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V. ESTIMATED GAINS FROM MULTILATERAL TRADE LIBERALIZATION

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V. ESTIMATED GAINS FROM MULTILATERAL TRADE LIBERALIZATION

There have been a number of attempts to estimate in quantitative terms the potential gains from trade liberalization. Most of the recent work aimed at assessing *ex-ante* the effects of trade policy reform is based on computable equilibrium models. Given a (partial or general equilibrium) model to represent the economies under study, the objective is to determine the change in the main endogenous variables (e.g. trade flows, consumption and production) associated with exogenous changes in policy variables (e.g. tariffs), assumed to be exogenous. The link between endogenous variables and policy variables is a complex one, which is shaped by the assumed structure of the model (number of equations, functional forms, etc.) and the numerical value of a set of relevant parameters (e.g. technology parameters, demand elasticities, etc.).[1] The models used for this kind of analysis differ widely. A model can be a partial or general equilibrium one, may account for many effects (e.g. non-constant returns to scale in production) or only few of them, may be defined at a high level of country and sector disaggregation or provide only an aggregate representation.[2]

The systematic use of CGE models to simulate the effects of trade negotiations started during the Tokyo Round (see, e.g. Deardoff and Stern, 1981; Whalley, 1985). Rapid progress has been made since then, as regards both modelling and data collection and assembly. Results from CGE simulations had a wide echo before the conclusion of the Uruguay Round, and contributed to a certain extent to persuading the GATT contracting parties to conclude the Round, showing that nearly all countries would have lost opportunities from a failure to reach agreement (see the surveys of Harrison, Rutherford and Tarr, 1996 and Francois, McDonald and Nordström, 1993, 1994).[3]

In recent years, several CGE analyses of the effects of trade policy reforms in a future WTO Round have been produced. Some of them only consider agricultural liberalization, other include manufacturing tariff reform. Only a few analyses consider the impact of service trade liberalization, mainly because of poor data on trade flows in the services sector and poor measurement of service trade barriers. Table 11 summarizes the findings of recent CGE work concerning the global gains associated with future possible trade liberalization scenarios. Results differ quite widely, especially when broad liberalization scenarios are considered (i.e., when manufacturing and services liberalization are included).[4] The sources of the discrepancies are several. Much of the difference in the estimated gains is to be attributed to a different assessment of the liberalization prospects. Some studies assume deeper or more comprehensive cuts in trade barriers than other. Results are also sensitive to the model specification. In particular, liberalization gains are higher in models allowing for increasing returns to scale and imperfect competition in the manufacturing sector. The gains are further enhanced in specifications allowing for dynamic effects of trade liberalization, associated with trade-related changes in savings and investment or with developments in productivity. A further motive for differences in results has to do with the chosen baseline. In most recent studies it is used the GTAP dataset used to replicate the world economy. The most updated versions of the dataset tend to yield lower estimates of the liberalization effects since the status-quo level of trade barriers is lower. Finally, the estimates from CGE models are quite sensitive to their dimensionality (the number of sectors and regions considered), the chosen values for elasticity parameters and the followed closure rule.[5]

It is worth noting the very large gains that have been estimated for liberalization of trade in services (Brown, Deardoff and Stern, 2001, World Bank, 2001). These large gains are due to two basic reasons. First, services account for a large share in consumption in most middle and high-income countries, much larger for instance than that of agriculture. Second, services are major inputs in the production of manufactures (and of services themselves). Hence, any trade-related reduction in the prices of services will translate into a widespread productivity gain for liberalizing economies. For these reasons, CGE models tend to yield high gains from the liberalization of the service sector, especially when trade-induced effects on productivity are taken into account (see, e.g., World Bank, 2001). However, it should be noted that the CGE modelling of liberalization in the service is still very tentative. The limitations of these exercises are not only found in the lack of reliable and comprehensive data on trade flows and trade barriers in services, but also in the difficulties encountered in making operational such measures in CGE analysis and in adequately representing the major links through which trade liberalization in service trade affects the whole economy.

A final caveat to be mentioned with the use CGE models concerns the usual assumption of efficient factor markets and the neglect of supply-side rigidities and bottlenecks. In developing countries factor markets are far from being efficient (mainly due to underdeveloped institutions and imperfect sectoral mobility) and supply rigidities are quite widespread. Ignoring these characteristic features of developing economies may lead to an overestimation of the short-run allocation gains associated with trade liberalization.

