5] For a number of applications which develop this point, see the studies contained in the volume edited by Stoeckel, Vincent and Cuthbertson (1988).

include the European Community and the United States. Unilateral liberalisation in the European Community creates bigger benefits for New Zealand than its own liberalisation and liberalisation in the United States generates roughly the same benefits New Zealand achieved from its own liberalisation.

In addition to the initial pattern of trade, there is a question of what the consequences of unilateral reform are for the pattern of output in the liberalising economy. As noted above, the Japanese will face stiffer competition in non-food manufacturing if their significant competitors reform their farm policies. Thus the reform of the European Community's Common Agricultural Policy causes European Community manufacturing to become more competitive internationally. The negative effect of such a reform on Japanese manufacturing exports is further reinforced by a rise in farm and food prices, if the liberalising economy reduces farm output. In the absence of full price insulation, such an increase sends a signal to the inefficient Japanese farm sector to expand. This expansion comes at further expense to Japanese manufacturing production and exports. As a consequence of these dual forces, Japanese and Korean real consumption *fall* in the wake of unilateral liberalisation in Canada, the United States, and the European Community.

3 MULTILATERAL AGRICULTURAL TRADE LIBERALISATION

The results presented in the previous section clearly illustrate the disproportionate size of the distortions in international agricultural trade, which, when removed, account for a large portion of the total gains from multilateral trade liberalisation. Because of the large scope for gains, the lack of progress on agriculture in the GATT negotiations is rather frustrating. This is even more of a concern since this stalemate has held up agreements in other areas. This section explores the problem of global agricultural trade liberalisation in greater detail, focussing particularly on the implications for the global distribution of food production and farm household income.

Changes in trade flows

Table 6 presents the absolute changes in farm and food trade volumes following multilateral liberalisation of agriculture by all SALTER countries. Since one region's exports must equal another region's imports, the sum of the row totals (change in gross exports fob, by region), must equal the change in the sum of the column totals (change in gross imports fob). The combined total increase in trade of US$23.6 billion of farm and food products is equivalent to 10 per cent of base trade in these commodities.

This global expansion in trade of farm and food products is entirely attributable to increased trade in processed food products. While not shown in table 6, trade in crops and raw livestock products *declined* by about 2 per cent when the large production and export subsidies on these items were removed. The largest beneficiaries of this increased trade were found in the rest of the world, which was simulated to increase exports to SALTER regions by US$42 billion. ASEAN, Australia and New Zealand also increased exports of farm and food products.

The destinations for these increased exports may be readily ascertained by scanning the column totals in table 6. By far the largest market opening is the European Community, where gross imports of food products increased by about US$17 billion. This is almost as large as the sum of increased imports into the United States plus Japanese markets. However, virtually all of the net increase in European Community imports comes from the rest of the world. This reflects two things. First, recall from table 1 the very large share of the European Community market which the rest of the world enjoys prior to liberalisation. This means that even if they only enjoyed an equi-proportionate increase in exports, their absolute increase would be very large.

Table 6: **Estimated effects of agricultural trade liberalisation on farm and food products trade volumes by source and destination**

Exporter	*Australia* US$b	*New Zealand* US$b	*Canada* US$b	*United States* US$b	*Japan* US$b	*Korea* US$b	*European Community* US$b	*ASEAN* US$b	*Rest of the world* US$b	*Total* US$b
Australia	–	0.01	0.27	0.83	1.60	0.38	0.27	–0.22	–0.89	2.25
New Zealand	0.05	–	0.17	0.38	0.50	0.15	0.63	0.27	–0.65	1.49
Canada	0.02	..	–	0.30	0.07	–0.01	–0.16	–0.04	–2.17	–1.98
United States	0.02	0.01	0.03	–	0.44	0.37	–0.42	–0.23	–6.48	–6.25
Japan	..	..	0.01	0.07	–	0.02	0.01	0.03	0.02	0.16
Korea	–0.01	..	–0.02	–0.08	0.32	–	0.01	0.01	–0.09	0.14
European community	–0.14	–0.01	–0.17	–0.74	–0.37	..	–	–0.31	–15.98	–17.71
ASEAN	0.02	0.01	..	0.32	3.13	0.26	–0.20	–	–0.48	3.06
Rest of world	0.18	0.04	0.42	4.12	7.79	1.32	17.19	0.93	10.41	42.39
Total	0.13	0.17	0.71	5.19	13.48	2.50	17.34	0.43	–16.31	23.55

.. Between -US$5 million and US$5 million.

Source: SALTER simulations and database

In addition, since the rest of the world is not engaged in the liberalisation exercise, their export prices become more competitive, relative to those from most other regions. Thus they actually garner a disproportionate share of the new imports.

It is also interesting to examine the differential composition of increased exports on the part of Australia, New Zealand and the ASEAN region. This may be observed by scanning these three rows in table 6. These differences depend both on initial market shares, and on the degree of complementarity arising from the liberalisation exercise. For example, the importance of rice exports from ASEAN, coupled with the relatively large opening in the Japanese and Korean rice markets, means that this is where ASEAN's big export gains arise. Total farm and food exports from ASEAN to the European Community actually fall. For Australia, increased exports to the United States and Japan account for most of the total change in food exports. The European Community is relatively less important for Australian exports. Indeed, this US$0.3 billion gain is exceeded by the US$0.4 billion increase in Australian farm and food exports to Korea, following multilateral agricultural trade liberalisation. In contrast, New Zealand's largest export gains come in the United States, European Community and Japanese markets.

World price effects

Estimates of the average world price changes for farm and food products are presented in table 7. As in previous studies, they follow quite closely the initial pattern of support across commodities (Magiera and Herlihy 1988). The largest price increases are achieved in the most heavily protected commodities, namely paddy rice and milk products. Grains, meat and dairy

product prices rise by more than 30 per cent, with other commodities being less dramatically affected.

Estimated output effects

The pattern of output changes projected by the SALTER model following agricultural trade liberalisation are reported in table 8. These are provided at a disaggregate level for all farm and food products, and for several manufacturing sectors of interest. Other manufacturing sectors and services have been aggregated for the sake of brevity.

