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# THE URUGUAY ROUND: A GLOBAL GENERAL EQUILIBRIUM ASSESSMENT

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## ABSTRACT

### The Uruguay Round: A Global General Equilibrium Assessment*

In this paper we provide an economic assessment of the Uruguay Round agreements on tariffs, textiles and clothing, and agriculture, highlighting scale economies, imperfect competition, and dynamic linkages between trade, incomes, and investment. We present estimates of the welfare effects of the individual agreements and their overall impact on different regions in the world. We also provide a decomposition of estimates with respect to various assumptions about model structure. The inclusion of imperfect competition, scale economies, and capital accumulation effects proves to be important, not least for developing countries.

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## NON-TECHNICAL SUMMARY

The Uruguay Round (UR) agreement has been described as the most ambitious and comprehensive trade agreement in history. The Final Act of the seven-year round of multilateral trade negotiations contains some fifty Agreements, Understandings and Decisions that will make up the core rules of the game for the world trading system in the coming decades. Appended are more than 20,000 pages of national tariff schedules and market access concessions, including the initial liberalization commitments under the General Agreement on Trade in Services (GATS). The negotiation results are scheduled to come into force in 1995, provided that a 'critical mass' of the approximately 120 potential Contracting Parties (the European Union being counted as one) have ratified the agreement.

In contrast to previous GATT rounds, the UR was born largely on non-tariff concerns. The successful reduction of tariffs in the first seven rounds – particularly on industrial goods in the developed countries, which have come down from 40% in 1947 to 5% today – has made traditional, non-discriminatory Most Favoured Nation (MFN) tariff protection a relatively minor issue between developed countries. The hard-fought gains in this area have, however, gradually been eroded by less transparent trade barriers. The relative decline of tariff barriers has merited a shift in focus to more pressing areas for reforms, including non-tariff barriers (NTBs), GATT rules, and trade in services. While still important in the UR tariffs were only one of many areas that called for attention.

In this paper we provide both an overview of the market access components of the UR and an assessment of its economic implications. Our assessment is based on a fifteen-sector, nine-region numerical model of the world economy. Three aspects of the UR are considered. First, we model improved market access for goods resulting from tariff reductions. Second, we model the elimination of GATT exceptions for quantitative restrictions on industrial products, particularly the agreement to bring textiles and clothing back under normal GATT rules. Finally, we examine the agreement on agriculture, which includes a conversion of NTBs to tariff equivalents paired with some cuts in the rates, and a reduction of trade distortive export and production subsidies. Our results represent, at best, a rough estimate of the likely effects of the Round. While the text of the Final Agreement is no longer a moving target, the pattern of implementation will continue to evolve through 2005. In addition, even in the area of market access, it is difficult at best to quantify the likely impact of the Round.

Our analysis differs from earlier studies in several important ways. First, it is based on the final set of UR market access offers. Previous studies have had to make do with formula tariff cuts derived from stated negotiation objectives. Second, we break new ground in terms of model structure. In contrast to previous estimates of the global effects of the UR, we account for imperfect competition and scale economies, including returns from increased specialization at intermediate stages of production. Previous global assessments have, in general, assumed perfect competition and constant returns to scale. Specialization and related scale economies affect the results considerably, not least for developing countries Finally, we also account for medium-run investment effects, wherein initial static income effects affect steady-state investment, compounding the initial impact over time. The combination of dynamics and intermediate product specialization captures important effects of trade liberalization often missed when perfect competition and static technologies are assumed.

According to our simulations, the most important overall source of gains from the UR follows from the elimination of quotas on industrial products. (There are a number of industrial quotas that we have not been able to account for that would reinforce this conclusion). The second most important source depends on the model. With a world characterized by constant returns to scale technologies, it is agriculture. The agricultural reforms provide up to 31% of the income gains in this case. Industrial tariff cuts become relatively more important when scale and specialization economies are at stake. In this case, the net complementarities implied by two-way trade, involving both pro-competitive effects and increased specialization and product variety, also yield cross-border spillovers of the effects of liberalization. These spillover effects, which prove particularly important for the group of developing and transition economies, are missed in constant returns models. In the case of the UR, such cross-border spillovers reinforce the advantages of undertaking liberalization in a multilateral context.

Our assessment of income effects is that, had the market access provisions of the UR been in place in 1990, global incomes may have been $291 billion higher. We estimate that by the year 2005 (when the UR is supposed to be fully implemented) the market access provisions may contribute $510 billion annually to global welfare (measured in 1990 dollars). These gains result from a combination of gains from specialization, a more efficient allocation of global resources, and the realization of scale economies as markets are further integrated. The welfare gains are relatively broad-based among the regions defined in our model. While these results in no way constitute a forecast, they

do provide some rough sense of the relative magnitude of effects implied by the UR.

In terms of trade and production patterns, the trade of all regions is expected to expand, led by the trade of developing and transition economies. Developing countries are estimated to expand production and exports of clothing, textiles and other manufactures, while developed countries are estimated to expand production of capital and technology-intensive industrial products, including transport equipment. Moreover, countries that are well-endowed with arable land are expected to significantly increase their exports of agricultural products, due largely to the reduced presence of export-subsidized competition. On a sectoral basis, the greatest increases in exports are in textiles and clothing from developing economies. In viewing these results, however, an important qualifier is called for. One may want to question whether the sometimes dramatic changes in export volumes indicated for particular sectors and particular markets by this type of analysis, which emphasizes market-based mechanisms, can be accommodated by the political mechanisms of the developed economies without triggering a defensive response of contingent protection or related interventions.

## 1. Introduction

The Uruguay Round (UR) agreement has been described as the most ambitious and comprehensive trade agreement in history. The *Final Act* of the 7 year round of multilateral trade negotiations contains some fifty Agreements, Understandings and Decisions that will make up the core rules of the game for the world trading system in the coming decades (GATT 1994).[1] Appended are more than 20,000 pages of national tariff schedules and market access concessions, including the initial liberalization commitments under the General Agreement on Trade in Services (GATS). The negotiation results are scheduled to come into force January 1, 1995, provided that a "critical mass" of the roughly 120 potential Contracting Parties (the European Union being counted as one) have ratified the agreement by then.

Our objective in this paper is to provide an assessment of some of the likely effects of the UR on trade and welfare, using a 15 sector, 9 region Computable General Equilibrium (CGE) model of the world economy. Quantifying the effects of the UR is a difficult task. While those aspects of the UR dealing with tariffs and direct government subsidies are readily subjected to quantitative analysis, other aspect of the agreement, such as those dealing with non-tariff barriers (NTBs) and indirect government support, can be quantified only with limited precision. Still other aspects of the UR are currently beyond meaningful quantitative analysis. To this latter category belong the effects of implementing a strengthened and extended set of rules and procedures and the long-run effects on investor confidence, investment, and growth.

Three aspects of the UR (arguably not necessarily the most important ones) are considered here. First, we model improved market access for goods resulting from tariff reductions. Second, we model the elimination of GATT exceptions for quantitative restrictions on industrial products, particularly the agreement to bring textiles and clothing back under normal GATT rules. This agreement calls for a 10 year phase out of the Multifibre Arrangement (MFA). We also account for the phase out of quotas (voluntary export restraints) on Japanese cars in the EU market. Finally, we examine the agreement on agriculture, which includes a conversion of NTBs to tariff equivalents paired with some cuts in the rates, and a reduction of trade distortive export and production subsidies.

[1] We note that the Round took much longer than was originally expected. In this regard, we find the treatment of the issue by Musgrove (1985) particularly enlightening.

The analysis and estimates presented here differ from earlier studies, including our own, in several important ways.[2] First, the analysis is based on the final offer data. Previous studies of the UR had to make due with formula tariff cuts derived from stated negotiation objectives. Second, the analysis has been extended in terms of model structure. We now account for imperfect competition and scale economies, while previous assessments, with the exception of Haaland and Tollefsen (1994) and Yang (1994a), have been based on models built on the assumption of perfect competition and constant returns to scale. Specifically, we model sectors for which we have evidence of scale economies as being characterized either by Marshallian "external" scale economies and perfect competition (Panagariya, 1981), or by Chamberlian "internal" scale economies and large group monopolistic competition (Dixit and Norman, 1980, Krugman, 1980, Helpman, 1981, Ethier, 1982). This implies cross-border spillover of the effects of liberalization (Francois 1992, 1994a). The latter specification affects the results considerably, not least for developing countries. Finally, following Smith (1976,1977) and Baldwin (1989, 1992), we also account for the medium-run dynamic effects of trade liberalization. We assume that a share of the static income gains is saved and invested in new production capacity, compounding the initial impact over time.[3]

The UR is examined in a set of counterfactual simulation experiments. Specifically, we use the model to examine the following hypothetical question. Given the structure of the world economy in the 1990 benchmark dataset, what would the economy have looked like if the UR agreements on tariffs, industrial quotas, and agriculture had been in place? This exercise is meant to offer some sense of the isolated impact of these limited aspects of the UR agreement. It does *not* constitute a forecast of the global economy. Other "shocks" to the system -- exogenous technological changes, changes in the taste of consumers, unilateral policy reforms in developing economies, continues rapid growth and industrialization in East Asia, the new market orientation of transition economies -- will all independently shift the pattern of global

[2]See the review of ex ante studies of the Uruguay Round in Francois, McDonald, and Nordström (1993).

[3]Note that we do *not* account for the long-run linkages between trade and economic growth, which find plenty of support in the empirical literature. See Francois and Shiells (1993), and Francois, McDonald and Nordström (1993b) for a brief survey on the theoretical and empirical links between trade and economic growth.

production and trade. Naturally, none of these effects are captured by the simulations that we are undertaking.

Keeping this in mind, our assessment of the efficiency gains is that, had the accounted market access provisions of the UR agreement been in place in 1990, global GDP may have been $291 billion higher.[4] Based on OECD and World Bank regional growth projections, we estimate that the market access provisions by the year 2005, when the Uruguay Round agreement is supposed to be fully implemented, may contribute $510 billion annually to global GDP (measured in 1990 dollars). The efficiency gains result from specialization and trade based on comparative advantage and scale economies. These welfare gains are supported by an estimated increase in world merchandise trade of between 8 and 23 percent (above where it would otherwise be). The welfare gains are relatively broad-based among the regions defined in our model. This result follows, in part, from the inclusion of scale economies, imperfect competition in industrial markets, and income-investment dynamics. Overlooking these aspects of the global economy can lead to significant underestimation of the impact of the UR.

Section 2 of the paper provides some background on the aspects of the Uruguay Round that we are trying to quantify. Section 3 presents an overview of the structure of global production, demand, and trade, based on our model aggregation. By pairing the economic structure of various regions with the trade policy changes resulting from the UR agreement, we hope to facilitate the understandings of the simulation results. The economic structure of the model, with its three versions, is outlined in Section 4. The simulation results, with emphasis on trade and income effects, are presented in Section 5. The final section of the paper offers some concluding remarks.

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[4]Note that this estimate is not directly comparable with previous estimates in the range $213 to $274 billion by the OECD/World Bank (Goldin et. al 1993; OECD 1993). These studies involved moving the resource base forward to the end of the implementation period of the Uruguay Round using available growth projections for productivity, population and foreign capital flows. A given percentage welfare gain is then translated into a larger *nominal* amount because the economic base to which it is multiplied is larger in ten years than today. Here, we adopt the more straightforward procedure of comparing the actual equilibrium in the benchmark year (1990) with a counterfactual, steady-state equilibrium. However, to facilitate comparisons, we also "translate" some of our results into 2005 estimates, using OECD and World Bank regional growth projections.

## 2. Background: Tariffs, Textiles and Clothing, and Agriculture

In contrast to previous GATT rounds, the Uruguay Round was born largely on non-tariff concerns. The successful reductions of tariffs in the first seven rounds -- particularly on industrial goods in the developed countries, which have come down from forty percent in 1947 to five percent today -- had made traditional, non-discriminatory (MFN) tariff protection a relatively minor issue between developed countries. The hard-fought gains in this area were, however, gradually being eroded by less transparent trade barriers that had emerged, or otherwise become more evident as tariffs were reduced. This is illustrated in Figure 1. For many sectors, the key form of protection has shifted to modes not covered by MFN tariff bindings under the GATT.

The relative decline of tariff barriers merited a shift in the focus to more pressing areas for reforms: NTBs; GATT rules, including the procedures for settling trade disputes and providing contingent protection; specific sectoral exemptions from general GATT rules (such as textile, clothing and agriculture); trade related investment measures (TRIMs) and trade related aspects of intellectual property rights (TRIPs); and to trade in services.[5] While still important, tariffs were in the Uruguay Round only one of many areas that called for attention.

### 2.a Tariffs

The main tariff issues addressed in the Uruguay Round can be grouped under five headings: (i) Tariff peaks (defined as tariffs above 40%), (ii) nuisance tariffs (defined as tariffs less than 5%), (iii) differences in tariff bindings, (iv) credits for autonomous liberalization, and (v) tariff escalation. The Ministerial Declaration at Punta Del Este[6] mandated that "negotiations shall aim, by appropriate methods, to reduce or, as appropriate, eliminate tariffs including the reduction or elimination of high tariffs and tariff escalation. The emphasis shall be given to the expansion of the scope of tariff concessions among *all* (italics added) participants." The Mid-term Ministerial Meeting in Toronto at the end of 1988 specified an overall target for

[5]Services have become the fastest growing component in international trade. As is evident from Tables 7 through 8, they also account for a large of production and GDP, particularly in OECD countries.

[6] The Uruguay Round of multilateral trade negotiations was formally launched in a ministerial meeting taking place in September 1986 in Punta del Este, Uruguay. For the complete text see GATT "Ministerial Declaration on the Uruguay Round."

tariff reductions "at least as ambitious as that achieved by the formula participants in the Tokyo Round," that is, a reduction of 33 percent on a trade weighted basis.[7] The target for the developing countries was set at 24 percent.