Table 11. Estimates of global welfare effects of multilateral trade liberalization

	Model and dataset*	Policy experiments	Welfare change (US$b. p.a.)**
Anderson, Hoekman, and Strutt, 1999	Model: Static, perfect competition Dataset: GTAP3	Full liberalization in all countries in all sectors	260
Nagarajan, 1999	Model: Static, increasing return to scale and imperfect competition in manufacturing Dataset: GTAP4	50 per cent cut in agricultural protection and implementation of additional trade facilitation measures	385
Dessus, Fukasaku, and Safadi, 1999	Model: Dynamic, perfect competition Dataset: GTAP4	Full merchandise trade	284 (exogenous productivity) 1210 (endogenous productivity)
Hertel et al., 1999	Model: Dynamic, constant returns to scale and perfect competition Dataset: GTAP4	40 per cent cut in agricultural tariff, export and production subsidies	70
Anderson et al., 2000	Model: Static, constant returns to scale Dataset: GTAP4	Full liberalization in agriculture Full merchandise trade liberalization	164 253
ABARE, 2000	Model: Static, perfect competition Dataset: GTAP5	50 per cent cut in agricultural support 50 per cent cut in agricultural support and 50 per cent reduction of import protection in all other sectors	53 (GDP in 2010) 94 (GDP in 2010)
Francois, 2000b	Model: Dynamic, monopolistic competition and imperfect competition in manufacturing, increasing returns from input variety Dataset: GTAP4	50 per cent cut in agricultural protection 50 per cent cut in agricultural, merchandise and service protection	27 (monopolistic competition) 21 (oligopoly) 384 (monopolistic competition) 233 (oligopoly)
Diao, Somwaru and Roe, 2001	Model: Static and dynamic with technological spillovers, constant returns to scale Dataset: GTAP5	Full removal of agricultural tariffs and in domestic agricultural support	31 (static version) 56 (dynamic version)
Scollay and Gilbert, 2001	Model: Dynamic, imperfect sectoral labour mobility Dataset: GTAP4	100 per cent cut in agricultural tariffs	69.43
World Bank, 2001	Model: Static and dynamic, constant returns to scale Database: GTAP5	100 per cent cut in merchandise protection 100 per cent cut in service protection	355 (static version) 830 (dynamic version) 1073 (developing countries only, static version)
Brown, Deardorff and Stern, 2001	Model: Static, increasing returns to scale, and monopolistic competition in manufacturing Dataset: GTAP4	100 per cent cut in agricultural tariffs 100 per cent cut in all merchandise and service protection	33 1857
Van Meijl and Van Tongeren, 2001	Model: Static, perfect competition Dataset: GTAP5	100 per cent cut in agricultural tariffs and in domestic agricultural support 100 per cent cut in merchandise protection	44.4 78.3

* Data in the GTAP3, GTAP4 and GTAP5 databases are referred to, respectively 1992, 1995, and 1997.
** If not specified otherwise, welfare changes are measured by Equivalent Variation changes, i.e. by the money transfers necessary to make individual consumers indifferent between the status quo and the post-reform situation.

Notwithstanding the notable differences in results from different CGE analyses, it is possible to identify a number of common findings. First of all, the global welfare results concerning agricultural liberalization are quite similar across models and studies. This convergence of estimates for agricultural liberalization is to a large extent due to a consensus of modelling agriculture as a constant returns to scale sector where trade-related dynamic gains are quite limited. A second noteworthy common feature of static, constant returns to scale CGE models is that the global gains associated with (full) agricultural liberalization are not very different from those originating from trade liberalization in manufactures. Concerning the source of the gains, almost all studies show that the major source of the gains accruing to each country is its own liberalization, rather than that of partner countries.[6] As for the distribution of the global gains between developed and developing countries, in the majority of the studies it was found that the gains are shared quite equally between the two groups. Among developing countries, Asian countries will reap the largest gains (especially if manufacturing is also liberalized), while the gains for Latin American and African countries will be more limited. A further notable result found in several analyses are possible losses for sub-Saharan countries associated with agricultural liberalization, markedly with terms-of-trade developments consequent upon export subsidies removal.[7]

A consensus is emerging among modellers that, owing to the robustness problems described above, results from CGE analysis should be interpreted more in a qualitative than in a quantitative sense, and that putting too much emphasis on specific numbers and figures should be avoided (see, e.g., Francois, 2000a), for a discussion).

As may be observed, the estimated gains to global economic welfare on an annual basis vary widely according to the database, the assumptions of the model and the policy experiment (i.e. the trade liberalization scenario). Table 11 does not give a breakdown of the effects on developing countries; however, experience from a variety of modelling exercises shows that developing countries capture about 40 per cent of the gains, but these are not evenly distributed. In agriculture important gains go to those countries that liberalize, including the European Union and Japan. Developing countries that are exporters of commodities also make significant gains in relation to the level of their production. The textiles and clothing sectors are also very important, with important gains for China and other exporters. Estimates of the potential gains from liberalization of the services sector are substantial: while trade in services as a share of GDP is modest in most cases, the sector is important in most economies (and becomes larger as economies develop) and changes in trade policies in this sector therefore have far-reaching effects.

A. Current simulations

In this section, the effects on the world economy of alternative liberalization scenarios are evaluated using CGE techniques, focusing on merchandise trade, particularly agriculture, for which the effects of both tariffs and export subsidies are analysed. The scenarios considered should not be regarded as an attempt to reproduce closely the outcome

of the current WTO trade negotiations.[8] Rather, the aim is to define a range for the possible magnitude of gains and losses associated with possible trade policy reforms that may be implemented in the years ahead and to assess how these gains and losses might be distributed across countries. Two main features characterize the following analysis with respect to previous studies. First, the status quo protection figures take into account the existence of preferential tariff schemes associated with non-reciprocal arrangements (e.g. the GSP) and with all major regional trade arrangements. Second, the eventuality of non-reciprocal liberalization in agriculture is considered, on the basis of the fact that WTO commitments concern the level of bound tariffs, and that for many developing countries actual tariffs in agriculture are quite lower compared with bound rates.