Table 7: **Average change in world prices[a] for farm and food products following agricultural trade liberalisation**

	Change
	%
Paddy rice	52.03
Non-grain crops	0.14
Wheat	36.20
Coarse grains	32.15
Wool	9.49
Other livestock products	0.63
Meat products	31.43
Milk products	65.99
Other food products	4.38

[a]All price changes are relative to the supply price of net world exports

Source: SALTER simulation and database

As anticipated by the world price shocks, the most dramatic output changes occur in rice and dairy products. Australia and ASEAN step in to partially replace production of rice in the European Community, Japan and Korea. New

Table 8: **Changes in sectoral output, following multilateral agricultural trade liberalisation**

	Australia	*New Zealand*	*Canada*	*United States*	*Japan*	*Korea*	*European Community*	*ASEAN*
	%	%	%	%	%	%	%	%
Paddy rice	68.18	..	..	-1.28	-20.79	-16.77	-44.74	16.50
Non-grain crops	-1.15	-19.92	-6.20	0.96	1.31	6.29	-8.40	-5.02
Wheat	11.15	-3.13	-37.95	-21.35	-96.28	-49.61	-16.68	..
Other grains	14.85	6.53	0.40	-18.50	-88.60	-92.77	-18.28	8.19
Wool	-9.18	-7.25	..	-67.72	..	29.61	39.35	..
Other livestock products	15.10	28.46	-7.98	-7.51	-18.47	22.16	-13.32	5.47
Meat products	33.75	30.91	-12.34	-7.52	-19.11	33.20	-18.95	18.41
Milk products	-27.00	75.33	-12.21	-5.74	-39.59	13.58	-28.72	-7.82
Other food products	0.61	0.71	4.25	-1.78	-3.38	-4.87	-7.69	4.58
Textiles, clothing and footwear	-3.93	-9.98	-0.83	-0.15	1.86	33.56	2.42	-4.11
Transport equipment	-6.20	-6.52	0.60	0.30	3.55	-2.99	2.56	-2.64
Other machinery and equipment	-4.29	-11.15	1.07	0.44	1.63	-2.63	2.39	-4.09
Other manufacturing[a]	-2.51	-6.37	0.55	0.12	0.80	0.43	1.25	-2.47
Other primary industries[a]	-4.40	-8.37	1.58	0.28	0.96	-1.30	2.10	-3.20
Services[a]	0.40	-0.77	0.48	0.11	0.34	0.24	0.57	-0.61

[a] These represent aggregates of SALTER sectors. .. Between -0.005 and 0.005 per cent.

Source: SALTER simulation results and database

Zealand dramatically expands dairy production as the dairy sector shrinks in all of the other SALTER regions except for Korea. Livestock production of all sorts in Korea has been historically penalised by grains policies which have maintained high domestic prices for feedstuffs and have biased the use of farm land towards crops. Both Korea and Japan dramatically reduce domestic production of feed grains, importing cheaper foreign grains instead.[6]

Turning to the non-food output changes associated with this experiment, we see that they are generally smaller, but by no means insignificant. *The prospects for increased international trade in non-food manufactures are not unrelated to trade in food products.* The strong expansion in food production in New Zealand, for example, means that fewer resources will be devoted to non-food production. Conversely, the contraction in Japanese agriculture leaves more room for an expansion of other activities. These are complementary developments which encourage increased trade to the advantage of consumers in both regions. Japanese households consume more inexpensive dairy products from New Zealand, while New Zealanders use their increased income to purchase more Japanese automobiles. All of this, despite the fact that the tariff on imported automobiles is left unchanged!

[6] At this point it should be noted that some of the projected output declines in table 8 are likely overestimates, due to the failure of this version of the SALTER model to deal adequately with supply control measures. Thus the change in United States grains production assumes that currently idled acreage will either not return to production, or if it does, that it will have a negligible impact on production. While it is true that some of this land has been idled under long term contracts, for alleged environmental reasons (that is, the Conservation Reserve), *even this land* could legally be brought into production under 'tight' supply conditions. The conventional set-aside acreage in the United States would surely return to some productive use in the absence of farm programs. In sum, it is doubtful that United States grains production would fall so dramatically following trade liberalisation. Indeed some authors have argued that output might even increase (Gardner 1988).

Similar qualifications apply to parts of the Canadian farm sector. For example, in the case of dairy production, farm level production controls have prevented individual producers from capturing potential scale economies (Moschini 1988). If the Canadian dairy programs were fully eliminated, the critical question is: Which would fall more, producer prices or the average cost of production on an optimally configured dairy farm? Conservatively put, the potential for increased scale economies will surely lessen the projected decline in Canadian dairy farm output.

In sum, the individual commodity output estimates in table 8 must be heavily qualified due to the relatively simplistic treatment of farm policies. However, there can be little doubt that the broad thrust of this table is robust. The removal of tens of billions of dollars in farm support will surely lead to a net contraction in the farm sectors of Canada, the United States, Japan, Korea and the European Community. Conversely, given the relatively low levels of farm support in Australia, New Zealand and ASEAN, there can be little doubt that agriculture in these economies (and in the rest of the world) would expand following multilateral liberalisation of farm and food trade.

Land rents and farm household welfare

While the *average* household in each of the SALTER regions is left better off following agricultural trade liberalisation, the question remains: How severely are the farm households in the European Community or Japan, for example, likely to be affected by liberalisation of agricultural protection? Since the SALTER model treats farm land as the only sector-specific factor of production, land rents become the repository for producer losses in these medium run simulations. The percentage change in this variable, by region, is reported at the top of table 9. As anticipated, the expansion of agriculture in Australia, New Zealand and ASEAN is reflected in an increasing scarcity of farm land, and subsequently higher returns in those regions. Other regions experience declining land rents. These losses are greatest for Canada, followed by Japan, Korea, the European Community and the United States.[7] This ordering is quite similar to that estimated using the OECD's WALRAS model (Martin, Burniaux, Delormė, Lienert and van der Mensbrugghe 1990, p. 139, table 3b), although the overall declines are somewhat greater in that study. This is likely the consequence of differing base years for the two analyses.