Note that the Ministerial Declaration called for tariff concessions of *all* parties, including the tariffs of developing countries, which had seen small progress in previous rounds. Developing countries had in previous rounds not been required to fully reciprocate the tariff cuts (or other liberalization efforts) of the developed countries. They were granted "special and differential treatment" with obligations commensurate to their perceived development needs. Lacking the incentive and peer pressure to liberalize, many developing countries have been stuck with high and costly levels of protection for decades. These have only recently started to come down as outward oriented development strategies have won ground over inward oriented strategies, stimulating countries to embark on unilateral liberalization "sponsored" by the World Bank and/or the IMF, or liberalization in the context of regional trade agreements.

Bearing this in mind, one of the most important results of the tariff negotiations is that many developing countries have "locked in" their recent unilateral liberalizations by binding a majority of their tariffs, although in some cases at levels above (sometimes far above) currently applied rates.[8] On industrial products, tariff bindings of the developing economies increased from 22 percent of the tariff lines to 72 percent, for transition economies from 73 to 98 percent, and for developed economies from 78 to 99 percent. The progress in tariff bindings has been even more dramatic in agricultural products. For the first time, bindings cover a broader share of agricultural trade than industrial product trade. Indeed, bindings will now cover almost 100 percent of agricultural trade (Japanese and Korean rice being a notable exception), including tariffs that resulted from the tariffication process of NTBs. The data on tariff bindings are

[7]The "formula participants" of the Tokyo Round refer to a group of mostly industrial countries that agreed to cut their tariffs according to a simple non-linear formula with the property that high tariff rates (tariff peaks) were cut by a greater percentage than low tariffs. The other participants used the traditional "request-offer" procedure, detailing the duty reductions requested from another country and the concessions it was willing to offer in return.

[8]Under the General Agreement, tariffs rates are limited only to the extent a country has made a specific "tariff binding," a commitment not to exceed the (ceiling) rate at which the tariff was bound. The applied rate may of course be lower, which is also commonplace.

summarized in Table 1.[9] In addition to binding most of the tariff lines, our data point to a tariff reduction of some 27 percent on average for the developing countries, including the autonomous trade liberalization undertaken during the course of the negotiations. Hence, it appears that the developing countries as a group, if not individually, reached the 24 percent target set out for developing countries in the UR. Reductions of the average tariffs of developed countries are clustered around the 33 percent target, as shown in Table 2.[10]

Note that the tariffs of the developed countries are normally below 5 percent (10 percent in the case of Australia/New Zealand), textiles and clothing being an exception with tariffs in the range 10 to 30 percent. (These tariffs are imposed in addition to MFA quotas). The tariffs of developing countries are generally higher but with no apparent tariff peak. However, this is an artifact of the high level of aggregation. Tariff peaks are "hidden" by averaging over a large number of commodities (tariff lines) that composes a sector, and over a large number of countries that composes the "region" of developing and transitional economies. In the real world, national tariff schedules ranges from being completely flat (like Chile at 20 percent) to having rather dramatic peaks and troughs. This is true for developed and developing countries alike.

The reported tariff rates do not include customs surcharges that are common in developing countries in particular. Customs surcharges and fees are tariffs under another name (but with

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[9]While we view the progress on tariff bindings as extremely valuable, no attempts have been made in our simulations to account for the market-access-security aspects of the UR. We believe that tariff bindings are particularly important for countries with a history of frequent policy reversals, and therefore in need of some institutional mechanism to make their trade regime more credible. Tariff bindings reduce the risk of investing in distribution channels supporting trade or foreign direct investment projects that are dependent on imported intermediate goods. They therefore have an import impact on trade, investment and welfare.

[10]The table reports the average MFN tariff cuts for the sectors and regions defined in the model (except for China and Chinese Taipei, which did not formally participate in the UR). The base (old) rate for each sector and region is calculated by averaging over the tariff lines in the sector, and over the countries in the region, using trade shares as weights. We use the applied MFN tariff rates as reported in GATT's Integrated Data Base (IDB). The base years are centred around 1988, ranging from 1986 to 1992 depending on data availability. The new rate is calculated by the same type of averaging using the offered rates for each tariff line as input, except in cases where a country has offered to bind the tariff above the applied base rate. For tariff lines where this is the case, we conclude that no actual cuts are necessary.

a different justification) and can add substantially to protection. Indeed, examples where surcharges add 50% or more to the basic tariff rates are not uncommon.[11] Unfortunately, we do not have access to comprehensive data on custom surcharges and related fees, so these are not incorporated in the model. Our data, therefore, understate the effective tariff distortions for countries which compliment base tariffs with custom surcharges.

The underlying level of protection is also understated because of lack of data on contingent protection. At the moment, our data on contingent protection are limited to antidumping (AD) actions reported to the GATT secretariat by Canada, the United States, and the European Union. Data on the other principal user of antidumping duties, Australia, are not included. In addition, our data only cover such protection through mid-1992. We therefore miss the most recent round of dumping actions in the industrialized countries, as well as the spread of AD regimes to developing countries.

A similar downward bias originates from the high level of sectoral and regional aggregation that "hides" the tariff peaks of the real world. Based on Magee (1972), comparing two sectors (regions) that are identical in all aspects except for the intra-sector (intra-region) variance in tariffs, we expect an uniform tariff cut to give a higher welfare boost in the sector (region) with the higher tariff variance. This is not captured in the model, where tariff cuts are effectively treated as if all products in a sector (region) face identical rates. For the above reasons, we consider our welfare estimates of the Uruguay Round tariff cuts to be conservative.

## 2.b Textiles and Clothing

The aim of integrating textiles and clothing into the normal GATT rules and disciplines was explicitly stated in the Punta del Este Declaration. This sector had previously been treated as a special case with its own regulatory framework, institutionalized first in the beginning of the 1960s with the Short Term Arrangements (STA) regarding international trade in cotton textiles.[12,13] These arrangements grew out of the many quotas and "voluntary" restraint

[11]For details on specific countries, see the Trade Policy Reviews published by the GATT Secretariat.

[12]The key part of the negotiation mandate given by Trade Ministers in the Punta Del Este Declaration stated that: "Negotiations in the area of textiles and clothing shall aim to formulate modalities that would

(continued...)

agreements -- known as the "hard core" residual restrictions -- that had resisted the generally successful dismantling of quantitative restrictions in non-agricultural trade in the 1950's. The STA aimed at an orderly opening of restricted markets to avoid (for importing countries) detrimental market disruptions. The definition of "market disruption" adopted by the Contracting Parties in 1960 entailed the possibility of singling out imports of particular products from particular countries as the disrupting source. A logical corollary was that market restrictions could be applied on a discriminatory rather than Most Favoured Nation (MFN) basis. This opened the door for the series of bilaterally negotiated quota restrictions that became the rule under the Long Term Arrangement (LTA), 1963-1973, which grew into the Multifibre Arrangement (MFA) in 1974 when the product coverage was extended to non-cotton textiles and clothing. The current MFA IV arrangement was extended in December 1993 for a final year to the anticipated entry into force of the Agreement on Textiles and Clothing as an integrated part of the single undertaking of the Uruguay Round.[14]

Like the preceding arrangements, the MFA provides rules for the imposition of quotas, either through bilateral agreements or unilateral actions, when surges of imports cause market disruption, or the threat thereof, in importing countries. In recent years, six developed participants have been applying quotas under the MFA -- the EU, the U.S., Canada, Norway, Finland and Austria -- almost exclusively on imports from developing countries.[15,16] The product

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[12](...continued)
permit the eventual integration of this sector into GATT on the basis of strengthened GATT rules and disciplines, thereby also contributing to the objective of further liberalization of trade."

[13]This section draws on the following: GATT (1984); Hamilton (1992); and notes prepared by Jan Eirik Sørensen, Director of the Textile Division, GATT Secretariat.

[14]The UR agreement must be accepted in total, or not at all. The "a la carte" option of previous rounds is limited to the signing of plurilateral side-agreements, like the Agreement on Government Procurement and the International Dairy Agreement. The rights and obligations of these agreements apply only to the signatories.

[15]Sweden liberalized its textile and clothing regime in 1991 and withdrew from the MFA agreement. (The MFA quotas may, however, be reintroduced temporarily if the accession to the EU materializes as planned). Two other developed country participants, Japan and Switzerland, have not imposed any MFA quotas. However, they have "signalled" their readiness to do so by the mere act of being signatories to the MFA agreement, combined with (active) import surveillance. Indeed, as shown in Winters (1994), import surveillance can, at least in concentrated industries, induce a fall in import levels as producers are trying to forestall explicit quotas.

coverage of the quota agreements has varied from being fairly comprehensive for the agreements concluded by the EU and the U.S., to the agreements concluded by the EFTA countries, where coverage have been quite selective.

The restrictiveness of the applied MFA quotas varies from product to product, and from supplier to supplier, and aggregate measures are highly uncertain. The aggregate, bilateral restrictiveness of the MFA quotas are derived from the estimated MFA quota price-wedges reported by Yang (1992, 1994b), Whalley (1992), and the U.S. International Trade Commission (1991,1993). These estimates are detailed in Table 3.[17] The estimated quota price-wedges are approximately 15 to 25 percent for textile and 25 to 40 percent for clothing. The difference in the rates of protection may reflect that the relatively capital intensive textile sector in the OECD countries is at less of a competitive disadvantage than the labour intensive clothing sector. Note also the above-average restrictiveness of the MFA quotas facing China.

The Uruguay Round Agreement on Textile and Clothing requires a gradual phase out of the quota restrictions carried over from the MFA regime, as detailed in Table 4. The integration of the products covered by the agreement is to be achieved in three stages under a ten year transition period. The first stage calls for the integration of products comprising not less than 16 percent of the total volume of each member's 1990 imports of the products listed in the annex to the Agreement. The second stage, to be taken at the beginning of year 4, requires the integration of a further 17 percent. The third stage, at the beginning of year 8, requires that still 18 percent of imports is brought under normal GATT rules. Each importing country is free to choose the products it will integrate at each stage, the only constraint being that they shall encompass products from each of the four groupings: tops and yarn, fabrics, made-up textile products, and clothing.

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[16](...continued)

[16]The only developed countries that have at one time been subject to quotas on their exports are Japan, Portugal and Spain. These have now been terminated, however.

[17]We assume that the individual EFTA agreements are equally restrictive to the EU agreements. However, since only Norway, Finland and Austria apply MFA quotas, and these countries make up about 50 percent of EFTA's GDP, the weighted restrictiveness of the EFTA agreements is approximated to be 50 percent of the restrictiveness of the EU agreements.

Products that remain restricted during the transition period benefit from a progressively increasing quota. The previously applied MFA quota annual growth rates are to be scaled up by a factor of 16 percent in the first stage -- for instance, from 3% to (3×1.16 =) 3.48% -- an additional 25 percent in the second stage, and yet another 27 percent in the third stage. This will turn a 3% initial annual growth rate to 5.52% in the third stage. This could render some of the quotas non-binding even before they are formally eliminated. At the end of the ten year transition period, all remaining quantitative restrictions on textiles and clothing (carried over from the MFA regime) are to be terminated. From this point onward, import restrictions must be sought under normal GATT rules, like the safeguard (escape) clause in Article XIX.[18]

## 2.c Agriculture

At the time the Uruguay Round was launched in 1986, it was clear that agricultural production and trade had very little to do with comparative advantage.[19] Normal market forces of supply and demand were replaced with an intricate network of regulations, subsidies and trade barriers. In the developed countries, this system had roots in the war-economies of the first and second world war, and the intervening depression. For many developing countries, the roots could be traced to the colonial administration carried over by the new regimes after independence. In this world, governments acted as if they faced no budget restriction in the pursuit of domestic agricultural and development objectives. As the more extreme cases show, a sufficient dose of government intervention could, albeit at huge cost to consumers and taxpayers, make the partly arctic country of Sweden into net exporter of agricultural products and turn the deserts of Saudi Arabia into a hitherto untapped source for wheat exports. Or, by over-taxing agricultural production (which is common in developing countries through marketing boards with monopoly power of purchasing farm crops), the economic basis for agriculture could be undermined even in the most fertile of land, causing massive urban migration of discouraged, former farmers seeking employment in industrial sectors targeted by governments.

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[18]The Agreement contains a special transitional safeguard mechanism applicable in cases of surges of imports causing severe damage or the threat thereof in products not yet integrated into GATT. It also contains provisions concerning circumvention of quotas, the settlement of trade disputes, and special provisions for the least developed countries. See the Final Act (GATT, 1994) for details.

[19]This section draws on the impressive volume edited by Stewart (1993), containing the negotiation history of the Uruguay Round up to the end of 1992, the political economy and historical perspective offered in Anderson (1994), the assessment of the agriculture agreement by Tangermann (1994), and the Final Act GATT (1994).

The decision to break with the past and incorporate agriculture into the Uruguay Round negotiations was made on the background that this sector, in addition to draining government budgets,[20] had become a constant source of trade friction among the Contracting Parties. The Ministerial Declaration at Punta Del Este stated that there was an "urgent need to bring more discipline and predictability to world agricultural trade by correcting and preventing restrictions and distortions including those related to structural surpluses so as to reduce the uncertainty, imbalance, and instability in world agricultural markets." The negotiation mandate aimed at (i) improving market access through reduction of import barriers; (ii) improving the competitive environment by increasing discipline on the use of all direct and indirect subsidies and other measures affecting agricultural trade; and (iii) minimizing the trade-distortive effects of sanitary and phytosanitary regulations. A multilateral effort to address these problems offered advantages over unilateral reforms, economically and not least politically by allowing the liberalizations to be sold as a necessary concession to secure the overall benefits of the UR.

As in the case of textiles and clothing, the agricultural sector had previously been treated as a special case in the GATT framework, with generous scope for government intervention. The ban on export subsidies under Article XVI did not apply to primary products,[21] provided that the subsidy did not give the user more than an "equitable share" of the world market in a particular product. This qualification has failed to discipline the use of export subsidies in agricultural trade. For instance, it has been estimated that over 55 million tons of wheat, or more than half of world trade, are being exported under various subsidy schemes (Wolter, 1994). Similar trade distortions are commonplace in products like coarse grain (corn, barley, oats, etc), beef, butter, margarine, and skim milk powder.

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[20]For example, total transfers from consumers and taxpayers to farmers in the OECD countries were in 1990 approximately $300 billion (OECD, 1991), or about $1,400 for an average family of four.