The model used in the simulation is the standard static GTAP model, with perfect competition in all sectors and constant returns to scale.[9] The database is GTAP5, final release, modified by UNCTAD to account for tariff preferences (related to GSP, non-reciprocal agreements as the Lomé-Cotonou agreement, and regional trade agreements) available from the UNCTAD TRAINS database. In spite of the well-known limitations of standard CGE models (absence of dynamic effects, perfect market clearing, lack of robustness with respect to model parameters, and so on), they are useful tool for assessing an order of magnitude for the distribution of gains and losses of trade liberalization, especially when the major trade reforms are assumed to take place in agriculture. In the experiment, the structure of the model is kept simple, so that liberalization gains and losses emerging from simulation analysis are easy to interpret, being associated with changes in allocation efficiency and in the terms of trade. While sectors will be kept quite aggregate, countries will be relatively disaggregated in the analysis, and will be grouped according to geography and level of development (see tables 22 and 23 for the description of sectoral and regional aggregations).

Results indicate that a 50 per cent reduction of tariffs in agriculture would increase world welfare by about $20 billion, a figure that is in line with those obtained in recent studies. All world regions would gain from agricultural liberalization. As found in previous analyses, the elimination of tariffs is by far more important in improving the allocation of resources than the elimination of export subsidies.[10] Moreover, the elimination of export subsidies, if not coupled with tariff liberalization, would hurt some world regions, especially African countries. Finally, extending liberalization to all merchandise trade would almost double world gains and would benefit developing countries in particular (as found, e.g., in Hertel and Martin, 2000). However, the distribution of gains and losses from a comprehensive liberalization scenario would be very unequal across different groups of developing countries. While most Asian countries would gain substantially if tariff cuts in manufacturing were added to liberalization in agriculture, sub-Saharan Africa would incur market share losses and negative terms-of-trade developments.

The main focus of the experiments is on agricultural liberalization, which is both part of the built-in WTO agenda and one of the major pillars of the Doha agreement. As noted earlier, it is from liberalization in agriculture that most LDCs and many developing countries can obtain the largest export gains. The aggregation of six sectors and 12 world

regions is chosen in order to isolate the sectors most likely to be greatly affected by trade liberalization, allowing for an analysis of the effects of tariff escalation in agriculture and aggregation of countries to the smallest number of regions with some degree of geographical and economic homogeneity.

The protection data from the GTAP database that form the basis of the simulation experiments are shown in tables 4 and 5. These are, respectively, the simple averages of the tariffs applied by the chosen geographical aggregates and of those faced by their exports. They are based on applied MFN tariffs and the *ad valorem* equivalents for non-tariff protection in agriculture and in textiles and clothing.[11] Thus, GTAP protection data provide a convenient *ad valorem* assessment of most of the trade barriers currently used by Governments. Two caveats are to be entered, however. First, preferential tariff rates in the GTAP database are limited to a number of major reciprocal regional trade arrangements (e.g. EU, EFTA and NAFTA) and no account is taken of non-reciprocal preferential arrangements with development purposes. To correct for this, UNCTAD has modified the database from its TRAINS database to take into account the large share of preferential trade occurring in developing countries. Second, the database covers only applied tariffs, and not the bound rates that are the subject of multilateral negotiations.

A close look at table 4 helps in understanding the simulation results. Worldwide, protection appears to be concentrated in agriculture and textiles and apparel. The only areas that heavily protect other manufacturing are South Asia, Africa, transition economies and Latin America. In general, processed agriculture is much more protected than primary agriculture (a notable exception are Asian NICs). Those regions that protect agriculture more are Western Europe, Japan and North Africa. Textiles are particularly protected in South Asia, sub-Saharan Africa and Latin America. Finally, table 5 shows that the areas that face higher protection against their agricultural exports are China, Oceania and North America. In manufacturing, the regions that suffer the highest protection are Japan and China, whereas in textiles it is China, Asian NICs and transition economies.

In the first experiment, a worldwide reduction of 50 per cent in all agricultural tariffs brings about an aggregate welfare gain of $21.5 billion (table 12). This estimate is in line with those recently produced using the GTAP5 database. All the world regions appear to gain, but gains differ widely both in absolute and in relative terms. The largest absolute gains are captured by Japan, North America, the NICs, North Africa and the Middle East, and Oceania. In percentage terms, those regions that appear to gain most are Oceania, the Asian NICs and North Africa. The estimated percentage gain for sub-Saharan Africa and Latin America is lower than in other studies conducted under similar assumptions (e.g., Diao, Somwaru, and Roe, 2001; van Meijl and van Tongeren, 2001). This is likely because of the inclusion of tariff preferences in the protection database used by UNCTAD. Since Africa and Latin America are among the major beneficiaries of preferential schemes, it seems likely that the gains from liberalization for these countries in other studies could be overstated when full account is not taken of tariff preferences as has been done here.