Table 9: **Changes in prices[a] and income following multilateral agricultural trade liberalisation**

	Australia	*New Zealand*	*Canada*	*United States*	*Japan*	*Korea*	*European Community*	*ASEAN*
	%	%	%	%	%	%	%	%
Land rents	15.87	36.48	–40.52	–22.21	–36.15	–34.97	–26.77	11.69
Wages	1.94	7.54	–1.50	–1.18	–1.40	2.03	–1.51	0.87
Capital rentals	1.59	7.09	–1.86	–1.47	–2.31	0.08	–2.45	1.15
Earned income	5.70	16.31	–14.55	–8.69	–13.41	–15.43	–7.22	4.73
Disposable income	6.21	17.17	–12.86	–8.01	–13.44	–18.37	–6.40	1.85
Consumer price index	1.83	6.38	–0.67	–0.79	–2.89	–7.38	–1.65	–2.25
Real disposable farm household income	4.38	10.79	–12.19	–7.22	–10.55	–10.99	–4.75	4.10
	US$m	US$m	US$m	US$m	US$m	US$m	US$m	US$m
Real disposable farm household income	587	266	–1483	–3628	–7621	–1579	–5732	1752

[a]All price changes are *relative to* the supply price of exports from the rest of the world
Source: SALTER simulation results and database

However, land rents are only a portion of farm household income. Furthermore, farmers are also consumers. We cannot obtain an accurate picture of farm household well-being without taking all of these dimensions into account. The second and third rows of table 9 account for changes in the economy-wide wage and capital rental rates. When these are weighted by their relative importance in initial farm household income, and then summed, we obtain the

[7] These results are sensitive to the treatment of supply control measures (see footnote 5). Consequently, we surely *overstate* the decline in Canadian land rents, while understating the impact on United States land rents. Offsetting the decline in average US land rents will be the increased producer income flowing from planting of previously idle acreage. See Hertel (1991) for a method for adjusting the farm income calculations.

percentage change in earned income. This is smaller than the change in land rents, reflecting the moderating influence of non-land income on total farm household earnings.[8]

The next line of table 9 captures the change in farm household well-being as a consequence of changes in the factor tax rate required to maintain a constant real budgetary balance for each of the governments in question. With the exception of Japan and Korea, where the loss in tariff revenue outweighs subsidy savings, factor tax rates fall and the adjustment leaves farmers better off. When taking account of the consumer price changes in each of these economies, we obtain the estimated change in real farm household income attributable to multilateral liberalisation of agriculture.[9] This more complete view of the aggregate farm household's position is somewhat different from that offered by the land rent variable alone. For example, once other sources of income, tax changes and consumer price changes are accounted for, the 27 per cent fall in European Community land rents translates into a fall in real household income of less than 5 per cent. The final line of table 9 quantifies the absolute change in farm incomes due to agricultural trade liberalisation. The losses in farm income are greatest for Japan and the European Community because these countries provide the largest subsidies to agricultural producers.

Offsetting the decline in average US land rents will be the increased producer income flowing from planting of previously idle acreage. See Hertel (1991) for a method for adjusting the farm income calculations.

[8] This medium-run analysis assumes that farm households' labour and capital leaving agriculture find non-farm employment at a competitive wage rate. Indeed the SALTER model takes this redeployment of labour into account in its computations of non-food output.

[9] Several simplifying assumptions were necessary in order to compute these real income changes. First of all, we approximate initial farm household income with after-tax payments to land, labour and capital initially employed in the sector. To the extent that farm households have diversified their earnings outside of agriculture, this will *overstate* their estimated change in real income following agricultural trade liberalisation (Hertel 1991). Secondly, we abstract from changes in the level of public goods consumed. This should be minimal, since the shares of public and private consumption are constant. Finally, the formula itself is only an approximation to the true welfare change, which cannot be obtained without more detailed knowledge of farm household preferences.

4 LIBERALISATION IN APEC COUNTRIES

Complete trade liberalisation in all countries, however desirable, is clearly not an outcome to be expected over the short run. A major obstacle is resistance within each country by sectors which benefit from trade distortions. Another factor may be the belief that it is in each country's interest to postpone the benefits of unilateral trade liberalisation, if by so doing it can negotiate greater trade liberalisation by its trading partners.

It is therefore of some interest to examine the effects of a less complete trade liberalisation outcome, and compare them with the results from total liberalisation. The partial trade liberalisation outcome chosen for examination is a fifty per cent reduction in trade barriers in APEC member countries (that is, all regions in the model other than the European Community). In particular, it is assumed that all trade barriers in the APEC region are converted to their ad valorem tariff equivalent form and subsequently cut by 50 per cent. Meanwhile, trade barriers in the European Community are left in place. A further element of realism is injected by *insulating agriculture in European Communities* from changes in the world price of farm products. This is a fairly accurate representation of how the Common Agricultural Policy is likely to operate, if it were left in place following partial trade liberalisation. The effects of this partial trade liberalisation are compared with total global liberalisation in table 10.

The first point that emerges from these results is that, even with the European Community maintaining its trade barriers, all APEC member regions benefit from partial trade liberalisation. The benefits of this partial trade liberalisation are generally less than those of full liberalisation, but still very substantial. For APEC as a whole, the benefits of partial liberalisation are equivalent to about 65 per cent of those of full liberalisation. For the European Community on the other hand, not liberalising while others liberalise leads to a small welfare loss. This loss arises because the liberalising regions find trade between themselves relatively more attractive, so that the European Community suffers a terms of trade loss. The terms of trade loss is less severe than in the case where the Community does liberalise, but unlike that case it is not offset by any benefits from improved internal efficiency in resource allocation. This illustrates the point that hanging back in trade liberalisation in the hope of negotiating concessions from trading partners can be a very costly tactic.

Comparing the benefits to each APEC member region of the two trade liberalisation outcomes, the benefits of total liberalisation exceed those of partial liberalisation in almost all regions. The

Table 10: **Estimated effects on real national consumption of complete and partial trade liberalisation**

	Complete global removal of agricultural and manufacturing trade barriers		*50 per cent reduction in agricultural and manufacturing trade barriers in APEC countries*	
	US$b	%	US$b	%
Australia	3.21	1.70	1.67	0.88
New Zealand	1.34	4.69	0.43	1.50
Canada	2.68	0.74	2.36	0.66
United States	7.41	0.18	7.57	0.18
Japan	9.18	0.42	2.43	0.11
Korea	1.93	1.53	2.31	1.84
European Community	12.32	0.34	–3.12	–0.08
ASEAN	1.15	0.58	0.69	0.35

Source: SALTER simulation results and database

only region to obtain significantly greater benefits under the partial liberalisation option is Korea. This is because Korea obtains terms of trade advantages from the European Community not liberalising. The greatest of these relate to exports of leather and fur products. The main exporters of these products in the model are the European Community and Korea. Agricultural trade liberalisation, whether in Korea or in the European Community, reduces the price of these products in each liberalising region, through its effects on agricultural prices. So the maintenance of agricultural trade barriers by the European Community gives Korea an advantage in exporting these products, relative to the case of full liberalisation.