[21]The notes to Article XVI defines a primary product as a "product of farm, forest, or fishery, or any mineral, in its natural form or which has undergone such processing as is customarily required to prepare it for marketing in substantial volume in international trade." Some exporters have applied a broader definition to accommodate processed agricultural products like margarine and pasta under their export subsidization schemes. For details, see the chapter on Article XVI in the "Analytical Index: Guide to GATT Law and Practice," GATT (1994).

Agricultural trade has also been exempted from the ban on quantitative import restrictions (QRs) under Article XI, provided that such restrictions are necessary to the enforcement of government measures that operate to control the domestic production or marketing of like products. This provision has been invoked to justify an array of QRs, from import licensing to effectively zero import quotas. Some countries have pointed to the so-called "Section 22 waiver" granted to the U.S. -- which entitles the U.S. to impose import quotas on sugar, peanuts, tobacco, and manufactured dairy products[22] -- as a justification for their own import quotas. Quantitative measures in the form of "Voluntary Export Restraint" agreements (VERs) are also common, an example being the EU agreement with Thailand limiting cassava imports.

Another characteristic in the protection of agriculture has been the use of variable levies in addition to base tariffs. The variable levy is normally determined by the difference between the world market and domestic target price of the product. A reduction of the world market price is automatically offset by a higher levy to keep the domestic price of the imported good constant at the desired level. Variable levies are often combined with a similar instrument on the export side. For instance, the Common Agricultural Policy (CAP) of the EU combines variable import levies with variable export restitution payments to shield the farmers from movements in world market prices. The export restitution is effectively a variable export subsidy which depends on the difference between the domestic target price and the world market price. The combination of variable import levies and variable export subsidies shields domestic farmers and consumers from price fluctuations. As shown by Bigman (1987), this may be good for the own country. However, at the same time, such actions tend to exacerbate the price fluctuations in the world market,[23] pushing the burden of adjustments onto other parties, because domestic agents have no incentive to take part in the normal equilibrating demand and supply responses that would dampen the fluctuations. Variable levies and export subsidies have, therefore, an additional beggar-thy-neighbour dimension, or "destabilize thy neighbour" as

[22]The waiver refers to Section 22 of the Agricultural Adjustment Act, enacted in 1933 during the Great Depression. It authorized the U.S. Department of Agriculture to impose import quotas on a wide range of agricultural products. The waiver was granted to the U.S. in the mid 1950s at a time when the U.S. President's authority to enter into reciprocal trade agreements was conditioned on such agreements being applied in a manner consistent with the requirements of Section 22.

[23]Sarris and Freebairn (1983), for instance, estimate that the variability of the world market price for wheat would decline by 35 percent under free trade.

put by Bigman (1987), by imposing the adjustment costs on others. This aspect is not captured by our non-stochastic model, however.

Imports may also be restricted on grounds of health and sanitary reasons. Such measures can be invoked under Article XX of the GATT, if "necessary to protect human, animal or plant life or health." Sanitary and phytosanitary regulations may discourage exports from developing countries in particular because the compliance requires a scientific infrastructure that few developing countries possess.

Finally, besides providing the regulatory framework, governments were often themselves directly involved in the agricultural sector through marketing boards and state trading enterprises. For instance, it is estimated that 90% of the international trade in wheat and 70% of the trade in coarse grains flow through state trading enterprises (Hathaway, 1987). The operation of these entities may distort trade, as explicitly noted in Article XVI of the GATT,[24] because government agencies are often required to take other than market concerns into account when making decisions. An example is Japan. The Food Control law designates the Japanese Food Agency as the sole authorised importer of rice. Rice imports are only allowed for specific purposes, such as a special grade of rice needed to brew a type of alcoholic beverage called Awameri (GATT Trade Policy Review, Japan, 1992). The Republic of Korea operates a similar scheme through the Grain Management Fund, which sets domestic intervention prices for rice and barley with a view to maintaining the self-sufficiency of these products. The agency is typically not authorized to import any rice or barley as long as domestic production is sufficient to satisfy the domestic demand (GATT Trade Policy Review, Republic of Korea, 1992).

The Uruguay Round Agreement on Agriculture is clearly a break with the past, although not a clean break. The main features are summarized in Table 5. First, it provides for conversion

[24]The contracting parties of the GATT recognize in paragraph 3 to Article XVII that state trading enterprises "might be operated so as to create serious obstacle to trade; thus negotiations on a reciprocal and mutually advantageous basis design to limit or reduce such obstacles are of importance to the expansion of international trade."

of NTBs to tariff equivalents.[25] The converted NTBs and previously bound or applied tariffs are to be reduced on a simple unweighted average basis by 36% for developed countries and 24% for developing countries, with a minimum of 15 and 10%, respectively, for each tariff line.[26] Second, the budget outlay on export subsidies is to be reduced by 36% for developed countries and 24% for developing, and the volume of subsidized exports by 21% and 14%, respectively. Third, the Aggregate Measure of Support (AMS) is to be reduced 20% for developed economies, except for the European Union where the requirement has effectively been discounted to 16.8% according to the submitted schedules, while developing countries are expected to cut the AMS by 13⅓%. Exempted are "green box" measures with "no, or at most minimal, trade distortion effects or effects on production." The latter are also non-actionable for purposes of countervailing duties. The agreed reductions in tariffs, domestic support and export subsidies are to be implemented during the transition period of six years for developed, and ten years for developing, countries. Fourth, the agreement includes new minimum market access opportunities at reduced tariff rates for products where there are no significant imports originally. This provision applies, for instance, to rice imports into Japan and the Republic of Korea. The minimum market access is set to 3% of domestic consumption at the outset, rising to 5% at the end of the implementation period.[27] Finally, the right of countries to set their own safety and health standards is reaffirmed, but with the provision that such standards shall be based on "sound scientific evidence," and that use be made of international standards where possible. The agreement also includes a special agricultural safeguard provision which may be invoked in case of import surges.[28]

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[25]Commonly applied NTBs are (i) quantitative import restrictions, (ii) "voluntary" export restraints (VERs), (iii) variable import levies, (iv) minimum import prices, (v) discretionary import licensing, (vi) monopoly positions granted to state trading enterprises.

[26]According to the principle of "special and differential treatment," the liberalization goal for developing countries is set to 2/3 of that for developed countries. The least developed countries are exempted from the requirements to liberalize the agricultural sector.

[27]The minimum market access will be administered as a tariff quota, where imports up to the minimum access level benefit from a reduced tariff rate, possibly zero, while imports above that level will pay the full MFN rates. It is unclear how these preferential access quotas shall be allocated.

[28] In the simulation exercises reported here, we examine a policy scenario based on the actual schedule of commitments. However, one could imagine two policy scenarios, differing with regard to the assumed implementation of the agreement. See footnote 35.

*Agriculture protection data*

Our data on agricultural protection are drawn from OECD and USDA estimates of agricultural support (OECD 1990, 1993; USDA 1990), and from the submitted schedules of commitments. The latter needs substantial data processing before it becomes readily available. For instance, we do not have comprehensive data on the ad valorem tariff rates that resulted from the tariffication process of NTBs in agriculture. Most countries converted their NTBs into specific rather than ad valorem tariffs, and the specific tariffs must somehow be converted into ad valorem equivalents before they can be aggregated into broad agricultural categories like grains and other agricultural products defined in the model. For now, therefore, we apply formula tariff cuts to the base level of border protection, where the latter is deduced from data underlying the OECD and USDA PSE estimates.

Our estimates of the base level of agricultural protection are detailed in Table 6. We report the budget outlays on domestic subsidies and export subsidies, and the implied subsidy rates for grains and other agricultural products. In addition, we report the estimated base level of border protection (tariffs and NTBs). The rates are low for land abundant countries with a comparative advantage in agricultural production (the United States, Australia/New Zealand and many developing and transitional countries), while high-cost producers in Japan and Europe are heavily protected.

## 3. Benchmark Social Accounting Data

In this section we provide an overview of the structure of global production, demand, and trade, based on our model aggregation. The model is benchmarked to 1990, meaning that the unknown parameters of the model are chosen so that the model generates the observed market data for 1990 as an initial market equilibrium. We assume 1990 to be representative year for the world economy preceding the Uruguay Round agreement, while still being sufficiently close to the various Uruguay Round "base periods" to which specific liberalization provisions are related, where the base periods are normally in the range 1986 to 1990.

The benchmark data are organized as a social accounting matrix (SAM). The SAM provides a comprehensive and consistent record of national income accounting relationships between

different sectors and regions.[29] An initial SAM was drawn from an 8 region, 15 sector aggregation of the Global Trade Analysis Project (GTAP) 1990-dataset. [30] This initial GTAP SAM was then augmented, with the EFTA countries (not included as a separate region in the GTAP SAM) being broken out as a separate region to avoid mixing developed countries with developing and transitional economies.[31] Our augmented Rest of World region is now solely composed of developing and transitional economies, as currently defined by GATT.

Based on the SAM, Table 7 presents summary information on the economic structure of each region. This information is complemented by a set of regional comparisons data in Tables 8. We provide the following summary statistics for the base year. In Table 7, the first column, *O*, gives each sector's share of the total gross output of the economy, where gross output is by definition equal to value added plus consumption of intermediate goods in production. The second column, *V*, gives each sector's share of total value added or the sector's relative contribution to GDP. Comparing the two columns, note that the industrial goods share of gross output is generally higher than its share of value added, because of the relatively high use of intermediate goods in production. The opposite is true for production of services which, compared to industrial production, use relatively few intermediate inputs in production. The third column, *D*, gives each sector's share of total demand of the economy, where total demand is comprised of final and intermediate demand from domestic and foreign sources. The fourth and fifth columns, *X* and *M*, contain information on each sector's share of the total exports and imports of the economy. The sixth column, *X/O*, gives the share of each sector's output that is exported. Finally, the seventh column, *M/D*, gives the share of a sectors demand for final and intermediate goods that is satisfied by imports.

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[29]SAMs are based on a fundamental, general equilibrium principle of economics, namely that every income (receipt) has a corresponding expenditure (outlay). As opposed to the real world records of economic activity, all accounts must add up in the world model (as they must do in reality). This necessitates various data adjustments to avoid statistical illusion like the apparent trade deficit that the world runs with itself (or perhaps the moon). The basic principles of SAMs, with application to trade policy modelling, are excellently summarized in Reinert and Roland-Holst (1994).

[30] See Jomini et al (1991), James and McDougal (forthcoming), Hambley (forthcoming), and Hertel and Tsigas (1993).

[31] The EFTA breakout involved trade and production data from the GATT's integrated database (GATT 1991, 1992), EFTA (1992), the Nordic Council (1992), and the OECD (1992).

A number of patterns are evident from Tables 7 and 8. Note in particular the difference in economic structure between OECD and non-OECD countries. In the OECD countries, agricultural and primary production make up some 5 to 10 percent of GDP, compared to 25 percent in the aggregate of developing and transition economies. The GDP share of manufacturing is in the range 20 to 30 percent in the "post-industrialized" OECD countries, compared to around 30 percent in non-OECD economies. The opposite relation hold true in services, which in the OECD countries make up 65 to 75 percent of GDP, compared to 45 percent in developing and transition economies. Within the OECD block, Australia and New Zealand have a relatively large share of agriculture and primary production, while Japan has a relatively large share of manufacturing.

Exports of OECD countries are generally concentrated in manufactured goods, which range from 40 percent of the total exports of Australia and New Zealand to 75 percent of the total exports of Japan. Imports of OECD countries are also concentrated in manufactures, implying a high degree of intra-industry trade in addition to inter-industry trade. Japan, being relative scarce in natural resources, imports relatively more primary products and fewer manufactures, while the opposite is the case for Australia and New Zealand, one-third of whose exports are composed of agricultural and primary products. Data on trade in services are still rather undeveloped, and are frequently unreliable. However, available data indicate that the share of services in exports is non-trivial, at least in the case of the OECD countries. The generally higher export shares than import shares suggest that the OECD countries are net exporter of services to developing and transitional economies.

Exports of developing and transition economies are made up of roughly one-third agricultural and primary products, one-half manufactured products and one-sixth services. The export composition of manufactured products differs from that of the developed countries. The export share of clothing and textiles is generally larger, and so is the share of natural resource based manufacturing. Note the high share of textiles and clothing in China's exports (25 percent). Imports of developing and transition economies are concentrated in services and manufacturing, which together make up more than 90 percent of imports, and are divided in about equal shares. Note the low share of services in the imports of China and Chinese Taipei (Taiwan). Services

constitute less than 5 percent of their total imports, compared to some 45 percent for other developing and transition economies.

Trade intensity, as measured by the share of output that is exported or the share of demand that is imported, is generally higher for small countries than for large countries. It is not uncommon, for instance, that the small EFTA countries export more than two-thirds of production, or import more than two-thirds of consumption, of a particular product. Note also that, controlling for size, the trade intensity of developed countries seems larger than that of developing countries.

## 4. The Model

The formal analysis is based on a 15-sector, 9-region Computable General Equilibrium (CGE) model of the world economy. A central feature of CGE models is the input-output structure, which links industries together in a value-added chain from primary goods, over continuously higher stages of intermediate processing, to the final assembling of consumption goods for households and governments. The link between sectors may be direct, like the input of steel in the production of transport equipment, or indirect, via the intermediate use in other sectors. An example of the latter is the indirect link between steel and agriculture through production of steel-intensive equipment like tractors and plows. Sectors are also linked through various economywide constraints. For instance, firms in different sectors may compete for the same production factors: labour, capital and land. Given a fixed supply of these factors, expansion of one sector must then be accompanied by a contraction of another sector, except when the expansion is driven by technological improvements that economize on the use of scarce production factors.[32]

The CGE model used in our assessment of the Uruguay Round has three versions: The basic version has constant returns to scale technologies in all sectors. Firms employ domestic

[32]The general equilibrium structure recognizes that all parts of the world economy hinge together in a network of direct and indirect linkages. This means that *any* change in *any* part of the system will, in principle, have repercussions throughout the entire world (albeit often too small to be noticed, let alone measured). The effect will normally be greatest in the sector and country where the policy change is initiated. It will then spread through forward and backward production and consumption linkages to adjacent sectors at home and in the markets of trading partners.

production factors (capital, labour and land) and intermediate inputs from domestic and foreign sources to produce outputs in the most cost-efficient way that technology allows. There is a single representative, composite household in each region, with expenditures allocated in fixed shares over personal consumption, government consumption, and savings (future consumption). The composite household owns endowments of the factors of production and receives income by selling them to firms. It also receives income from the receipt of tariff revenue and rents from the sale of import/export quota licenses (when applicable). Part of the income is distributed as subsidy payments to some sectors, primarily agriculture. Prices on goods and factors adjust until all markets are simultaneously in (general) equilibrium. Quotas are modelled explicitly through a Leontief specification where imports cannot exceed the quota allocation,[33] and where the effective size of the bilateral quotas are calibrated from initial price wedges.[34] We do not model changes in international capital flows induced by the Uruguay Round, but rather our capital market closure involves fixed net capital inflows and outflows. Factor markets are competitive, with labour and capital being mobile between sectors but not between countries. A third factor, land, is used only in two agricultural sectors of the model.