Table 12. Agricultural tariff liberalization – welfare changes

Regions	Values (1997 US$ million)			
	Percentage change	Total	Terms of trade effect	Allocative effects
Asian NICs	0.342	3 363.6	-417.2	3840.4
China	0.082	964.0	-379.1	1 387.6
South Asia	0.074	361.2	-205.0	599.5
Western Europe	0.021	1 562.1	26.1	1574.0
North America	0.046	3 613.3	3 046.7	520.9
Transition Economies	0.118	900.8	-97.4	1 023.9
Sub-Saharan Africa	0.072	226.2	-197.0	437.2
Oceania	0.419	1 719.8	1 646.7	76.4
North Africa and Middle East	0.387	3 033.8	-1 720.7	4 867.5
Latin America	0.073	1 304.7	173.8	1 126.9
Japan	0.116	4 221.2	-2 029.8	6 019.8
Rest of the world	0.110	277.1	108.0	155.0
Total		21 547.9	-44.9	21 629.0

(50 per cent cut in all agricultural tariffs)

Looking at aggregate trade indicators (table 13), the value of exports increases in all regions after liberalization. Lower worldwide protection in agriculture translates into increased worldwide import demand and improved trade opportunities in all areas. Not all regions, however, profit equally from the increased trade potential. While the value of exports increases considerably in relative terms in Africa, Oceania and Latin America, export gains are quite modest for Western Europe.[12] As for terms-of-trade changes, the improvement is substantial for Oceania, while the biggest losses are observed in Japan, North Africa and South Asia.

Table 13. Agricultural tariff liberalization – aggregate trade data

Regions	Percentage change	
	Exports	Terms of trade
Asian NICs	0.888	-0.072
China	1.199	-0.083
South Asia	1.954	-0.302
Western Europe	0.476	0.006
North America	0.914	0.266
Transition economies	1.474	-0.045
Sub-Saharan Africa	1.810	-0.210
Oceania	2.299	1.833
North Africa and Middle East	2.829	-0.595
Latin America	1.708	0.056
Japan	1.763	-0.392
Rest of the world	2.248	0.223

(50 per cent worldwide cut in tariffs on processed agriculture)

The second experiment is the elimination of export subsidies in agriculture, without parallel changes in tariffs.[13] The results show modest worldwide welfare losses (table 14).

Table 14. Liberalization in agriculture: export subsidy removal – welfare changes

Regions	Values (1997 US$ million)			
	Percentage change	Total	Terms of trade effect	Allocative effects
Asian NICs	-0.008	-73.9	-44.0	-10.9
China	-0.015	-178.8	-53.8	-96.4
South Asia	-0.000	-1.9	54.1	-56.3
Western Europe	0.033	2 410.0	1 699.7	628.8
North America	-0.001	-88.0	94.6	-182.1
Transition economies	-0.117	-891.5	-515.1	-374.1
Sub-Saharan Africa	-0.113	-354.9	-165.0	-192.3
Oceania	0.024	100.1	107.3	-3.6
North Africa and Middle East	-0.283	-2 209.7	-881.5	-1 329.5
Latin America	0.004	80.3	82.3	-29.6
Japan	-0.013	-484.9	-251.0	-170.2
Rest of the world	-0.063	-158.7	-124.8	-43.2
Total		-1 851.7	2.8	-1 859.3

These losses are mainly associated with a worsened allocation of resources within countries, because the elimination of export subsidies would not necessarily improve the allocation of resources while other major distortions remain in place. After the elimination of subsidies, all regions except Europe start increasing their agricultural value-added.[14] However, since many countries still face high protection against their agricultural exports, this shift might be counterproductive. Most regions actually stand to lose from the elimination of subsidies, while the gains appear to be very concentrated in Western Europe – which is the area characterized by the highest value of initial subsidies – and in regions that are net agricultural exporters, such as Oceania and Latin America.[15] Western Europe gains both from better resource allocation (the elimination of subsidies brings the specialization pattern of this region more into line with its natural comparative advantages) and from improved terms of trade. The removal of export subsidies directly reduces the agricultural exports of Western Europe, thus leading to a lower world supply for these goods and to improved terms of trade for Europe, whose exports are sold now at higher prices on international markets. As for the terms-of-trade effects on the other regions, they depend on their agricultural export pattern. Countries that are net agriculture and food exporters (e.g. North America, Oceania and Latin America) are likely to gain, while those that are not may lose (e.g. Asian NICs and North Africa).