For most other APEC regions, partial trade liberalisation secures a large part of the gains from total liberalisation (though still leaving further substantial gains to be secured). For most regions, the difference between the benefits to each region of partial and total liberalisation may be attributed largely to the different degree of liberalisation by the country itself. For example, the fact that under partial liberalisation Australia obtains only US$1.7 billion of the US$3.2 billion gains from full liberalisation is due largely to the maintenance of barriers to trade by Australia itself, and the persistence of inefficiency in resource allocation, under partial liberalisation.

There are two exceptions to this general rule, that the partial liberalisation outcome secures a large part of the benefits of full liberalisation: Japan and New Zealand. In Japan this is because barriers to agricultural imports are initially so high that a fifty per cent reduction is estimated to

have little effect on import volumes. So the degree of resource reallocation under partial liberalisation is relatively minor, and the efficiency gains are likewise minor.[10]

For New Zealand, the benefits of the partial trade liberalisation outcome are much smaller than those of total liberalisation, because of the importance to New Zealand of trade in milk products, and the critical importance of European Community policy interventions in world trade in those products. Thus New Zealand is the only APEC region in the model of which it can be said, that the benefits of the partial liberalisation scenario are much less than those of full liberalisation, because of the maintenance of trade interventions by the European Community.

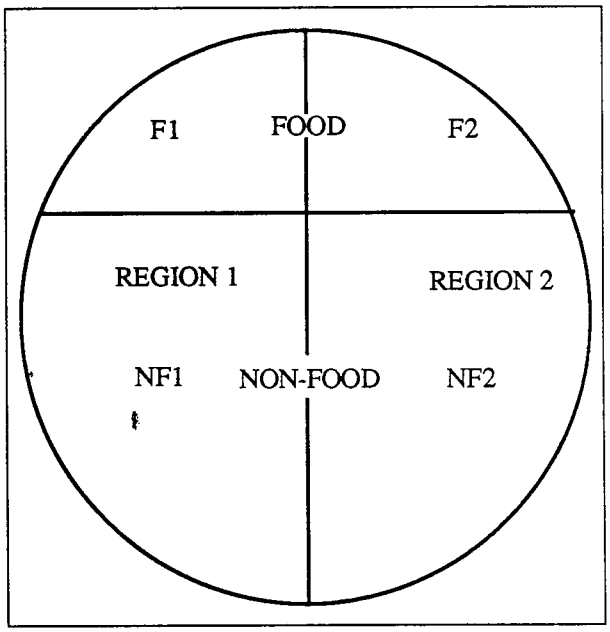
[10] This particular aspect of the simulation results is not robust. Estimating the effects of trade liberalisation on Japanese agriculture in a general equilibrium model is exceptionally difficult, because of the very high levels of assistance, and the very low impact levels for some commodities. The results are therefore exceptionally sensitive to the parameter settings and behavioural assumptions incorporated in the model. A more detailed study of Japanese agriculture would be needed to determine with any confidence the extent to which partial trade liberalisation would affect domestic production.

5 SUMMARY: LINKING AGRICULTURAL AND NON-AGRICULTURAL REFORM

This study has attempted to answer two types of questions. First, how would the global allocation of food and non-food production be altered if the current pattern of distortionary trade policies were eliminated? Secondly, how much does the world in general, and individual regions in particular, stand to gain from such a move? Is such an effort warranted on the basis of a ratio of relevant benefits achievable versus cost incurred?

Figure 7 will help in summarising key findings with respect to the first question. For a moment think of the world as being divided along two axes. The first is a regional division which separates countries which protect food producers relative to the non-food sector (region 1), from those in which the converse is true (region 2). In terms of figure 4, the first region would include Japan, whereas Australia would fall into region 2. The second axis cuts across regions and distinguishes food from non-food production. In this way, global production activity may be seen as being divided into four quadrants: F1 is food production in region one, NF1 is non-food production is region one, and similarly for F2 and NF2.

Figure 7: **The global allocation of food and non-food output**



The analysis in this report has shown that the size of each of the quadrants in figure 7 is affected by liberalisation in any one region, or across any set of commodities. For example, assuming that absolute support levels are higher in F1 than F2, (as is the case for Japanese as compared to Australian agriculture), liberalisation of farm and food policies causes F1 to shrink and F2 to expand. *However*, there is a simultaneous *expansion* in NF1 and contraction NF2. As such it cannot be said that region 1 (Japan) loses as a result of agricultural trade liberalisation. Indeed, as we have demonstrated, real income in all regions rises. The latter point relates to the size of the 'pie' in figure 7. It will be explored in more detail momentarily.

Because countries which have a high level of *absolute* support for agriculture also tend (not surprisingly) to protect agriculture *relative to* non-agricultural activity, across-the-board liberalisation of all trade policies strengthens the tendency for F2 (Australian agriculture) and NF1 (Japanese manufacturing) to expand, while F1 and NF2 (for example Australian manufacturing and Japanese agriculture) contract. Table 11 provides estimates of the degree to which economic activity is reallocated among these eight regions. For ease of interpretation sectors have been grouped into five categories: agriculture, other primary industries, food processing, other manufacturing, and services. The columns in this table sum roughly to zero, reflecting the finite resource base in each of these economies. The row totals need not sum to zero, since the rest of world has been omitted from the table. Also, the mix of global demands will change with increasing global incomes.

The results in table 11 show that, taken as a group, the industrialised market economies are maintaining vastly inflated farm and food sectors. In particular, value-added is almost US$60 billion 'too large' in these economies. This has penalised three groups. First of all, food producers in Australia, New Zealand, ASEAN, and the rest of the world have suffered from depressed world prices. This has caused these regions to *underinvest in agriculture while simultaneously overinvesting in non-food production.* This brings us to the second group which has suffered from the current pattern of policy distortions: non-food producers in the industrialised market economies. By maintaining an overdeveloped farm and food sector, production in the non-food economy has been thwarted. In particular, non-food value-added is estimated to be about US$55 billion less than it would be in the presence of a liberal trading environment.