The second version of the model allows for industry-wide *national* (regional) scale economies that are *external* to individual firms, which relate production costs to the aggregate activity level of the industry. The larger the aggregate activity level of the industry, the lower the production cost of each individual firm. External scale economies may, for instance, arise because of the dissemination of production experience (knowledge) among the firms in an industry, or because a larger industry is able to support production of a wider variety of intermediate, specialized inputs that boost the productivity of the industry. (The latter interpretation is explicit in the third, monopolistic competition version). The firms in the industry are small in that they perceive themselves as having no influence over industry-wide scale economies. External scale economies are therefore consistent with the assumption of perfect competition between price-taking firms. The constant-returns and external scale economy versions incorporate the so-called Armington (1969) assumption, meaning that goods from

[33]This is possible because under MPSGE (a mixed complementarity solver) prices can fall to zero without computational difficulties. See Rutherford (1994a,b).

[34]MFA quota price wedges are drawn from several sources: Yang (1992, 1994), Whalley (1992), and the U.S. International Trade Commission (1991,1993). The price effects of European restraints on Japanese cars are based on Flam and Nordström (1994).

different regions are differentiated by origin. Japanese and American cars are hence imperfect substitutes in the eyes of consumers.

The third version of the model incorporates imperfect competition and scale economies that are *internal* to each firm depending on its own production level rather than the aggregate level of the industry. In particular, for sectors where we have estimates of scale elasticities, we model the sectors as being characterized by Chamberlinian large-group monopolistic competition. An important property of the monopolistic competition model is that increased specialization at intermediate stages of production yields returns due to specialization, where the sector as a whole becomes more productive the broader the range of specialized inputs. These gains are realized through two-way trade in specialized goods (Brown, 1994; Ethier, 1982; Krugman, 1980). The scale economy sectors are: mining, textiles, clothing, chemicals, steel, non-ferrous metals, fabricated metal products, transport equipment and other manufactures. The mining sector is not modelled as being monopolistically competitive, but rather as a sector subject to external scale economies. Given the pervasiveness of state ownership, cartel pricing and state trade in this sector, the assumptions of free entry and exit and average cost pricing that underlies monopolistic competition seemed particularly inappropriate. The other sectors (grains, other agriculture, forestry, fishery, trade and transport services, and other services) are assumed to operate with constant return to scale technologies.

The model also includes a simple dynamic link, whereby the static or direct efficiency (income) gains from trade liberalization induce additional savings and investment, which compound output and welfare effects over the medium-run. The dynamic link is a general equilibrium version of the Baldwin (1989, 1992) multiplier, which was used in assessment of the medium-run impact of the EC 1992 program. Given the parameters in the model, the income-investment linkage adds about 60 percent to the static welfare effects under constant returns to scale. More details on the model are contained in the technical appendix.

## 5. Simulation Results

This section presents our simulation results, divided into trade effects and income effects, and based on the commitments outlined in the previous sections.[35] In the simulations, we compare the actual equilibrium in the benchmark year (1990) with a counterfactual 1990 equilibrium. We also translate some of the income results into 2005 estimates using OECD and World Bank regional growth projections. This is done to facilitate comparisons to other studies, such as the World Bank/OECD (1993) and OECD (1993). [36]

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[35] One could imagine two policy scenarios, differing with regard to the assumed implementation of the agreement. For example, there is some flexibility in the averaging procedure in the cut of tariffs (including converted NTBs), and the base level of domestic support in the base period 1986-1988 was generally higher than in the base period of the model (1990). Both indicate that real liberalization in agriculture may be less, in the beginning, than what the agreement on agriculture seems to suggest *prima facie*. The agreement on agriculture calls for a conversion of NTBs to tariff equivalents. These and previously bound or applied tariffs are to be reduced on a simple average basis (unweighted) by 36% for developed countries and 24% for developing countries, with a minimum rate of reduction of 15 and 10%, respectively, for each tariff line. This part of the agreement offer some flexibility in choosing tariff cuts strategically to minimize the impact on the domestic agricultural industry. In certain cases, the necessary reduction in the average tariff rate of agricultural products may not be much higher than the minimum rate of reduction for each tariff line. In addition, applying cuts in domestic support of 20 respective 13⅓ percent seems somewhat optimistic, at least in the short run. The AMS calculations are based on the outlays during the period 1986 to 1988, which was characterized by relatively low world market prices for agricultural goods and therefore high outlays of domestic support to farmers. Because of higher world market prices and recent domestic reforms, the new commitments may not, *initially*, entail any further real cuts in domestic support. However, commitments on subsidies and specific tariffs in agriculture have generally been made in nominal terms. Inflation should eat away at allowable support over the long run, forcing further liberalization anyway. Even beyond the approach to averaging and the AMS calculations, there remains a great deal on other uncertainties regarding the actual shape of implementation in the area of agriculture that will not be resolved until studying the Uruguay Round becomes an exercise in economic history. For example, independent assessments of the tariffication process (See International Agricultural Research Consortium, 1994) indicate cases of "dirty tariffication," meaning the introduction of rates offering tariff-based protection much higher than the non-tariff protection that is being replaced. In some cases, this implies much smaller initial cuts in effective protection rates in agriculture than official documents suggest. Assessments by USDA(1994) also indicate rules flexibility allowing limited liberalization in certain key sectors. At the same time, however, we believe that minimum access commitments should, in most cases, force liberalization anyway. Complicating the calculus further is the fact that a very large number of newly introduced industrial country tariffs on agriculture are specific tariffs. With inflation in nominal agricultural prices, therefore, such protection will erode even further over time. On net, we have decided therefore to assume agricultural liberalization in line with official offers detailing average cuts in effective protection. For the interested reader, we have also estimated a more moderate liberalization scenario, based on smaller cuts in domestic support and much lower cuts in border measures. These estimates are available upon request.

[36] As noted before, our 2005-based estimates are quite rough. We have only made the 2005-based projections to facilitate comparison of our results to other studies of the Round. Other studies have

(continued...)

## 5.a Trade Effects

Once the Uruguay Round has been implemented, we expect shifts in the global pattern of production and trade. While new trading opportunities will arise for exporting firms, competitive pressures will be increased on import-competing firms in protected home markets. The associated efficiency gains and pro-competitive effects will impact on incomes and demand, magnifying initial trade effects. The estimated aggregate effects on world trade are given in Table 9. Estimated trade expansion (measured from the export side) is sensitive to the model specification, ranging from 8.7 percent in the perfect competition (PC) constant returns to scale (CRTS) version to 23.5 percent in the monopolistic competition (MC), increasing returns to scale (IRTS) model. Not surprisingly, the Armington specifications of the model, which feature a geographic anchor placed on the location of production, yields the smallest trade effects. External scale economies, by magnifying the efficiency gains associated with resource reallocation somewhat, increase this effect. The monopolistic competition framework, which emphasizes firm rather than location-based product differentiation, is more akin to factor intensity models of trade in terms of the determinants of the location of production. Even this specification, however, entails some geographic preference through the CES share parameters. (See the technical annex).

Note the small differences in trade expansion between the two versions of the model (a 9.6 percent increase in merchandise exports compared to 8.6 percent). This is largely due to the national product differentiation assumption, which is kept in both sets of results. Under this assumption, one explains two-way trade between similar countries by assuming products are differentiated by country of origin. German automobiles, hence, are treated as different from U.S. automobiles, and as a result Germany and the U.S. will trade with each other. If the assumption of regional preferences is dropped, we see a much more dramatic realignment of production and trade patterns in the world. The increase in merchandise trade jumps from around 10 percent to over 20 percent, according to the simulation results. There are at least two reasons for the jump in trade. Firstly, the national or regional anchor provided by the

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[36](...continued)
often involved moving the resource base forward to the end of the implementation period of the Uruguay Round, using available growth projections for world GDP, population, investment, etc. A given percentage welfare gain is then translated into a larger *nominal* amount because the economic base to which it is multiplied is larger in ten years than today (given positive growth).

national product differentiation assumption is relaxed. Secondly, variety *per se* is valued in this specification of the model, implying that any increased production also increases the incentives for trade, even between similar countries. Consumers like to wear different types of clothing, for instance, while producers become more productive following improved access to more highly specialized machinery and related inputs. These gains are realized through increased intra-industry trade. Indeed, as shown in the table, it is the imperfectly competitive sectors of the model -- chemicals, steel, non-ferrous metals, transport equipment, textiles, clothing, and other manufactures -- where the jump in trade between the two different demand specifications is concentrated.

Tables 10a and 10b show the estimated increase or decrease of real exports in various sectors and regions, as simulated in the two polar versions of the model: (CRTS, PC) and (IRTS, MC). Not surprisingly, the results indicate a realignment of production and trade pattern in accordance with (current) comparative advantages. Developing countries are estimated to expand production and export of labour-intensive clothing, textiles (that are relatively more capital intensive than clothing) and other (presumably light) manufactures, while developed countries are estimated to expand production of capital and technology-intensive industrial products, including transport equipment. Moreover, countries that are well-endowed with arable land -- the United States, Canada, Australia, New Zealand and many developing countries -- are estimated to increase their exports of agricultural products, due to the reduced presence of export-subsidized competition, and improved access to foreign markets.

On a regional basis, the merchandise trade of all regions is expected to expand, led by the trade of developing and transition economies. On a sectoral basis, under both model specifications the greatest increases in trade flows are in textiles and clothing from China, Taiwan, and the ROW aggregate of developing and transition economies. EFTA and EU exports of grain fall under all model specifications. Grain exports increase from Canada, Australia and New Zealand, the United States, and the ROW aggregate of developing and transition economies under all scenarios. Of these countries, the impact on grain exports in relative terms is greatest for Australia and New Zealand. In viewing these results, an important qualifier is called for. One may want to question whether sometimes dramatic changes in export volumes for particular sectors and particular markets, like clothing and textiles, can be accommodated

by the developed economies without triggering a defensive response of contingent protection actions, or related interventions.

Somewhat surprising, perhaps, is the small trade impact on the EFTA countries. This is related to their trade dependence on the European Union. Outside of agriculture and fisheries, the EFTA countries enjoy free trade with the European Union, and about 60 percent of their trade is also absorbed by the EU market. The (MFN) tariff cuts by the European Union imply a substantial erosion of trade preferences for the EFTA countries. As a consequence, EFTA countries will export less to the EU market.[37] Instead, they will trade more with other parts of the world were they enjoy enhanced market access for their products. The net effects on overall merchandise trade are small when compared to other regions.

It is possible, or even likely, that the isolated impact of the EU's liberalization on EFTA countries is negative because of the erosion of trade preferences. This does not mean, however, that they will be made worse off on balance. Rather, because its heavily protected agricultural sector will be liberalized somewhat, MFA quotas on textiles and clothing will be dismantled, and tariffs on manufactured products are to be cut, income will increase for the EFTA countries on a par with the gains enjoyed by other regions in the world. However, their welfare gains will come largely from their *own* liberalization efforts, and to a lesser extent from other parties liberalizations. This point carries over to other regions subject to preference erosion. The gains from the Round will depend for such regions, to a large extent, on the extent of their own reforms.

## 5.b Income effects

We now turn to the income effects, measured in terms of equivalent variation,[38] of the Uruguay Round agreement. These are summarized in Tables 11 and 12. We report both the 1990 counterfactual simulations (Table 11a,12a), and corresponding 2005-based estimates

[37] However, these trade preferences may be restored and even strengthened if the EFTA countries join the European Union, as four members are currently considering (Austria, Finland, Norway and Sweden).

[38] Equivalent Variation (EV) measures the income change at *current* prices that would be equivalent to the proposed Uruguay Round agreement in terms of its impact on welfare.

(Table 11b,12b). Corresponding income effects as a percent of GDP are also reported (Table 12c). Tables 11 and 12 present a decomposition of effects, depending in part on model structure assumptions. As with the trade figures, the estimates of the welfare or income effects of the UR agreement are sensitive to the model specification. Table 11 highlights the impact as a basic, static constant returns to scale model is modified to incorporate scale economies, imperfect competition, and dynamic investment-income linkages. We start with a simple, Armington-type model of trade with constant returns, similar to GTAP and RUNS-type analyses of the Round. The next column in these tables provides a *partial* transition to monopolistic competition, through the introduction of external (national) scale economies under perfect competition. The third column provides the full transition to a static monopolistic competition model. Finally, the last three columns provide the corresponding results in which investment-income dynamics have also been incorporated into both.

With the static specification, the estimated *annual* income gain for the world in the 1990 counterfactual simulation ranges from $65 to $181 billion, while the steady-state dynamic specification shifts the range upwards some 60 percent to between $110 to $291 billion. The corresponding estimated range for 2005, using the World Bank and OECD growth projections, is $109 to $315 billion with the static specification, and $184 to $510 billion with the dynamic specification. Under the full model, with dynamic features and imperfect competition, these gains are well distributed, with all regions (except Japan) gaining at least 1 full percent of GDP, as detailed in Table 12c. In absolute terms, estimated gains are concentrated in the European Union, the United States, and the group of developing and transition economies.