Aggregate trade data (table 15) show that trade flows are reduced in some regions and increased in others by the elimination of subsidies. The largest percentage drop in exports occurs in sub-Saharan Africa and in Western Europe. Western Europe exports drop because of the direct effect of the elimination of export subsidies. The fall in sub-Saharan Africa's exports is mainly associated with reduced agricultural imports in Western Europe

Table 15. Liberalization in agriculture: export subsidy removal – aggregate trade data

Regions	Percentage change	
	Exports	Terms of trade
Asian NICs	0.008	-0.007
China	0.006	-0.013
South Asia	0.125	0.082
Western Europe	-0.124	0.065
North America	-0.013	0.013
Transition economies	-0.056	-0.172
Sub-Saharan Africa	-0.234	-0.161
Oceania	0.107	0.119
North Africa and Middle East	-0.148	-0.296
Latin America	0.056	0.035
Japan	-0.047	-0.061
Rest of the world	-0.225	-0.189

coming from that region. In fact, after the elimination of export subsidies, agricultural imports (in value) fall in the EU (owing to a reduced difference between domestic and world prices), and the region suffering most from that is Africa, for which the European market is traditionally of great relevance. Conversely, the exports of Latin America, Oceania and South Asia increase substantially in value, mainly as a result of improved terms of trade (higher world prices for agricultural products).[16]

In the third experiment, intended to look at the effects of tariff escalation in agriculture, tariffs are reduced by 50 per cent on processed agriculture only. Under this scenario, the global gains are roughly half those obtained from the liberalization of all agricultural sectors (table 16). The distribution of the gains are however quite different. While North America, Oceania and all Asian regions receive gains that are considerably smaller than those arising under the liberalization of all agricultural sectors, Africa and Latin America

Table 16. Liberalization in agriculture: the role of tariff escalation – welfare changes

Regions	Percentage change	Values (1997 US$ million)		
		Total	Terms of trade effect	Allocative effects
Asian NICs	0.101	994.9	212.6	804.7
China	0.04	475.4	-271.0	761.9
South Asia	0.047	230.7	-167.0	418.3
Western Europe	0.022	1 613.2	936.2	742.4
North America	0.018	1 415.7	946.5	478.1
Transition economies	0.098	750.0	-97.1	857.7
Sub-Saharan Africa	0.049	153.0	-207.9	372.2
Oceania	0.232	951.4	899.4	51.9
North Africa and Middle East	0.26	2 036.4	-1168.5	3 274.6
Latin America	0.057	1 013.8	143.6	867.6
Japan	0.058	2 127.0	-1323.8	3 253.5
Rest of the world	0.096	242.1	80.2	140.4
Total		12 003.4	-17.0	12 023.3

(50 per cent worldwide cut in tariffs on processed agriculture)

obtain gains of a similar size, and Western Europe even finds the option of limiting liberalization to processed agriculture preferable. The smaller gains for South Asia than under the full liberalization scenario are explained by the high level of protection in primary agriculture in that region (table 4). Limiting liberalization to processed agriculture results in larger terms-of-trade gains for Western Europe, which compensate for smaller gains in allocative efficiency. As for North America and Oceania, the lower gains than under the full liberalization scenario are mainly due to unexploited terms-of-trade gains: both regions are net exporters of primary agriculture and would gain from its liberalization in terms of better export prices (compare table 17 with table 13). Finally, the fact that the African and Latin American regions appear to gain mostly from liberalization in processed agriculture is associated with the heavy protection faced by their processed agriculture and food exports, especially in Western Europe and Japan. These findings therefore support the thesis that developing countries bear the larger share of costs arising from tariff escalation in agriculture.

Table 17. Liberalization in agriculture: the role of tariff escalation – aggregate trade data

Regions	Percentage change	
	Exports	Terms of trade
Asian NICs	0.578	0.037
China	0.697	-0.059
South Asia	1.215	-0.243
Western Europe	0.340	0.038
North America	0.403	0.080
Transition economies	1.150	-0.039
Sub-Saharan Africa	1.324	-0.220
Oceania	1.425	1.003
North Africa and Middle East	1.706	-0.408
Latin America	1.042	0.042
Japan	1.196	-0.255
Rest of the world	1.843	0.183

(50 per cent worldwide cut in tariffs on processed agriculture)

Many developing countries apply agricultural tariffs that are well below the values bound as a result of the Uruguay Round negotiations. The fourth experiment, therefore, consists of a liberalization scenario in which developing countries, either because they are already applying rates lower than the bound ones, or for some other reason, are not reducing their applied tariffs in agriculture. A "broad" definition of developing country is considered: only Western Europe, North America, Japan and Oceania are treated as developed. Only these regions will be those to undertake a 50 per cent cut in their agricultural tariffs. Under this scenario, there is a considerable reduction in global gains compared with those arising from a worldwide tariff cut (table 18). Under the assumptions of the model, developing countries would not benefit from not participating in liberalization. Thus in this scenario, the larger share of the gains are captured by Japan, Oceania and North America. In spite of the fact that all developing countries would benefit from improved terms of trade (the better market access conditions in developed countries are not reciprocated), the allocation gains are so small that no developing country would benefit by not joining agricultural liberalization. While non-reciprocal liberalization can be helpful to beneficiary countries when targeted to a restricted number of beneficiaries, owing to a "fallacy of composition" argument the positive effects on terms of trade are almost negligible when the beneficiaries