These trade distortions have also stunted the total size of the 'pie' in figure 7, thus limiting real consumption possibilities. The cost of these trade distortions to the regions covered by the

Table 11: **Estimated effects from global agricultural and manufacturing liberalisation on value added, by sector and region**

	Australia	*New Zealand*	*Canada*	*United States*	*Japan*	*Korea*	*European Community*	*ASEAN*	*Total*
	US$b	US$b	US$b	US$b	US$b	US$b	US$b	US$b	US$b
Agriculture	1.044	0.372	–2.183	–4.154	–13.027	–1.045	–18.530	0.761	–36.761
Primary industries nec	0.319	–0.065	0.425	1.211	–0.385	–0.218	4.052	–2.097	3.243
Food processing	0.707	0.648	–0.393	–2.512	–3.141	0.033	–17.631	0.518	–21.772
Manufacturing nec	–2.412	–0.840	0.740	–1.159	14.042	3.403	13.432	1.706	28.913
Services	0.709	–0.043	1.122	4.966	0.213	–0.651	17.334	–1.187	22.464
Total	0.366	0.072	–0.289	–1.649	–2.297	1.523	–1.342	–0.298	–3.914

Source: SALTER simulation results and database

SALTER model may be summarised by attaching a dollar value to the identified gains in world economic welfare reported in table 3. These gains comprise increases in national consumption in regions included in the model, and terms of trade gains by the rest of the world. Further gains would be likely through improved resource allocation in the rest of the world, but these cannot be identified in the model.

For global agricultural and manufacturing trade liberalisation, total identified gains amount to US$55 billion. Of these, US$47 billion may be attributed to farm and food policies directly.

To put the matter in appropriate perspective, it is useful to consider these potential gains relative to the farm household income transfers which they enable. Taking all regions in the model together, agricultural trade interventions increase disposable income to factors currently employed in agriculture by US$17 billion. This is the net effect of a US$19 billion gain in regions in which agriculture is relatively highly assisted (Canada, the United States, Japan, Korea, and the European Community) and a US$3 billion loss in other regions (Australia, New Zealand and ASEAN). But these interventions generate identifiable losses in economic welfare of US$47 billion. Most of these losses — US$42 billion — occur within the agriculture-assisting regions themselves. Thus for each dollar by which current arrangements increase agricultural sector income in the high assistance regions, they reduce economic welfare in the world as a whole by US$2.40. Thus a loss of US$3.40 is borne by other regions, and by non-agricultural sectors in the high-assistance regions.

The sheer magnitude of these losses, coupled with the enormous strain placed on the international trading system by tensions in agriculture, suggest that non-farm interests have a large stake in reforming agricultural trade.

APPENDIX A: ECONOMIC STRUCTURE OF THE SALTER MODEL OF THE WORLD ECONOMY

The SALTER model was used to analyse the implications of trade reforms. A brief description of the model is provided in this appendix while more comprehensive documentation is provided in a separate document (Jomini, Zeitsch, McDougall, Welsh, Brown, Hambley and Kelly 1991).

The sectoral classification and regional coverage of the SALTER model were designed with several considerations in mind. First, as may be seen from table A1, the emphasis is squarely on countries in the Asia-Pacific Economic Cooperation (APEC) group. In addition, the European Community has been included due to its large role in world trade. All other countries are aggregated together and treated in a rather simplistic manner, whereby they passively react to developments in the world market place.

Table A1: **Net domestic product of economies modelled: 1988**

	Net domestic product	*Share of ndp in modelled economies*
	US$m	%
Australia[a]	224 881	1.9
New Zealand[a]	38 501	0.3
Canada[a]	429 047	3.6
United States[a]	4 228 343	35.4
Japan[a]	2 442 351	20.5
Korea[b]	159 173	1.3
European Community[a]	4 201 765	35.2
ASEAN[b]	216 930	1.8

Sources: [a]OECD (1990a), [b]United Nations (1990).

The sectoral breakdown in the SALTER model is given in box A1. This is designed with several criteria in mind. First, because SALTER is an economy-wide model, these sectors must exhaust all economic activity in each of the regions. Second, owing to the trade liberalisation orientation of the model, every attempt was made to disaggregate industries/commodities where trade distortions were deemed to be severe. Third, given the proposed regional disaggregation, commodity coverage was constrained by computional constraints and the sheer magnitude of the data required for the model. Thus considerable aggregation was required in places, and this was done by grouping commodities which are close substitutes in use. A total of 34 industries, each producing a single product, were ultimately modelled in each of the eight regions.

Box A1: **Industry and commodity groupings contained in the SALTER model**

Agriculture
1 Paddy rice
2 Non-grain crops
3 Wheat
4 Other grains
5 Wool
6 Other livestock products

Resources
7 Forestry
8 Fishing
9 Coal
10 Oil and gas
11 Other minerals

Food
12 Meat products
13 Milk products
14 Other food products
15 Beverages and tobacco

Manufacturing non-metallic
16 Spinning, dyeing and made-up textiles
17 Wearing apparel

Manufacturing non-metallic *(continued)*
18 Leather, fur and their products
19 Lumber and wood products
20 Pulp, paper and printing
21 Chemicals, rubber and plastic
22 Petroleum and coal products
23 Non-metallic mineral products

Manufacturing metallic
24 Primary iron and steel
25 Other metals and products
26 Transport industries
27 Other machinery and equipment
28 Other manufacturing

Services
29 Electricity, gas and water
30 Construction
31 Trade and transport
32 Other services (private)
33 Other services (government)
34 Other services (ownership of dwellings)

Overview of the economic structure of the SALTER model

The SALTER model of the world economy can be thought of as a series of regional models linked together through trade. Each regional model can be further thought of as consisting of four blocks:

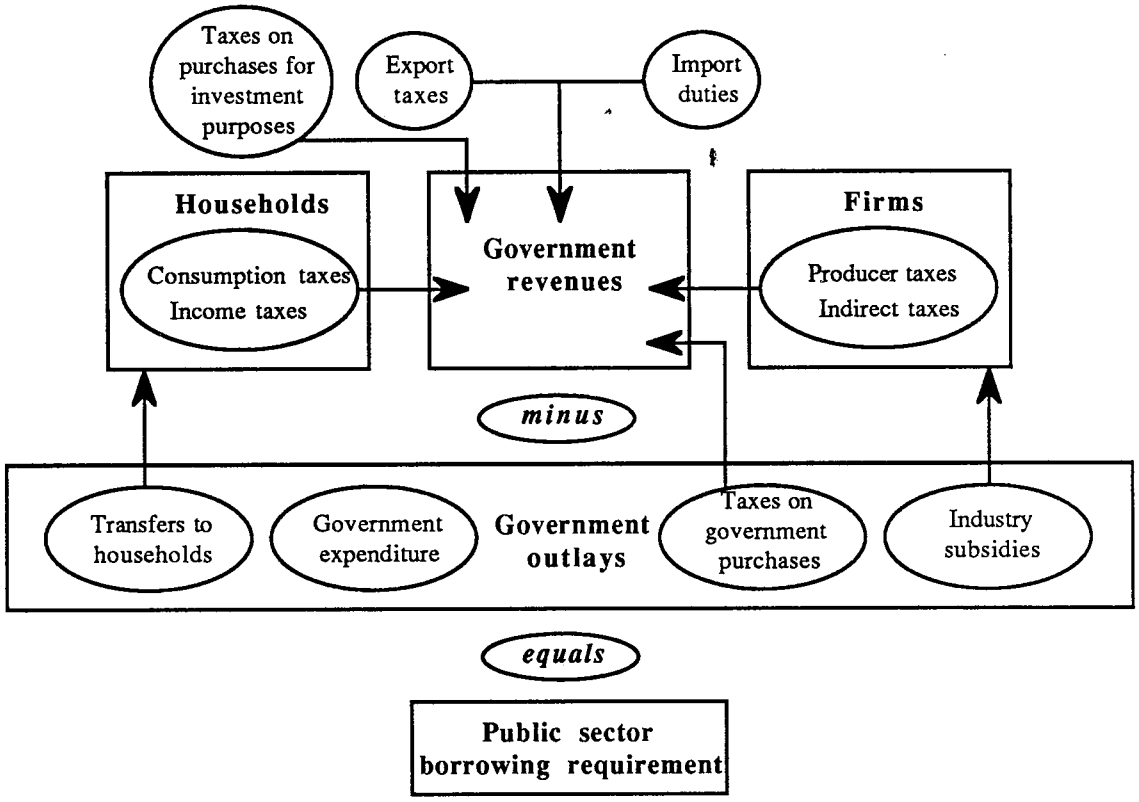
- a government block which keeps track of government revenues and expenditures;
- a macroeconomic block which keeps track of national accounting aggregates;
- a production block describing how each industry produces its output and the costs of these outputs; and
- a final demand block which determines how consumers allocate their budget among alternative consumer goods, the government allocates its revenues among commodity purchases, investment expenditures are allocated to commodity purchases, and export demands are satisfied.

The interactions between various economic agents in the model give rise to commodity flows and income transfers that are a function of each modelled region's characteristics. These characteristics are based on different endowments in primary factors and different production technologies. In addition to these productive characteristics regions differ according to consumers' tastes and preferences as well as the structure of government and investment demands.

The government sector

A number of income transfers occur between the private and government sectors (box A2). The government collects taxes from households in the form of income taxes and taxes on consumer purchases. In return, it redistributes income by distributing transfers to households. Ad valorem taxes are levied on all other purchases of commodities, that is, on purchases by producers and the government, and for investment purposes. In each region, governments also collect taxes on international trade as duties may be imposed on imports, and taxes may affect

Box A2: **Fiscal flows in the SALTER model**



IC Chart.

exports. In addition to transfers to households, total government outlays include the provision of subsidies to selected industries and the purchase of commodities.

The difference between total outlays and the government's revenues obtained through taxes constitutes the public sector's borrowing requirement. This is the amount the government must borrow in order to cover the difference between its outlays and revenues.

The external environment in the SALTER model

The external and internal macroeconomic constraints imposed on the model are depicted in box A3. As currently specified the model takes no account of net income payments paid overseas. Thus in the model the balance on the current account consists solely of movements in the balance of trade which is influenced by movements in both the volume of net exports (exports less imports) and the price of net exports.

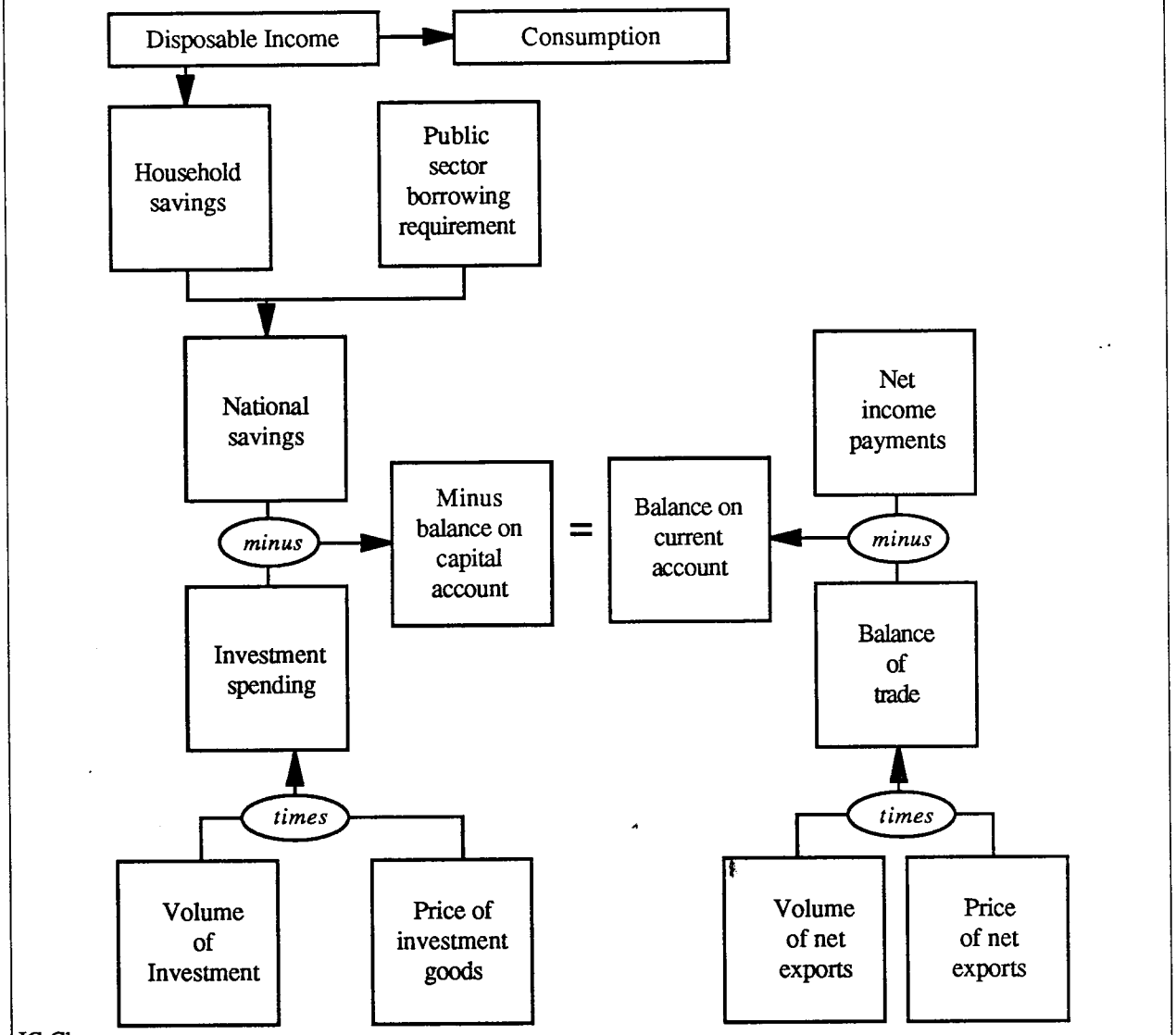
The balance on the capital account is equal to national saving minus gross investment. Investment spending is influenced mainly by movements in the price of investment goods as gross investment is held fixed in the current range of simulations. This is to ensure that gross investment maintains a fixed relation to the gross capital stocks of the economy which are also held fixed.