The estimates for the prefect competition versions of the model are roughly in parity with previous estimates of the World Bank and OECD. This is as it should be, because of similarity in model specifications. The big difference, in contrast to previous studies, is the introduction of monopolistic competition. This addition captures the importance of *intra-industry* (two-way) trade in similar products. Compared to Armington based specifications, trade liberalization leads here not just to deeper exploitation of comparative advantages and scale economies, but it also enhances variety of final and intermediate goods to the benefit of consumers and producers. This is why the trade and welfare effects loom so much larger in the monopolistic

competition case, not least for developing countries that are net importers of industrial products produced under increasing returns to scale.

Table 12 offers a rough decomposition of the welfare effects of the different parts of the UR agreement. Formally, we introduce one element of the UR after the other, starting with the tariff cuts on industrial goods, followed by the elimination of industrial quotas, and finally introducing the agreement on agriculture. The tables show the marginal contribution of each agreement for the two polar versions of the model: CRTS/PC and IRTS/MC.

According to these simulations, the most important, overall source of gains from the Uruguay Round follows from the elimination of quotas on industrial products: the MFA quotas and the elimination of quotas on Japanese cars in the EU market. (There are a number of other industrial quotas that we have not been able to account for which would reinforce this conclusion). The second most important aspect depends on the model. With a world characterized by constant returns to scale technologies in all industries, it is the agreement on agriculture. The agricultural reform provides up to 31% of the income gains in this case. Industrial tariff cuts become relatively more important when scale and specialization economies are at stake. In this case, the net complementarities implied by two-way trade, involving both pro-competitive effects and increased specialization and variety, also yield cross-border spillovers of the benefits of liberalization. These spillover effects, which prove particularly important for the group of developing and transition economies, are missed in constant returns models.[39]

A major difference between the two polar versions of the model is the impact on developing countries, including China and Chinese Taipei, of the elimination of MFA quotas on clothing

[39]The low "ranking" of the agricultural reforms is still a bit of puzzle, considering the unparalleled trade distortions in this sector. Normally, one would expect the largest gains in the most distorted sectors. One explanation is that agriculture makes up only a fraction of the economies in the OECD area. Another explanation is that the gains are there, but that the model as specified fails to capture them. The reason relates to model calibration. When the model is "calibrated" to fit the benchmark dataset, prices and quantities are used to deduce what the underlying parameters in the model must be to generate the observed market outcome. In an Armington model, if a particular type of agricultural good is not imported initially, there will be no subsequent demand even if the domestic price is lowered as a consequence of trade liberalizations. Starting from a "corner solution" with effectively prohibitive trade barriers, the Armington specification may understate the gains from the agricultural reforms because of understated preferences for imported agricultural products.

and textile. While the CRTS/PC model predicts a sizeable loss, the IRTS/MC version predicts a substantial gain. How can this be the case?

Recall that the MFA quotas are administrated through export licences that allow the "quota rents" or scarcity premiums to be captured by exporting countries. These quota rents will dissipate with the quotas, and the question is if improved market access will compensate for lower prices. This is where the models disagree. According to the CRTS/PC model, with its inherent regional bias in consumer preference (the Armington assumption) and therefore low demand responsiveness to lower import prices, the answer is no; and according to the IRTS/MC model, that treat all varieties of a product as equally good (bad) substitutes, the answer is yes. As seen in Tables 10a and 10b, the IRTS/MC model predicts an export increase that is about three times higher than that of the CRTS/PC model, and this is sufficient to turn a potential loss into a sizeable gain.

Note, finally, that countries gain not just from liberalization in export markets, but, and perhaps foremost, from their own liberalizations. Take the European Union as an example. The EU producers are not restricted by MFA quotas in their export markets, so they do not have a direct stake in the elimination of MFA quotas elsewhere. If anything they will lose from others industrial countries liberalizations in this area, because of sharper competition in export markets from developing and transitional countries that were previously restricted by MFA quotas. Still, the simulations indicate a substantial gain to the EU as a whole from the elimination of industrial quotas. Since their is no direct gain in export markets to expect, the gain must either be due to subtle indirect (general equilibrium) effects or because the EU gains from the withdrawal of their own industrial quotas. The latter seems more plausible. Consumers will gain immensely from the downward pressure on the prices of textiles and clothing that will follow the phase out of the MFA, and car consumers will gain substantially from the price reductions that should follow the GATT-illegality of European quotas on Japanese cars.

## 6. Summary

In this paper we have provided an assessment of the likely trade and income effects of key market access provisions of the Uruguay Round resulting from reduced tariffs, phase out of industrial quotas, and agricultural reforms. As something of a reader's guide to empirical studies

on the Round, we have provided a decomposition of the estimated effects of the Round, depending on assumptions about market structure, scale economies, and dynamic linkages between trade and income.

Our results are sensitive to model structure. For example, under constant returns, the estimated increase in world merchandise trade, measured from the export side, is about 10 percent. The corresponding amount under monopolistic competition is over 20 percent. Turning to income estimates, we estimate that the annual global income gain in 2005, when the Uruguay Round agreement is supposed to be fully implemented, may be up to $510 billion in 1990 dollars. However, estimates based on perfect competition and constant returns to scale indicate gains more in the range of $200 billion. In our assessment, this suggests that assuming perfect competition may also involve assuming away important aspects of the Round. Our result differ from earlier estimates, including our own, because we have now accounted for imperfect competition, scale economies, and new product introduction. Previous global studies have focused on the case of perfect competition and constant returns to scale.

Finally, it must be emphasized that these results are at best rough estimates of the likely effects of the Round. While the text of the Final Agreement is no longer a moving target, the pattern of implementation will continue evolve through 2005. In addition, even in the area of market access, it is difficult at best to quantify the likely impact of the Round. Other key aspects of the Round remain unquantified, like the important effects of liberalization in the service sectors, and of a strengthened set of trade rules. In addition, the Round may impact on long-term growth rates. While we have examined medium-term dynamic effects related to investment and incomes, we have not made any attempt to quantify permanent growth effects.[40]

[40] These issues are discussed at some length in our Uruguay Round background paper, Francois, McDonald, and Nordström (1993b).

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# Technical Annex

## Overview

This annex details the structure of the Computable General Equilibrium model used in our evaluation of "quantifiable" components of the Uruguay Round. Little space is devoted for examination of those parts of the model that are standard in multi-region CGE analysis. Interested readers should instead consult Shoven and Whalley (1993) or another source for a more complete description of these areas. We emphasize a schematic representation of the model at the expense of a more formal approach. For later reference, we index goods over the set $G$ and regions over the set $R$. Since there is a one to one correspondence between goods and sectors in the model, we do not distinguish between the two in this description, although they are distinct in the actual computer code. The model is implemented in GAMS/MPSGE (Rutherford 1994a, 1994b). Parameters are presented in Annex Table 1.

## The Basic Model: Constant Returns To Scale

The representation of the production technology under constant returns to scale (CRTS) in the model is pictured in Figure A-1. Each of the $G \times R$ goods in the model are produced according to a multi-input, single output nested constant elasticity of substitution production function. At the top level of each of these functions, a composite of primary factors[41] (the "value added" nest) is combined with intermediate inputs according to a Leontief specification. Under this specification, each unit of output of the good requires a fixed quantity of the value added. Three factors of production enter this nest: labour, capital and, for agricultural goods, land. These factors are then combined in a constant elasticity of substitution (CES) function to form the composite "value added" used in producing the good. The values of the elasticity of substitution, $\sigma$, in the primary factor nests range from 0.02 to 0.94 for most goods. These parameters are drawn from the GTAP database of elasticities. In the intermediate input nest, a fixed quantity of each input is required.[42] Under CRTS, the intermediate inputs used here are the Armington composite goods, a combination of the domestically produced input and imported inputs. As suggested by the diagram, this combination is *not* specific to the good

[41]As is usual, the composition of this primary factor nest is specific to the good and the region.

[42]Because the top-level structure is Leontief, it would be economically equivalent to drop the intermediate input nest and have each intermediate input enter at the top level.

being produced but is instead common to all users within the region, including industries, consumers, and government.[43] In other words, the Armington aggregation is done "at the border" rather than at the level of each user.[44]

Schematically, the demand flows for the economy are represented by Figure A-2. Factor markets are competitive, with capital, labour, and land being demanded by producers. Full employment is assumed in labour markets. Under CRTS, domestic production is as described in Figure A-1, with output feeding into the Armington aggregation function (domestic demand) and feeding into exports (foreign demand), as shown in Figure A-2. The composite good, in turn, is used both as an intermediate and as a final demand good. Imports also flow into the Armington aggregation function. Alternatively, under monopolistic competition, domestic production feeds into a CES aggregator for product varieties, as represented again in Figure A-2. These varieties are also exported. The production technology described by Figure A-1 then accounts for the linear-homogeneous component of IRS cost functions for individual firms, as described below.

## Demand

We distinguish four demand sources: personal consumption, government, investment (or savings), and exports. For purposes here, export demand is examined from the perspective of the importer and is treated under the section on international trade. Personal consumption, government, and investment are assumed to each take a fixed share of regional gross domestic product.[45] This concept is operationalized with the use of single, representative, composite

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[43]The information necessary to build use-specific Armington import composites is not usually available. In the case of production sectors, one would need to know the amount of good $G$ from region $R$ used in the production of each good $G'$ in each region $R'$. This detail is generally not available in national input-output tables.

[44]Among other advantages, this formulation saves tremendously on model dimensions. In our 15 good, 9 region application, the Armington specification at the border requires 135 dimensions. With (G+3) users (including sectors, households, the government, and a composite investment good) in each region, implementing the Armington specification at the user level would require (G+2)*G*R additional dimensions, a total of 2430.

[45]We do not model income generated abroad so there is no distinction in this model between GDP and GNP. Extensions into this area are limited mainly by the availability of detailed data rather than by any modelling difficulties *per se*. We are considering incorporating available information on factor
(continued...)

household in each region, having Cobb-Douglas utility functions defined over government consumption, personal consumption, and savings (future consumption).[46] The composite household holds endowments of the factors of production and receives income by selling them to firms. They also receives income from the receipt of tariff revenue and rents from the sale of import/export quota licenses (when applicable). Part of the income is distributed as subsidy payments to some sectors.

Each of the three demand sources in each region has its own sub-utility structure. The constant share of GNP spent on personal consumption is allocated between food consumption and non-food consumption. At this time, we assume an elasticity between the two aggregates to be equal to one, that is, a Cobb-Douglas specification, as we do between different products within each aggregate. (The facility to easily change this is kept open in the model, however). Similarly, all non-food goods enter the non-food personal consumption nest, also a CES function currently with a Cobb-Douglas specification. In the case of both food and non-food goods entering personal consumption, the goods referred to here are composite goods, composed of domestic and imported varieties and, as in production, the composition (imports and the domestic variety) of the composite goods is not directly determined by personal consumption demand. Instead, this aggregation is done once for each good at each border.

The structure used for government spending is very simple. We use a Leontief specification, that is, government demand fixed inputs of each product category. There are no substitution effects to price changes in this structure, only income effects. Total spending by the government is determined as a share of regional GDP, through the Cobb-Douglas specification discussed above.

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[45](...continued)
income flows into the database and making modifications to the model. The extensions we have in mind would more accurately allocate changes in factor returns to their actual recipients. The endogenization of foreign investment would be a much more complicated extension, and one where theory offers relatively little guidance.

[46] Base period international capital flows are held fixed during the counterfactual simulations unless the description of the counterfactual states otherwise. Effective exchange rates adjust in order to balance external accounts.

Likewise, a fixed share of regional GDP is "saved" and then spent on investment goods. Fixed savings rates are a common assumption in CGE models. Our formulation requires that a fixed amount of income be allocated to savings and that this allocation be transmitted directly into investment goods. The composition of the bundle of investment goods that is purchased in the economy is not sensitive to the prices of these goods (i.e. the composite investment good is produced through a Leontief aggregation), so that the relative quantities of goods purchased for investment purposes do not change. The representation of investment is done on an economywide, rather than sectoral, basis. The current/steady-state capital stock is allocated across sectors through competitive capital markets. We do not model capital movements between regions.

## International trade

The structure of international trade in our model under CRTS is similar to that found in most other multi-country CGE models. We employ a nested Armington formulation for imports and, as mentioned above, this is done at the border rather than at the level of the individual user. On the other hand, our model structure assumes that a good sold for export from a region is not differentiated from the good produced in that region and marketed domestically. One alternative on the export side is to introduce a function, usually with a constant elasticity of transformation, that transforms domestically produced goods into exports; this structure loses its appeal in large scale multi-country modelling, however.[47]

We model imports as imperfect substitutes with domestic goods and with other imports. Although some consumers and some purchasers of intermediate inputs do in fact attach great significance to the country of production of particular goods, this is not the primary motivation for the use of an imperfect substitutes approach. Rather, we motivate this assumption based on the composition of different "goods." While the database we use and the particular aggregation of goods that is used in the results reported in this paper are very detailed in

[47]In single country models this device serves the purpose of introducing an element of price-inelasticity to exports, which otherwise would be too price-responsive. In multi-country models this role is normally played by an Armington structure for imports in the importing countries. Introducing the domestic good - export good transformation, or "export Armington," in a multi-country model where imports are already imperfect substitutes for domestic goods needlessly increases the number of parameters and equations in the model.

comparison to other multi-country models, what we term "goods" in the model context are nevertheless highly aggregated. In this respect, it is important to remember that the *composition* of these aggregated goods does vary across regions, sometimes dramatically. We know, then, that it would be inaccurate to portray one of the model goods produced in a region $R$ and the same good produced in region $R'$ as identical.

However, it is not so clear how differentiated, or substitutable, these goods are, nor is it clear what substitution relationships exist across goods from different countries. With limited information, we follow a nested formulation of the Armington aggregation process. Armington elasticities are drawn from the GTAP parameter files. Every unit of every imported good produced in the model goes into an Armington aggregation function for that good in the domestic region or in one of the other regions. Whether we are discussing intermediate inputs, consumption, government spending, or investment, demand is always considered to be demand for an Armington aggregate good and never considered to be demand for a good from a particular source region. When firms, the consumer, the government, and investors of a particular region purchase a good, they are in fact purchasing an Armington composite (as is evident from the figures above) and the Armington composite they purchase is common across all users in the region. There are GxR composite goods in the model.