Table 18. Non-reciprocal tariff liberalization in agriculture – welfare changes

Regions	Values (1997 US$ million)			
	Percentage change	Total	Terms of trade effect	Allocative effects
Asian NICs	0.054	530.7	371.7	212.1
China	0.022	256.4	256.4	69.4
South Asia	0.000	-0.6	53.0	-42.8
Western Europe	0.003	220.7	-2158.7	2381.9
North America	0.017	1 333.2	956.8	463.9
Transition economies	0.071	545.5	410.4	129.5
Sub-Saharan Africa	0.054	168.7	125.7	43.0
Oceania	0.369	1 512.2	1447.3	70.2
North Africa and Middle East	0.003	26.0	54.9	-14.6
Latin America	0.045	812.9	578.8	215.2
Japan	0.109	3 984.6	-2272.1	6077.4
Rest of the world	0.096	241.8	151.9	49.3
Total		9 632.1	-23.8	9654.6

(50 per cent cut in all agricultural tariffs operated by developed countries only)

are the developing countries as a whole.[17] Thus, all regions are worse off compared with the case of a tariff reduction implemented worldwide. Interestingly enough, those regions that lose more with respect to worldwide liberalization are not developed countries, but some highly protected developing regions that do not have a comparative advantage in agriculture, such as Asian NICs, South Asia and North Africa. Looking at export changes (table 19), it may be noted that, by not liberalizing, developing countries compromise their own export expansion possibilities, since resources remain employed in import-competing sectors. The increase in the exports of each developing region is greater when liberalization occurs worldwide.

Table 19. Non-reciprocal tariff liberalization in agriculture – aggregate trade data

Regions	Percentage change	
	Exports	Terms of trade
Asian NICs	0.067	0.065
China	0.130	0.060
South Asia	0.263	0.080
Western Europe	0.369	-0.078
North America	0.556	0.084
Transition economies	0.204	0.146
Sub-Saharan Africa	0.193	0.131
Oceania	1.968	1.612
North Africa and Middle East	0.031	0.018
Latin America	0.342	0.176
Japan	1.495	-0.456
Rest of the world	0.933	0.365

(50 per cent cut in all agricultural tariffs operated by developed countries only)

Finally, under the fifth scenario there is a worldwide 50 per cent reduction of all merchandise tariffs. This results in a global welfare gain that is almost double that arising from liberalization in agriculture only (table 20).[18] The big gainers from adding manufacturing liberalization to agriculture liberalization are the Asian regions. Some countries, however, will not have an advantage from extending liberalization beyond agriculture. These are in particular North America, transition economies and sub-Saharan Africa, which would suffer from terms-of-trade losses by adding manufacturing liberalization. All these countries would see their market shares in textiles and clothing and other manufactures eroded by surging imports from Asia.

Table 20. A comprehensive liberalization scenario – welfare changes

Regions	Values (1997 US$ million)			
	Percentage change	Total	Terms of trade effect	Allocative effects
Asian NICs	0.674	6 636.5	1 000.5	5 467.6
China	0.424	5 017.1	31.3	4 727.2
South Asia	0.282	1 383.3	-1 282.3	2 841.4
Western Europe	0.075	5 489.6	1 537.0	2 968.9
North America	0.023	1 778.0	435.7	1 565.7
Transition economies	0.079	603.1	-1 260.8	2 080.8
Sub-Saharan Africa	0.004	13.3	-889.5	1 022.9
Oceania	0.386	1 584.1	1 310.5	233.0
North Africa and Middle East	0.476	3 735.8	-2 315.7	6 350.7
Latin America	0.079	1 414.0	-2 358.2	4 289.9
Japan	0.307	11 207.4	3 619.4	7 441.4
Rest of the world	0.281	706.3	96.9	706.9
Total		39 568.5	-75.1	39 696.4

(50 per cent worldwide cut in tariffs on all merchandise trade)

The removal of all tariff protection boosts exports in all areas (table 21). The increase is in general much stronger than that associated with the elimination of agricultural tariffs only. The pattern of changes in export values is quite clear. The biggest increases in exports occur in low- to middle-income Asian countries (China, South Asia), followed by other developing countries and by Japan and Oceania. Western Europe and North America do not achieve a major expansion of their exports.

Overall, the simulations carried out here confirm what has been found in previous studies (e.g. Hertel and Martin, 2000; Hertel et al., 1999), namely that the inclusion of manufacturing liberalization in a "comprehensive round" of negotiations would be especially interesting for the developing countries. However, while this conclusion holds for developing economies taken as a single broad aggregate, there are regions, notably sub-Saharan Africa, that might actually lose from extending liberalization from agriculture alone to all merchandise trade. It is emphasized that these results do not take into account any change in the dynamics of world trade and production that might arise from wide liberali-

Table 21. A comprehensive liberalization scenario – aggregate trade data

Regions	Percentage change	
	Exports	Terms of trade
Asian NICs	3.899	0.168
China	7.458	0.012
South Asia	12.043	-1.747
Western Europe	1.105	0.078
North America	2.591	-0.008
Transition economies	3.86	-0.483
Sub-Saharan Africa	4.59	-0.927
Oceania	4.265	1.435
North Africa and Middle East	5.004	-0.806
Latin America	5.719	-0.734
Japan	5.512	0.752
Rest of the world	8.789	0.091

(50 per cent cut worldwide cut in tariffs on all merchandise trade)

zation, but they point to the need to be prepared for possible negative effects on developing countries of the adjustment to changes in global protection.