Movements in national savings consist of movements in household savings plus movements in the public sector borrowing requirement. In most medium term simulations the public sector borrowing requirement is held fixed and household savings are assumed to be a fixed proportion of household disposable income. Under these assumptions movements in the balance on the capital account are largely driven by movements in disposable income and hence household saving.

Production

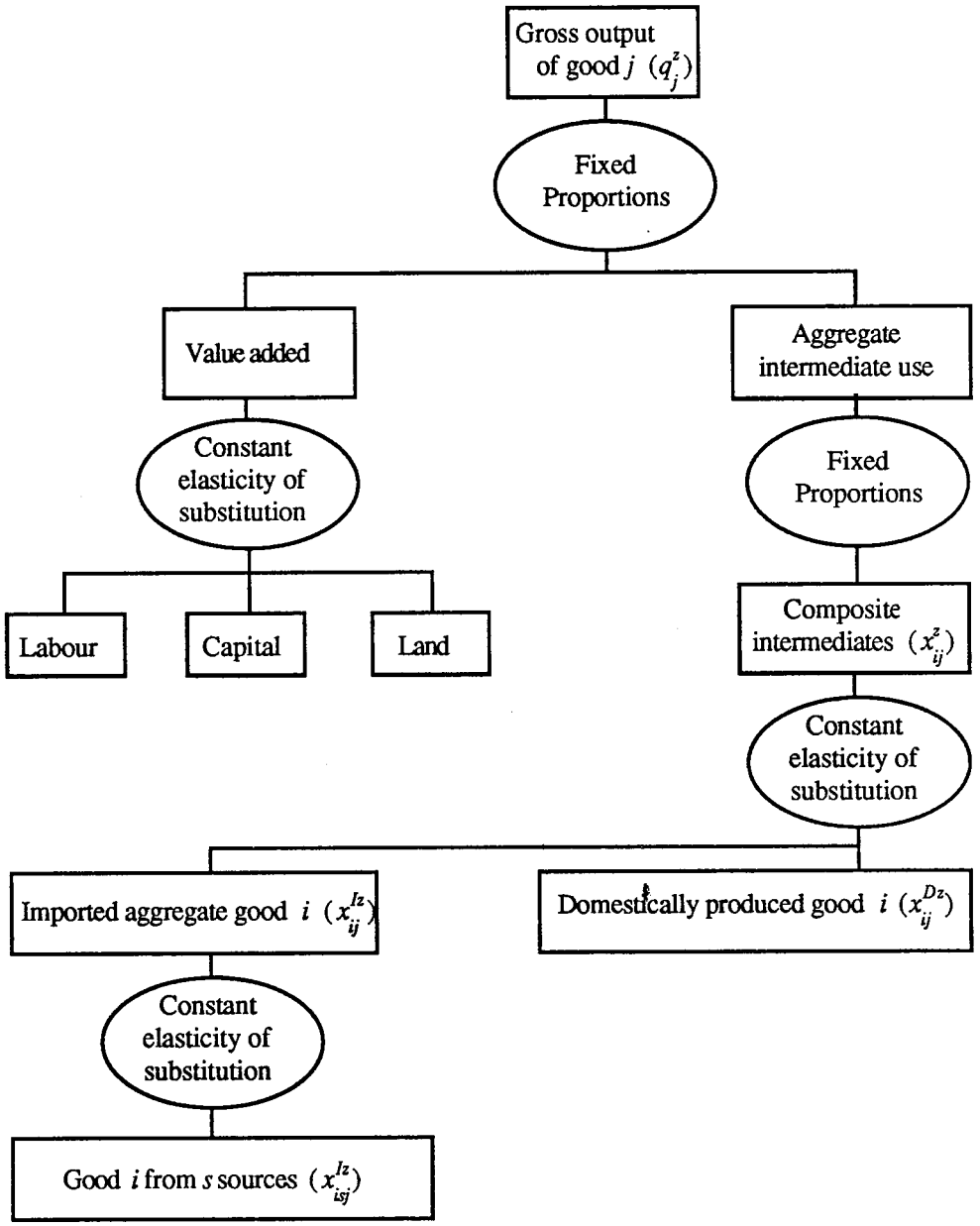
Production activities in each region are structured around single-output industries. These industries are listed in box A1. Six industries produce agricultural commodities, and there are five natural resource based industries. Food processing is disaggregated into 4 industries, while the textile sector is composed of three industries. The other industries compose the industrial manufacturing and services sectors.

Box A3: **National accounting identities embodied in the SALTER model**



The structure of input demand for each industry is described in box A4. A representative firm in each region is assumed to combine a bundle of intermediate inputs with a fixed proportion of primary factors in order to produce one of the outputs listed in box A1. Components of value added — labour, capital and land — are combined using a constant elasticity of substitution technology. The intermediate input aggregate is formed in fixed proportions of intermediate composite commodities. Demands for intermediate inputs are disaggregated into demand for domestic and imported commodities and demand for imports is itself disaggregated into demand for imports from different regions.

Box A4: **Structure of production in a single-output industry of the SALTER model**



IC Chart.

The choice between imports and domestically produced commodities and among imports is made assuming that producers minimise the cost of the bundle of intermediate commodities needed in production. The cost minimising opportunities are described by constant elasticity of substitution functions.

Technological change variables can be used to reflect productivity improvements in the use of intermediate inputs or primary factors due to technological or institutional change.

Final Demands

There are four components of final demand in each region modelled:

- consumer demand;
- government demand;
- demand for investment; and
- export demand.