The Armington structure is illustrated in Figure A-3. Lacking information on the substitutability of imports from different regions, our structure assumes that imports from all sources are equally substitutable among themselves, while the second Armington nest allows for a different degree of substitutability *among* imports than *between* imports and the domestic good, under perfect competition. The model incorporates the constant elasticity of substitution form to characterize the substitution possibilities within each of these aggregations.[48] Values for $\sigma$ in these Armington functions were obtained from estimates in the econometric literature. Upper-tier elasticities used in our base simulations are in the range 1.9 to 5.2. They are listed in Annex Table 1.

[48] This formulation nevertheless allows the domestically produced good to have a large share in the Armington aggregate. If this is the case in the benchmark data, the calibration process will generate a large distribution parameter for the domestically produced good; these parameters are not changed during the simulations.

## External Scale Economies

The second version of the model allow for industry-wide "external" scale economies, relating production costs to the aggregate activity level of the industry. External scale economies may, for instance, be due to dissemination of production experience (knowledge) among the firms in an industry, or that a larger industry is able to support production of a wider variety of intermediate, specialized inputs that boost the productivity of the industry. The firms in the industry are small in that they perceive themselves as having no influence over industry-wide scale economies. This is why external scale economies are consistent with the assumption of perfect competition.

Formally, we assume that scale economies are non-linearly related to the aggregate output of the firms (indexed $j$ ) in sector $i$,

$$(A\text{-}1) \qquad Z_i = \left[ \sum_j x_{ji} \right]^{\theta_i} ; \qquad \theta_i > 1 ,$$

yielding an industry-wide cost function that is equal to

$$(A\text{-}2) \qquad C_i(Z_i) = Z_i^{1/\theta} f(w) ,$$

where $f(w)$ is a cost-index of composite intermediates, which is linearly homogeneous in input prices (given by the vector $w$). We can then define an industry-wide measure of scale economies,

$$(A\text{-}3) \qquad \phi_i = 1 - \frac{Z_i C'(Z_i)}{C(Z_i)} = 1 - \frac{1}{\theta_i} .$$

It is worth noting that, in reduced form, this specification is also consistent with national industries characterized by increasing returns due to specialization. Alternatively, it is also consistent with a "nested" layer of preferences, with CES aggregation of differentiated varieties by country of origin, and with an upper-tier set of Armington-type preferences defined over the CES aggregates. While the calibration and interpretation of parameters would be different, the functional forms would all be identical.

## International Monopolistic Competition

We extend the basic, CRTS framework to incorporate imperfect competition and scale economies. In particular, for sectors where we have estimates of scale elasticities, we model the sectors as being characterized by Chamberlinian large-group monopolistic competition. This involves two-way trade in intermediates, along the lines of Ethier (1982). (Also see Brown 1994; Francois 1994a; and Krugman 1980). In this specification, we interpret trade as involving specialized intermediate products. The "composite aggregation" box in Figure A-1 then represents CES aggregation of these intermediates into a composite that is used by both producers and consumers. For want of appropriate data (and due to computational complexities), we do not assume different CES aggregators for intermediate and final products. The scale economy sectors are: mining; other manufactures; textiles; clothing; chemicals; steel; non-ferrous metals; fabricated metal products; and transport equipment. The mining sector is not modelled as being monopolistically competitive, but rather as a sector subject to external scale economies. Given the pervasiveness of state ownership and cartel pricing in this sector, and of state trading, the assumptions of free entry and exit and average cost pricing underlying monopolistic competition seemed particularly inappropriate for this sector.

Formally, within a region, demand for differentiated intermediate products belonging to sector $i$ can be derived from the following CES function,

$$(A\text{-}1) \qquad Q_i = \left[ \sum_j \gamma_{ij} x_{ij}^{\beta_i} \right]^{1/\beta_i} ; \qquad 1 > \beta_i = 1 - 1/\sigma_i > 0 ,$$

where $\gamma_{ij}$ is the demand share preference parameter, $x_{ij}$ is demand for variety $j$ of product $i$, and $\sigma_i$ is the elasticity of substitution between any two varieties of the good. Note that while we interpret $Q_i$ as the output of a constant returns assembly process, the resulting composite product enters both consumption and production. Equation (A-1) could therefore be interpreted as representing an assembly function embedded in the production technology of firms that use intermediates in production of final goods, and alternatively as representing a CES aggregator implicit in consumer utility functions. Both cases involve the same functional form. Because most industrial trade involves intermediates, we favour the former interpretation.

Given equation (A-1), in a symmetric equilibria the elasticity of demand faced by a individual firm producing variety $x_{ij}$ is given by

$$(A\text{-}2) \qquad \epsilon_{ij} = \sigma_i + (1-\sigma_i)/n_i \; ; \qquad \sigma_i = 1/(1-\beta_i),$$

where $n_i$ is the total number of domestic and foreign firms in the industry. Given that $n_i$ is "large," we may approximate the elasticity faced by an individual producer with the elasticity of substitution between any two varieties, that is, $\epsilon_{ij} \approx \sigma_i$.

Firms in a region are assumed to have identical costs and technologies, and face identical demand conditions, so that they end up producing the same quantity in the *symmetric* equilibrium, $x_{ir}$, and charging the same price $p_{ir}$, where r is an index of the regions. The first order condition for profit-maximizing yields the standard mark-up pricing role over marginal cost ($MC_{ir}$), namely,

$$(A\text{-}3) \qquad p_{ir} = \left(\frac{\sigma_i}{\sigma_i - 1}\right) MC_{ir} \; .$$

Given that there exist no restrictions on entry and exit, firms will enter whenever conditions are such that entry is profitable and exit when market condition are such that prices does not cover the average production cost ($AC_{ir}$). In a market equilibrium, prices must then be equal to average cost

$$(A\text{-}4) \qquad p_{ir} = AC_{ir} \; .$$

Firms produce subject to the following cost function

$$(A\text{-}5) \qquad c(x_{ir}) = (\alpha_i + \beta_i x_{ir}) f(w) \; ,$$

where $\alpha_i$ is a fixed cost, $\beta_i$ is a constant marginal cost, and $f(w)$ is a cost-index of composite intermediates, which is linearly homogeneous in input prices (given by the vector $w$). Note

that $\alpha_i$ and $\beta_i$ are identical across regions, though the functions f(.) may vary. Given these cost function, one may define the Cost Disadvantage Ratio (CDR) as

$$(A\text{-}6) \qquad CDR_{ir} = \frac{(AC_{ir} - MC_{ir})}{AC_{ir}} = 1 - [1 + \frac{\alpha_i}{\beta_i x_{ir}}]^{-1} .$$

Combining equation (A-3), (A-4) and (A-6), we find that the cost disadvantage ratio must be equal to the inverse of the demand elasticity of substitution in the market equilibrium.

$$(A\text{-}7) \qquad CDR_{ir} = \sigma_i^{-1} .$$

Given that the elasticity of substitution is fixed, the cost-disadvantage ratio must also be fixed, implying that the output of a representative firm will not change as a consequence of a change in government policy (unless it effects the fixed cost of the firm). Rather, firms will enter if the market conditions improves (as a result of a policy change) or exit when they become worse.

Given that region $r$ produce $n_{ri}$ symmetric varieties of product $i$, and that all varieties are produced in equal quantities, $x_{ri}$, we can rewrite equation (A-1) as,

$$(A\text{-}8) \qquad Q_i = [\sum_r \gamma_{ri} n_{ri} x_{ri}^{\mu_i}]^{1/\mu_i} ,$$

where the demand share parameter, $\gamma_{ri}$, is by assumption equal for all varieties from region $r$. Denote total output of the good $i$ from region $r$ by $X_{ri}$ ($= n_{ri} x_{ri}$), equation (A-8) becomes

$$(A\text{-}9) \qquad Q_i = [\sum_r \gamma_{ri} n_{ri}^{1-\mu_i} X_{ri}^{\mu_i}]^{1/\mu_i} .$$

Let $\delta_{ri} = n_{ri} / n_{ri,0}$ denote the ratio between the number of symmetric varieties in pre and post equilibria, where the initial benchmark equilibrium is distinguished by a zero subindex. Equation (A-9) can then be expressed as

$$(A\text{-}10) \qquad Q_i = [\sum_r \gamma_{ri} n_{ri,0}^{1-\mu_i} \delta_{ri}^{1-\mu_i} X_{ri}^{\mu_i}]^{1/\mu_i} .$$

where the variable $\delta_n$ may be interpreted as a "specialization scaling effect" within the CES functional framework.

## Income-Investment Linkages

Trade theory suggests that the more efficient utilization of productive resources following trade liberalization will lead to a one-time (static) increase in GDP income. In addition, growth theory suggests a "medium-run growth bonus" as the static efficiency gains induce higher savings and investment, which in turn yields more output, leading to further savings and investment, and so on. (See, Baldwin 1989, 1992, for a discussion). In general, from classical growth theory, a shock to the GDP function, if permanent, should translate into a shock to the steady-state level of capital. The exact effect depends on the assumed underlying savings behaviour (fixed savings, overlapping generations, etc).[49] Under our current assumption of fixed savings rates, the change in steady-state capital stocks, following a shock to the GDP function, will be proportionate to the change in the steady-state value of the GDP function itself.[50] In particular, it can be shown that, controlling for changes in the price of capital,

$$(A\text{-}11) \qquad K_1 = K_0 \left( GDP_1 / GDP_0 \right),$$

where $K_0$ and $K_1$ refer to steady-state capital stocks under the initial steady-state benchmark and under the counterfactual steady-state. Hence, by making the assumption that we are working with steady-state equilibria, we can solve explicitly for steady-state capital stock values. The pre-UR capital stock is allocated across sectors so that returns are equalized. We do not allow for international capital movements.

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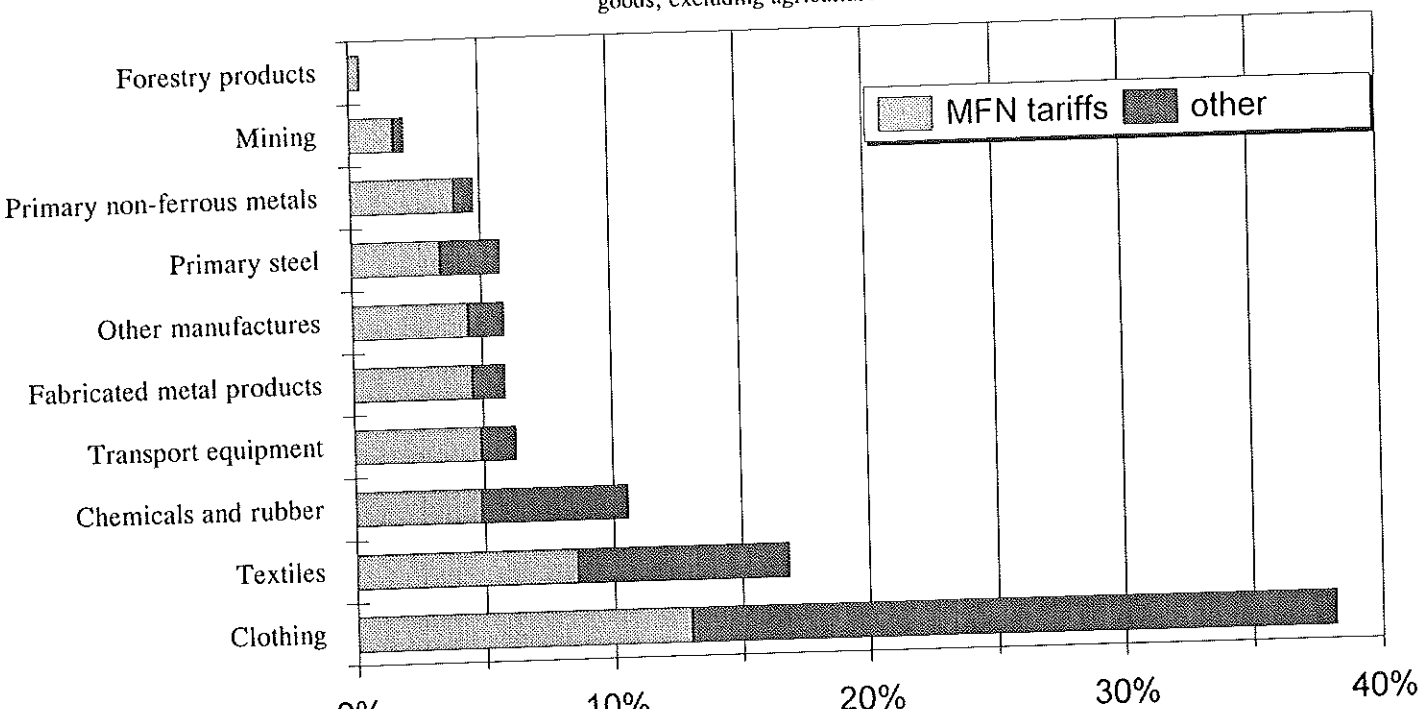
[49] These medium-run effects are different from any long-run, permanent growth effect that may materialize as ideas and technology are given freer scope to travel around the world.

[50] An alternative closure of the model involves linking the rate of interest to the rate of time discount, under forward-looking behaviour. This type of steady-state closure has been implemented within a version of the present model. See Francois (1994).

## Model calibration

The CES functions of our model contain distribution parameters that must have values assigned. The usual process, and that which we follow here, is to use the information on initial prices and quantities contained in the benchmark data set in combination with the exogenously specified (but empirically based) elasticity parameters to calibrate these parameters. Once calibrated, the parameters are exogenous in all counterfactual simulations. The calibration process is well documented in Shoven and Whalley (1993). Under the monopolistic competition specification, CES weights in the aggregation functions embody implicit benchmark variety indexes, as described in equation (A-10). The model is calibrated to reproduce the benchmark equilibrium, which under dynamic applications is treated as a steady-state.