In conclusion, the main findings from the policy experiments are as follows:

(a) Tariff cuts in agriculture would result in higher allocation gains compared with the elimination of export subsidies;

(b) The elimination of export subsidies alone would hurt some developing world regions, especially in the African region, because of increased import prices for food and reduced import demand from Europe; and

(c) On aggregate, developing countries would gain substantially from adding manufacturing liberalization to agricultural liberalization.

From the simulations emerge some new insights into the stake of different developing countries' aggregates:

(a) There is no broadly defined developing world region that would gain by not participating in agricultural liberalization;

(b) The large majority of gains accruing to low-income countries from agricultural liberalization come from the elimination of tariffs on food and processed agriculture;

(c) Sub-Saharan Africa and transition economies may not gain by adding manufacturing MFN liberalization to liberalization in agriculture only.

In summary, the analysis shows that developing countries would gain substantially from liberalization in agriculture, especially if this coincides with a reduction in the extent of tariff escalation in developed countries. Even though the level of applied agricultural tariffs in many developing countries is lower than bound levels, almost all developing world regions would gain by further reducing their applied tariffs. Thus, unless there are major difficulties in replacing reduced tariff revenues with other tax sources (and under the assumptions of the model), developing countries may well benefit from the further opening their own markets in the extended WTO negotiations (after a period of inevitable adjustment). A caveat must be entered concerning the reform of agricultural export subsidies. The present analysis supports the concerns expressed by net food-importing developing countries regarding a possible deterioration in their terms of trade. These concerns would need to be addressed by special provisions in the WTO negotiations.

Table 22. Sectoral aggregation used in simulations

Sector Aggregation	Original GTAP sectors included
Natural resources	Forestry; Coal; Oil; Gas; Minerals.
Manufactures	Wood products; Paper products, publishing; Petroleum, coal products; Chemical, rubber, plastic prods; Mineral products nec; Ferrous metals; Metals; Metal products; Motor vehicles and parts; Transport equipment; Electronic equipment; Machinery and equipment; Manufactures.
Primary agriculture	Paddy rice; Wheat; Cereal grains; Vegetables, fruit, nuts; Oil seeds; Sugar cane, sugar beet; Crops; Cattle, sheep, goats, horses; Animal products; Raw milk; Wool, silk-worm cocoons; Fishing; Meat: cattle, sheep, goats, horses.
Processed agriculture	Plant-based fibres; Meat products nec; Vegetable oils and fats; Dairy products; Processed rice; Sugar; Food products; Beverages and tobacco products.
Textiles and apparel	Textiles; Wearing apparel; Leather products.
Services	Electricity; Gas manufacture, distribution; Water; Construction; Trade; Transport; Sea transport; Air transport; Communication; Financial services; Insurance; Business services; Recreation and other services; Pub. Admin. / Defence/ Health/ Education; Dwellings.

Table 23. Regional aggregation used in simulations

Country aggregation	Original GTAP regions included
Asian NICs	Rep. of Korea; Indonesia; Malaysia; Philippines; Singapore; Thailand; Viet Nam.
China	China; Hong Kong (China); Taiwan Province of China.
South Asia	Bangladesh; India; Sri Lanka; Rest of South Asia.
Western Europe	Austria; Belgium; Denmark; Finland; France; Germany; United Kingdom; Greece; Ireland; Italy; Luxembourg; Netherlands; Portugal; Spain; Sweden; Switzerland; Rest of EFTA.
North America	Canada; United States.
Transition economies	Hungary; Poland; Rest of Central European Assoc; Former Soviet Union.
Sub-Saharan Africa	Botswana; Rest of SACU (Namibia, South Africa); Malawi; Mozambique; United Rep. of Tanzania; Zambia; Zimbabwe; Other Southern Africa (Angola, Mauritius); Uganda; Rest of sub-Saharan Africa.
Oceania	Australia; New Zealand.
North Africa and Middle East	Turkey; Rest of Middle East; Morocco; Rest of North Africa.
Latin America	Mexico; Central America, Caribbean; Colombia; Peru; Venezuela; Rest of Andean Pact; Argentina; Brazil; Chile; Uruguay; Rest of South America.
Japan	Japan.
Rest of the World	Rest of the World

(Included in "Rest of the World": Afghanistan, Albania, Andorra, Bermuda, Bosnia and Herzegovina, British Indian Ocean Territories, Brunei, Cambodia, Christmas Island, Cocos (Keeling) Islands, Croatia, Cyprus, Dem. People's Rep. of Korea, Falkland Islands, Faroe Islands, Fiji, French Polynesia, Greenland, Johnston Island, Kiribati, Lao People's Dem. Rep., Macao (China), Macedonia (former Yugoslav Republic of), Malta, Marshall Islands, Micronesia (Federated States of), Mongolia, Myanmar, Nauru, New Caledonia, Niue, Pacific Islands, Palau, Papua New Guinea, Pitcairn Islands, Saint Helena, Solomon Islands, Tokelau, Tonga, Tuvalu).