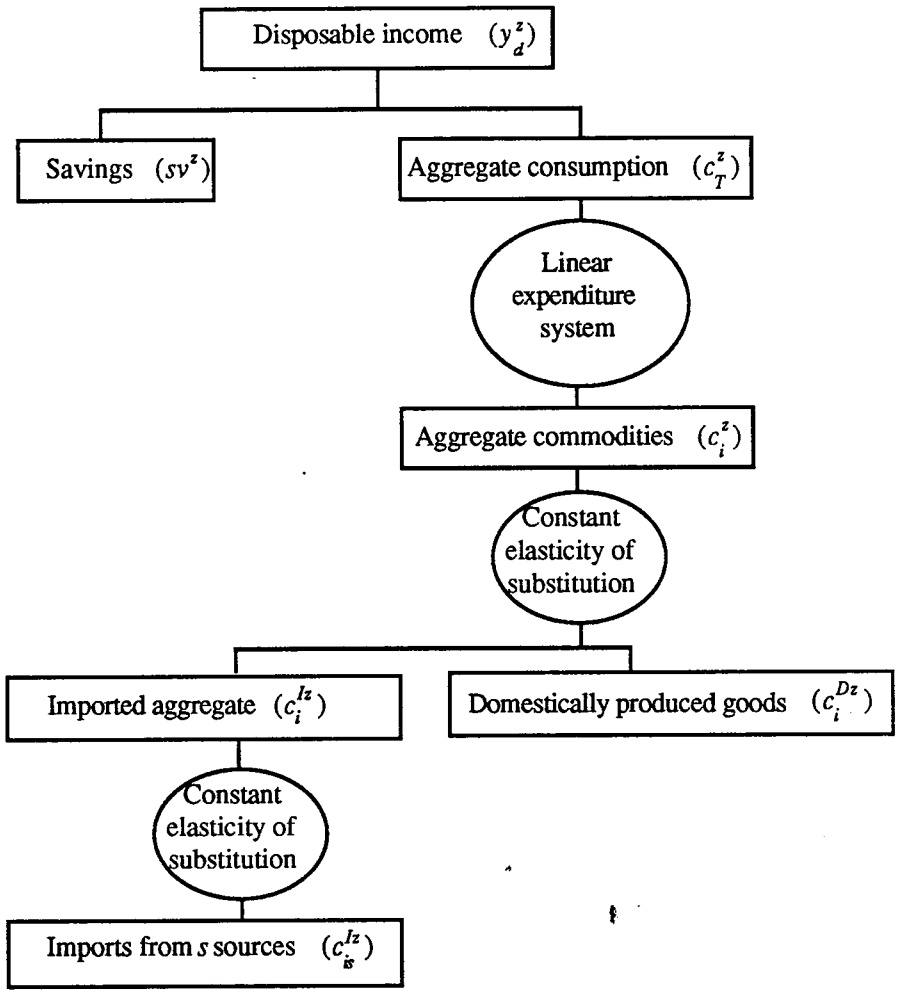
The structure of consumer demand is illustrated in box A5. In each region, a single representative consumer is assumed to maximise utility from the consumption of goods and services and savings. In the short run, nominal disposable income is assumed to be devoted in fixed proportions to savings or consumption expenditures. Consumption expenditures in turn are composed of composite goods using the assumptions underlying a linear expenditure system (see Phlips 1974, for an exposition of this expenditure system). The goods available for consumption are composites of domestic and imported commodities from various sources.

Consumer goods imported from different regions are assumed to be imperfect substitutes for the domestically produced goods and imperfect substitutes for each other. This results in the double level of aggregation using constant elasticity of substitution functions similar to the choices available to producers. Thus, consumer demand for aggregate commodities is assumed to be a function of consumer prices, and aggregate consumption expenditure, and are ruled by the own-price and cross-price elasticities of the commodity and its elasticity to aggregate consumption expenditures.

Demands for commodities by the government and for investment purposes follow the same basic structure as consumer and intermediate demands. However, commodity demands by the public sector are assumed to be a fixed proportion of real government spending on commodities. Investment demand for each composite commodity is a fixed proportion of aggregate real investment which is held fixed in most simulations.

For each modelled region, demands for exports are satisfied with domestically produced commodities. The demand for exports in one region is composed of the sum of import demands

Box A5: **Structure of consumer expenditure and savings in the SALTER model**



IC Chart.

for commodities from this region by other modelled regions and the rest of the world. It is therefore sensitive to relative export prices which are related to the prices paid by different users in the other regions and the rest of the world.

Trade links between regional models

The eight regional sub-models are linked through commodity flows between each other and with the rest of the world. These commodity flows are the imports and exports of commodities shown in box A1. Following Armington (1969), domestic and imported commodities are assumed to be imperfect substitutes for each other. In furthering the practical applications of his model, Armington assumes the elasticity of substitution between domestic commodities and

imports from different sources to be constant, constraining the elasticity of substitution between domestic and imported commodities. By contrast, a nested constant elasticity of substitution structure is assumed in the SALTER model, allowing the user to specify substitution parameters between imported and domestic commodities and among imports from different sources independently: each composite commodity is a constant elasticity of substitution function of domestic and imported commodities. Imports of each commodity are further disaggregated according to the source or region from which they are imported, and can be substituted at a constant rate. This latter nesting structure allows for different rates of substitution between imports and domestic commodities and among imports from different sources. This aggregation structure applies to both demands for intermediate inputs and final demands.

The international trade component of the model is completed by specifying a rest of the world aggregate which determines import demands, but has no consumption or production structure. Thus only the aggregate excess demands and excess supplies of the countries included in the rest of the world are represented in the SALTER model.

The nature of the experiments

The model is comparative static; that is, it is used to compare different possible states of the world economy at a single point in time, rather than to show changes over time. The results of a trade liberalisation experiment, for example, represent not what would happen over time if trade were liberalised, but how different the world economy would be at some future time if trade were liberalised, as compared to if liberalisation did not take place.

The model can be solved by either a linear or a nonlinear procedure. The linear procedure can provide only an approximate solution; for small shocks, the approximation may be close, but for large shocks, such as those involved in agricultural trade liberalisation, it may be very inaccurate. Accordingly, the main results presented in this volume are obtained through the more time-consuming nonlinear procedure. But the linear procedure has advantages besides that of speed; in particular, it has the property that the effect of a combination of shocks is equal to the sum of the individual shocks. Therefore some supplementary results are presented which have been obtained with the linear procedure; these are used to show, for a small uniform reduction in current trade interventions, the importance of the separate contributions of agricultural trade and manufactures trade liberalisation, and the importance of trade liberalisation by individual regions.

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