**Figure 1**
**OECD manufacturing protection -- 1990**
goods, excluding agriculture




Tariffs reflect MFN-based tariffs and regional preferences. Regional preferences result in trade with weighted protection below MFN rates. "Other" protection is not comprehensive, but represents a lower bound covering major industrial quotas and dumping actions.

Source: protection data described in text.

**Table 1. Tariff Bindings on Industrial and Agricultural Products (%)**

| | Percentage of tariff lines bound | | Percantage of imports under bound rates | |
|---|---|---|---|---|
| | Industrial Products | | | |
| | Pre-UR | Post-UR | Pre-UR | Post-UR |
| Developed | 78 | 99 | 94 | 99 |
| Developing | 22 | 72 | 14 | 59 |
| Transition | 73 | 98 | 74 | 96 |
| | Agricultural Products | | | |
| Developed* | 58 | 100 | 81 | 100 |
| Developing | 18 | 100 | 25 | 100 |
| Transition | 54 | 100 | 54 | 100 |

*The major exceptions are the tariffs on rice in Japan and Korea that are still unbound.

## Table 2. Pre- and Post-UR MFN Tariff Rates on Non-Agricultural Products

| | Australia & New Zealand | | | Canada | | | United States | | | Japan | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Old | New | Cut | Old | New | Cut | Old | New | Cut | Old | New | Cut |
| Fishery products | 0.7 | 0.5 | 28.3 | 3.2 | 2.1 | 34.4 | 1.2 | 0.9 | 20.6 | 5.7 | 4.1 | 28.6 |
| Forestry products | 0.2 | 0.2 | 0.0 | 0.0 | 0.0 | 34.3 | 0.3 | 0.0 | 100.0 | 0.0 | 0.0 | 30.2 |
| Mining | 1.5 | 1.1 | 31.5 | 2.6 | 1.3 | 49.3 | 1.3 | 0.8 | 36.4 | 1.3 | 0.6 | 56.3 |
| Textiles | 24.6 | 14.5 | 41.1 | 18.6 | 11.7 | 36.8 | 10.5 | 7.5 | 29.0 | 7.4 | 6.0 | 19.5 |
| Clothing | 50.5 | 34.8 | 31.0 | 22.9 | 16.6 | 27.7 | 16.7 | 15.2 | 9.1 | 13.0 | 10.2 | 21.9 |
| Primary steel | 9.7 | 1.6 | 83.5 | 7.4 | 0.4 | 95.2 | 4.5 | 0.2 | 95.2 | 3.9 | 0.6 | 84.6 |
| Primary non-ferrous metals | 11.2 | 6.4 | 42.8 | 4.9 | 2.7 | 44.4 | 2.9 | 2.6 | 7.2 | 4.1 | 2.4 | 41.7 |
| Fabricated metal products | 17.1 | 12.7 | 25.9 | 9.7 | 6.0 | 37.8 | 4.7 | 2.8 | 41.1 | 3.4 | 0.9 | 74.3 |
| Chemicals and rubber | 11.9 | 7.5 | 37.0 | 10.3 | 5.3 | 48.4 | 5.0 | 3.0 | 39.7 | 4.1 | 1.6 | 60.9 |
| Transport equipment | 25.7 | 19.4 | 24.8 | 8.1 | 5.4 | 34.1 | 4.8 | 4.6 | 4.5 | 1.5 | 0.0 | 100.0 |
| Other manufactures* | 11.6 | 7.6 | 34.5 | 6.3 | 2.9 | 54.3 | 3.5 | 1.5 | 56.5 | 2.0 | 0.9 | 52.1 |
| Total merchandise | 14.2 | 9.5 | 32.9 | 7.4 | 4.2 | 43.9 | 4.6 | 3.2 | 30.1 | 4.4 | 2.7 | 38.2 |

| | European Union | | | EFTA | | | Developing/Transitional | | | Dev/Tra excl Hong Kong | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Old | New | Cut | Old | New | Cut | Old | New | Cut | Old | New | Cut |
| Fishery products | 12.9 | 10.7 | 17.4 | 1.7 | 1.4 | 17.9 | 35.2 | 8.1 | 76.9 | 35.2 | 8.1 | 76.9 |
| Forestry products | 0.0 | 0.0 | 100.0 | 0.2 | 0.1 | 48.0 | 0.1 | 0.1 | 14.3 | 5.8 | 5.0 | 14.3 |
| Mining | 1.1 | 0.8 | 27.3 | 1.0 | 0.8 | 23.2 | 11.5 | 9.5 | 17.6 | 11.5 | 9.5 | 17.6 |
| Textiles | 9.0 | 6.8 | 25.0 | 12.2 | 8.0 | 34.3 | 30.3 | 20.3 | 33.0 | 30.5 | 20.4 | 33.0 |
| Clothing | 12.6 | 10.9 | 13.2 | 17.0 | 11.4 | 33.1 | 14.6 | 10.8 | 25.9 | 20.2 | 15.0 | 25.9 |
| Primary steel | 5.3 | 0.5 | 90.8 | 4.1 | 0.6 | 85.7 | 8.7 | 6.1 | 30.7 | 16.9 | 11.7 | 30.7 |
| Primary non-ferrous metals | 7.2 | 5.9 | 17.9 | 4.0 | 2.9 | 26.4 | 2.7 | 2.1 | 20.7 | 17.3 | 13.8 | 20.6 |
| Fabricated metal products | 5.7 | 3.1 | 46.4 | 5.3 | 3.0 | 43.1 | 8.5 | 6.9 | 18.9 | 20.7 | 16.8 | 18.8 |
| Chemicals and rubber | 7.7 | 4.2 | 44.8 | 5.8 | 3.0 | 48.9 | 19.1 | 13.2 | 30.7 | 19.2 | 13.3 | 30.7 |
| Transport equipment | 6.9 | 6.0 | 13.0 | 7.5 | 6.3 | 16.2 | 27.2 | 17.3 | 36.6 | 29.5 | 18.7 | 36.6 |
| Other manufactures* | 5.5 | 2.5 | 54.7 | 4.3 | 2.3 | 46.9 | 18.0 | 13.3 | 26.1 | 18.0 | 13.3 | 26.1 |
| Total merchandise | 5.3 | 3.2 | 39.7 | 6.2 | 3.9 | 36.4 | 13.5 | 9.8 | 27.4 | 18.2 | 13.2 | 27.5 |

**Table 3. Estimated MFA quota price-wedges**

| Exporters: / Importers: | Textiles | | | Clothing | | |
|---|---|---|---|---|---|---|
| | China | Taiwan | Dev/Tra | China | Taiwan | Dev/Tra |
| Canada | 23.2 | 14.2 | 15.0 | 42.0 | 28.7 | 30.0 |
| United States | 18.4 | 12.2 | 12.0 | 40.3 | 29.0 | 35.0 |
| EFTA | 13.5 | 8.5 | 7.5 | 18.0 | 16.5 | 17.5 |
| European Union | 27.4 | 17.5 | 15.0 | 36.1 | 33.5 | 35.0 |

**Table 4. Integration Scheme for Textile and Clothing**

| | **Integration** (Base: 1990 import volume of the products listed in annex) | **Growth rate of residual quotas** (Base: Previously agreed MFA growth rates of quotas) |
|---|---|---|
| **Stage I.** (Day 1) | 16 % | 16% higher growth rate than initially (Ex: 3% to 3.48%) |
| **Stage II.** (Year 4) | Further 17%, (Total 33%) | Increase by 25% (Ex: 3.48% to 4.35%) |
| **Stage III.** (Year 8) | Further 18%, (Total 51%) | Increase by 27% (Ex: 4.35% to 5.52) |
| **End of the 10 year transition period** | Remaining 49%, (Total 100%) | |

## Table 5. Summary of the Agreement on Agriculture

| | Market Access (Base: 1986-1988) | Export Subsidies (Base: 1986-1990) | Domestic Support (Base: 1986-1988) |
|---|---|---|---|
| **Value:** | i. Tariffication of NTBs<br>ii. 36 (24)% average tariff cut including converted NTBs<br>iii. 15 (10)% minimum tariff cut per tariff line | i. 36 (24)% cut in budget outlay | i. Cut of AMS by 20* (13.3)%, "Green Box" measures exempt<br>* EU 16.8% (special) |
| **Volume:** | i. Minimum market access of 3% rising to 5% | i. 21 (14)% cut in subsidized export quantity | |

Note: Developing country provisions within paranthesis. The least developed countries are exempted.

## Table 6 Estimated Base Protection Agriculture (Buget outlays in millions of 1990 dollars, rates in percent)

| | Production Subsidies | | | | Export Subsidies | | | | Tariffs & NTBs | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Grains | | Other | | Grains | | Other | | Grain | Other |
| Canada | $688 | 11% | $844 | 4% | $366 | 11% | $60 | 2% | 13% | 8% |
| USA | $16,553 | 32% | $4,489 | 3% | $644 | 6% | $43 | 0% | 5% | 8% |
| EFTA | $3,071 | 49% | $4,219 | 15% | $650 | 206% | $893 | 88% | 247% | 117% |
| EU | $2,115 | 18% | $45,800 | 40% | $4,105 | 132% | $1,320 | 16% | 70% | 55% |
| A & NZ | $59 | 1% | $0 | 0% | $0 | 0% | $134 | 2% | 0% | 6% |
| Japan | $1,868 | 5% | $12,814 | 18% | $0 | 0% | $0 | 0% | 470% | 84% |
| Dev/Tra | N.A. | N.A. | N.A. | N.A. | $1,356 | 33% | $871 | 2% | 27% | 42% |

## Table 7. The Economic Structure of Different Regions

| Canada | O | V | D | X | M | X/O | M/D |
|---|---|---|---|---|---|---|---|
| Grains | 0.6 | 0.4 | 0.3 | 2.7 | 0.1 | 59.0 | 3.5 |
| Other Agricultural products | 2.0 | 1.4 | 2.2 | 2.1 | 2.7 | 13.3 | 14.1 |
| Fishery products | 0.3 | 0.3 | 0.1 | 1.2 | 0.3 | 59.7 | 26.6 |
| Forestry products | 0.8 | 0.6 | 0.8 | 0.1 | 0.2 | 2.2 | 2.2 |
| Mining | 3.4 | 3.8 | 2.7 | 9.9 | 4.9 | 37.1 | 20.0 |
| Textiles | 0.8 | 0.8 | 1.0 | 0.6 | 1.9 | 10.1 | 22.3 |
| Clothing | 0.8 | 0.7 | 1.0 | 0.2 | 1.5 | 3.1 | 17.0 |
| Primary steel | 0.9 | 0.8 | 1.0 | 1.6 | 2.0 | 22.4 | 22.4 |
| Primary non-ferrous metals | 0.9 | 0.8 | 0.6 | 3.8 | 1.5 | 57.1 | 29.6 |
| Fabricated metal products | 1.5 | 1.2 | 1.6 | 1.5 | 2.6 | 13.0 | 17.7 |
| Chemicals and rubber | 3.2 | 3.0 | 3.5 | 6.2 | 8.8 | 24.9 | 28.2 |
| Transport equipment | 3.5 | 2.5 | 3.3 | 20.9 | 20.7 | 76.9 | 70.8 |
| Other manufactures | 17.6 | 13.8 | 18.8 | 33.2 | 45.3 | 24.4 | 26.9 |
| Trade and transport | 21.3 | 22.1 | 21.0 | 7.3 | 3.5 | 4.4 | 1.8 |
| Other services | 42.5 | 47.6 | 42.3 | 8.7 | 4.0 | 2.6 | 1.1 |

| The United States | O | V | D | X | M | X/O | M/D |
|---|---|---|---|---|---|---|---|
| Grains | 0.5 | 0.1 | 0.4 | 2.7 | 0.1 | 24.3 | 1.0 |
| Other Agricultural products | 1.6 | 0.8 | 1.6 | 3.5 | 2.2 | 10.5 | 7.8 |
| Fishery products | 0.1 | 0.1 | 0.1 | 0.5 | 0.9 | 41.6 | 55.1 |
| Forestry products | 0.3 | 0.2 | 0.3 | 0.6 | 0.0 | 10.0 | 0.4 |
| Mining | 2.6 | 3.5 | 3.1 | 2.1 | 11.1 | 3.8 | 19.7 |
| Textiles | 0.8 | 0.5 | 0.8 | 1.9 | 1.3 | 11.5 | 8.8 |
| Clothing | 0.7 | 0.6 | 1.0 | 0.5 | 3.6 | 3.5 | 20.4 |
| Primary steel | 1.1 | 0.8 | 1.2 | 1.2 | 2.1 | 5.2 | 9.9 |
| Primary non-ferrous metals | 0.5 | 0.3 | 0.5 | 1.2 | 1.9 | 12.2 | 19.1 |
| Fabricated metal products | 1.6 | 1.1 | 1.6 | 1.6 | 1.9 | 4.9 | 6.6 |
| Chemicals and rubber | 2.9 | 1.7 | 2.8 | 10.5 | 7.3 | 17.6 | 14.5 |
| Transport equipment | 3.3 | 2.3 | 3.6 | 13.1 | 15.7 | 19.0 | 24.1 |
| Other manufactures | 19.8 | 13.8 | 20.1 | 42.7 | 45.4 | 10.5 | 12.4 |
| Trade and transport | 19.4 | 22.2 | 18.9 | 8.4 | 2.8 | 2.1 | 0.8 |
| Other services | 44.8 | 52.0 | 44.1 | 9.5 | 3.7 | 1.0 | 0.5 |

| EFTA | O | V | D | X | M | X/O | M/D |
|---|---|---|---|---|---|---|---|
| Grains | 0.5 | 0.4 | 0.4 | 0.3 | 0.1 | 14.4 | 5.3 |
| Other Agricultural products | 2.1 | 1.3 | 2.9 | 0.6 | 2.0 | 6.2 | 16.2 |
| Fishery products | 0.2 | 0.1 | 0.1 | 0.7 | 0.2 | 83.0 | 59.5 |
| Forestry products | 0.6 | 0.8 | 0.6 | 0.1 | 0.3 | 5.1 | 11.0 |
| Mining | 3.4 | 1.8 | 3.2 | 8.8 | 7.6 | 60.5 | 56.1 |
| Textiles | 1.3 | 0.7 | 1.3 | 1.8 | 2.0 | 32.2 | 34.6 |
| Clothing | 0.5 | 0.6 | 1.1 | 0.9 | 3.1 | 41.2 | 67.3 |
| Primary steel | 0.7 | 0.8 | 0.6 | 2.9 | 2.3 | 98.0 | 97.1 |
| Primary non-ferrous metals | 0.6 | 0.4 | 0.4 | 2.3 | 1.5 | 93.3 | 89.1 |
| Fabricated metal products | 5.0 | 6.4 | 5.0 | 2.2 | 2.3 | 10.3 | 10.9 |
| Chemicals and rubber | 4.5 | 2.7 | 4.4 | 7.2 | 7.1 | 37.3 | 37.6 |
| Transport equipment | 3.0 | 2.3 | 3.8 | 6.1 | 9.3 | 47.4 | 57.8 |
| Other manufactures | 16.2 | 8.8 | 16.4 | 43.3 | 43.9 | 62.1 | 62.7 |
| Trade and transport | 14.6 | 17.5 | 14.1 | 5.9 | 4.3 | 9.4 | 7.2 |
| Other services | 46.9 | 55.4 | 45.7 | 17.0 | 14.0 | 8.4 | 7.2 |