Notes:

[1] Some model parameters can be directly measured from existing data or estimated using econometric techniques. Sometimes, when the parameters do not have a clear empirical counterpart, their value can be obtained only residually through a calibration procedure: given the observed values of endogenous variables and the estimated values of some parameters, the numerical value of the remaining parameters is determined from the model system if there are more equations than unknown.

[2] See, for example, Francois and Reinert (1997) for an extensive treatment of different types of applied general equilibrium models.

[3] The initial large estimates of the gains from the conclusion of the Uruguay Round were subsequently revised downwards, mainly after the realization that the implementation of the agreement would have led to smaller tariff cuts than initially estimated. For instance, the study by Francois, McDonald and Nordström (1993) assesses the global gains from the Uruguay Round at $510 billion per year on the basis of 1990 prices, whilst in Harrison, Rutherford and Tarr (1996) the gains are well below $200 billion at 1992 prices.

[4] Among noteworthy attempts to compare the effects of the Uruguay Round obtained from alternative CGE experiments, see Martin and Winters (1996), Francois (2000a) and Whalley (2000).

[5] The closure rule specifies which variables are considered exogenous in the model. In particular, the modeller has to choose whether to allow for an endogenous determination of the trade balance or to fix it at the same value as that in the status quo. As far as elasticity parameters are concerned, higher values for substitution elasticities in demand tend to be associated with greater liberalization effects.

[6] See, on this point, Safadi and Laird (1996) and World Bank (2001, p. 167).

[7] See Goldin and van der Mensbrugghe (1996), Harrison, Rutherford and Tarr (1996), Diao, Somwaru and Roe (2001), and van Meijl and van Tongeren (2001).

[8] There are several difficulties in simulating the outcome of actual multilateral trade agreements. First, what are negotiated at the WTO are bound tariffs, not applied tariffs. Databases for CGE analysis such as GTAP only include values for applied rates, and not for bound rates (see, however, Francois, 2000b, for a study using bound instead of applied tariff rates). Second, the committed cuts in protection may be quite different from the ones actually implemented. This is one of the basic reasons why the early studies on the Uruguay Round effects estimated larger gains compared with later studies (see, e.g., Francois, 2000a, and Whalley, 2000).

[9] See Hertel (1997).

[10] See, e.g., Harrison, Rutherford, and Tarr (1996), and Diao, Somwaru and Roe (2001).

[11] For agriculture, the protective power of specific duties, combined duties and tariff rate quotas are translated into *ad valorem* equivalents. Non-tariff protection in textiles and apparel often takes the form of voluntary export restraints administered by exporters under the Multi-Fibre-Agreement. In GTAP, this is modelled as a vector of *ad valorem* export taxes.

[12] As found, for instance, in Diao, Somwaru and Roe (2001) and van Meijl and van Tongeren (2001). Francois (2000b), in a model including both imperfect competition and dynamic investments related effects, finds much bigger gains for Western Europe.

[13] GTAP data on exports subsidies are derived from countries' notifications to the WTO (year 1998) concerning their subsidy expenditures. Only a limited number of countries notified export subsidies: the EU and EFTA, some Eastern Europe transition economies (Hungary, Poland and Czech Republic), the United States (dairy products only) and a few other middle- and low-income countries (Colombia, South Africa and Turkey). The simulation performed consists in setting to zero the value of export subsidies in primary and processed agriculture in Western Europe and transition economies, and in the United States with regard to processed agriculture (which comprises dairy products).

[14] This simulation result is not reported (but it is available on request). Intuitively, after the elimination of subsidies domestic prices fall compared with world prices in the subsidizing regions (e.g. EU), and this leads to a shift of resources away from agriculture in these regions. Conversely, the reduced supply from subsidizing regions translates into higher world prices. This induces a shift towards agricultural production in non-subsidizing regions.

[15] Similar results are obtained, for instance, in Harrison, Rutherford and Tarr (1996) and Diao, Somwaru and Roe (2001).

[16] If the removal of export subsidies in agriculture is coupled with reduction in domestic support, the positive terms-of-trade effect on countries that are net agricultural exporters (e.g. Latin America and Oceania) would be strengthened further. In such a case, however, domestic production in Europe would fall even more, and this would lead to a more modest reduction in European imports, which would be particularly to the advantage of African countries.

[17] See, for instance, Ianchovichina, Mattoo and Olarreaga (2001) and Bora, Cernat and Turrini (2002) for recent CGE assessments of the benefits received by LDCs from receiving duty- and quota-free access to developed countries' markets.

[18] Note that these figures should be considered as lower bounds, since important sources of liberalization gains in manufacturing such as the exploitation of scale economies and the availability of imported inputs are neglected.