**Table 7 (- Continue -)**

| The European Eunion | O | V | D | X | M | X/O | M/D |
|---|---|---|---|---|---|---|---|
| Grains | 0.5 | 0.4 | 0.5 | 1.0 | 0.2 | 13.5 | 2.9 |
| Other Agricultural products | 2.6 | 2.1 | 2.9 | 1.3 | 4.2 | 3.6 | 10.4 |
| Fishery products | 0.2 | 0.2 | 0.3 | 0.2 | 0.8 | 5.0 | 20.1 |
| Forestry products | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 | 3.5 | 11.7 |
| Mining | 3.6 | 2.5 | 4.3 | 3.0 | 13.8 | 6.0 | 23.1 |
| Textiles | 1.6 | 1.1 | 1.6 | 2.5 | 2.5 | 11.1 | 11.2 |
| Clothing | 0.8 | 0.6 | 0.9 | 1.7 | 2.7 | 15.9 | 21.0 |
| Primary steel | 0.5 | 0.4 | 0.4 | 2.6 | 1.7 | 40.0 | 30.1 |
| Primary non-ferrous metals | 0.4 | 0.4 | 0.5 | 1.0 | 2.2 | 18.6 | 32.8 |
| Fabricated metal products | 1.9 | 1.6 | 1.8 | 1.9 | 1.2 | 7.2 | 4.8 |
| Chemicals and rubber | 4.8 | 3.2 | 4.5 | 11.0 | 6.7 | 16.5 | 10.6 |
| Transport equipment | 3.4 | 2.7 | 3.2 | 9.3 | 5.6 | 19.5 | 12.8 |
| Other manufactures | 23.6 | 18.4 | 23.3 | 37.1 | 33.2 | 11.3 | 10.3 |
| Trade and transport | 13.1 | 13.8 | 13.0 | 10.1 | 9.6 | 5.6 | 5.4 |
| Other services | 42.9 | 52.5 | 42.5 | 17.2 | 15.3 | 2.9 | 2.6 |

| Australia and N. Z. | O | V | D | X | M | X/O | M/D |
|---|---|---|---|---|---|---|---|
| Grains | 0.6 | 0.8 | 0.3 | 3.7 | 0.1 | 53.8 | 1.9 |
| Other Agricultural products | 3.5 | 4.2 | 2.6 | 11.2 | 1.6 | 29.8 | 4.8 |
| Fishery products | 0.3 | 0.3 | 0.2 | 1.5 | 0.4 | 45.4 | 15.8 |
| Forestry products | 0.3 | 0.3 | 0.2 | 0.4 | 0.0 | 12.3 | 0.2 |
| Mining | 3.3 | 4.0 | 1.9 | 18.4 | 4.0 | 51.6 | 16.7 |
| Textiles | 1.9 | 1.1 | 1.6 | 7.0 | 3.8 | 34.2 | 18.6 |
| Clothing | 0.6 | 0.5 | 0.8 | 0.2 | 1.7 | 3.4 | 17.1 |
| Primary steel | 1.4 | 0.8 | 1.3 | 1.8 | 1.5 | 12.0 | 9.2 |
| Primary non-ferrous metals | 1.3 | 0.7 | 0.9 | 5.6 | 0.8 | 39.1 | 7.7 |
| Fabricated metal products | 1.9 | 1.3 | 2.0 | 0.9 | 2.2 | 4.5 | 8.8 |
| Chemicals and rubber | 3.2 | 2.7 | 4.0 | 3.0 | 12.1 | 8.6 | 24.0 |
| Transport equipment | 2.3 | 1.7 | 3.6 | 1.4 | 15.0 | 5.7 | 33.3 |
| Other manufactures | 16.2 | 11.7 | 18.4 | 21.6 | 47.4 | 12.3 | 20.4 |
| Trade and transport | 19.2 | 19.8 | 18.0 | 17.3 | 3.8 | 8.3 | 1.7 |
| Other services | 44.1 | 50.1 | 44.1 | 6.0 | 5.5 | 1.3 | 1.0 |

| Japan | O | V | D | X | M | X/O | M/D |
|---|---|---|---|---|---|---|---|
| Grains | 0.6 | 1.4 | 1.0 | 0.0 | 1.6 | 0.0 | 7.0 |
| Other Agricultural products | 1.2 | 1.1 | 1.6 | 0.2 | 4.5 | 1.2 | 12.0 |
| Fishery products | 0.5 | 0.5 | 0.6 | 0.1 | 3.7 | 1.4 | 25.2 |
| Forestry products | 0.3 | 0.3 | 0.3 | 0.0 | 1.8 | 0.0 | 21.8 |
| Mining | 0.6 | 1.0 | 1.6 | 0.2 | 23.7 | 1.7 | 61.8 |
| Textiles | 1.0 | 0.6 | 1.0 | 1.8 | 2.8 | 11.5 | 11.5 |
| Clothing | 0.9 | 0.6 | 1.1 | 0.2 | 3.4 | 1.1 | 13.4 |
| Primary steel | 2.1 | 1.6 | 2.0 | 3.5 | 2.0 | 10.7 | 4.3 |
| Primary non-ferrous metals | 0.8 | 0.5 | 0.9 | 0.6 | 4.0 | 5.2 | 18.1 |
| Fabricated metal products | 2.3 | 1.6 | 2.3 | 1.3 | 1.1 | 3.6 | 2.1 |
| Chemicals and rubber | 5.9 | 4.8 | 6.0 | 5.5 | 7.1 | 5.9 | 5.0 |
| Transport equipment | 3.1 | 2.6 | 2.1 | 19.1 | 4.7 | 39.6 | 9.5 |
| Other manufactures | 24.2 | 18.3 | 23.1 | 44.0 | 28.3 | 11.5 | 5.1 |
| Trade and transport | 18.8 | 20.8 | 18.2 | 18.9 | 8.0 | 6.4 | 1.8 |
| Other services | 37.8 | 44.3 | 38.3 | 4.6 | 3.3 | 0.8 | 0.4 |

**Table 7 (- Continue -)**

| China | O | V | D | X | M | X/O | M/D |
|---|---|---|---|---|---|---|---|
| Grains | 7.6 | 9.3 | 8.2 | 0.8 | 4.8 | 1.5 | 5.7 |
| Other Agricultural products | 11.0 | 13.2 | 10.8 | 8.0 | 4.6 | 9.5 | 4.2 |
| Fishery products | 1.2 | 1.6 | 1.0 | 1.8 | 0.4 | 19.8 | 3.8 |
| Forestry products | 1.2 | 1.9 | 1.4 | 0.1 | 1.3 | 0.7 | 8.9 |
| Mining | 3.3 | 4.3 | 2.7 | 7.3 | 3.2 | 29.5 | 11.4 |
| Textiles | 5.7 | 4.7 | 6.2 | 10.8 | 15.8 | 25.0 | 24.9 |
| Clothing | 2.7 | 1.9 | 0.7 | 15.8 | 0.3 | 76.3 | 4.4 |
| Primary steel | 2.5 | 2.4 | 2.8 | 1.7 | 4.0 | 8.8 | 13.8 |
| Primary non-ferrous metals | 0.9 | 0.6 | 0.9 | 0.9 | 0.8 | 12.8 | 9.2 |
| Fabricated metal products | 1.7 | 1.4 | 1.5 | 4.2 | 3.4 | 32.8 | 21.5 |
| Chemicals and rubber | 6.7 | 6.2 | 7.1 | 7.4 | 11.4 | 14.5 | 15.6 |
| Transport equipment | 1.2 | 1.0 | 1.5 | 4.8 | 8.9 | 53.6 | 58.7 |
| Other manufactures | 25.9 | 22.2 | 26.0 | 35.6 | 40.3 | 18.0 | 15.1 |
| Trade and transport | 8.6 | 8.6 | 8.9 | 0.2 | 0.2 | 0.3 | 0.2 |
| Other services | 19.7 | 20.7 | 20.3 | 0.6 | 0.6 | 0.4 | 0.3 |

| Chinese Taipei | O | V | D | X | M | X/O | M/D |
|---|---|---|---|---|---|---|---|
| Grains | 0.8 | 2.7 | 1.8 | 0.0 | 1.6 | 0.0 | 12.6 |
| Other Agricultural products | 3.3 | 3.8 | 4.3 | 0.5 | 3.9 | 3.8 | 13.2 |
| Fishery products | 1.0 | 1.3 | 0.9 | 1.1 | 0.4 | 21.8 | 6.2 |
| Forestry products | 0.2 | 0.3 | 0.3 | 0.0 | 0.7 | 1.3 | 38.3 |
| Mining | 1.0 | 1.9 | 2.3 | 0.1 | 9.2 | 1.5 | 56.5 |
| Textiles | 4.0 | 2.3 | 2.9 | 8.5 | 3.3 | 44.0 | 16.4 |
| Clothing | 1.8 | 1.1 | 1.1 | 3.9 | 0.7 | 46.4 | 8.9 |
| Primary steel | 4.1 | 1.8 | 4.9 | 1.3 | 5.5 | 6.5 | 16.0 |
| Primary non-ferrous metals | 0.9 | 0.7 | 1.3 | 0.8 | 3.6 | 18.2 | 39.8 |
| Fabricated metal products | 2.3 | 1.6 | 1.7 | 4.2 | 1.5 | 38.1 | 12.7 |
| Chemicals and rubber | 8.6 | 5.8 | 9.3 | 8.3 | 13.8 | 20.0 | 21.3 |
| Transport equipment | 2.4 | 1.9 | 2.8 | 3.5 | 7.0 | 30.5 | 36.0 |
| Other manufactures | 30.5 | 22.9 | 27.4 | 52.4 | 44.6 | 35.6 | 23.4 |
| Trade and transport | 12.2 | 17.4 | 11.6 | 7.7 | 1.4 | 13.0 | 1.7 |
| Other services | 26.9 | 34.6 | 27.4 | 7.7 | 2.7 | 5.9 | 1.4 |

| Developing/Transition | O | V | D | X | M | X/O | M/D |
|---|---|---|---|---|---|---|---|
| Grains | 2.8 | 4.2 | 2.9 | 0.6 | 2.1 | 1.9 | 7.5 |
| Other Agricultural products | 5.2 | 7.3 | 4.9 | 5.1 | 2.3 | 9.4 | 4.9 |
| Fishery products | 1.1 | 1.7 | 1.0 | 1.3 | 0.2 | 10.7 | 2.3 |
| Forestry products | 0.8 | 1.3 | 0.7 | 0.5 | 0.1 | 6.2 | 1.3 |
| Mining | 7.0 | 10.4 | 5.3 | 21.7 | 4.1 | 29.7 | 8.2 |
| Textiles | 2.5 | 1.4 | 2.6 | 3.0 | 3.3 | 11.6 | 13.2 |
| Clothing | 1.3 | 0.9 | 1.1 | 3.7 | 1.0 | 26.7 | 9.4 |
| Primary steel | 3.3 | 2.2 | 3.3 | 1.9 | 2.4 | 5.6 | 7.7 |
| Primary non-ferrous metals | 1.0 | 0.6 | 0.9 | 2.2 | 0.9 | 21.1 | 10.3 |
| Fabricated metal products | 1.2 | 0.6 | 1.3 | 1.9 | 2.3 | 14.9 | 18.1 |
| Chemicals and rubber | 5.7 | 4.0 | 6.0 | 5.0 | 7.7 | 8.5 | 13.4 |
| Transport equipment | 2.4 | 1.7 | 3.0 | 2.2 | 6.2 | 8.6 | 21.7 |
| Other manufactures | 26.9 | 19.2 | 27.4 | 24.1 | 28.3 | 8.6 | 10.9 |
| Trade and transport | 11.7 | 14.2 | 12.4 | 11.8 | 19.8 | 9.6 | 16.8 |
| Other services | 27.0 | 30.1 | 27.0 | 15.0 | 19.4 | 5.3 | 7.6 |

## Table 8a. Sectors's Share of Total Output (%)

| | Canada | US | EFTA | EU | A&NZ | Japan | China | Taiwan | Dev/Tra |
|---|---|---|---|---|---|---|---|---|---|
| Grain | 0.6 | 0.5 | 0.5 | 0.5 | 0.6 | 0.6 | 7.6 | 0.8 | 2.8 |
| Other Agricultural products | 2.0 | 1.6 | 2.1 | 2.6 | 3.5 | 1.2 | 11.0 | 3.3 | 5.2 |
| Fishery products | 0.3 | 0.1 | 0.2 | 0.2 | 0.3 | 0.5 | 1.2 | 1.0 | 1.1 |
| Forestry products | 0.8 | 0.3 | 0.6 | 0.1 | 0.3 | 0.3 | 1.2 | 0.2 | 0.8 |
| Mining | 3.4 | 2.6 | 3.4 | 3.6 | 3.3 | 0.6 | 3.3 | 1.0 | 7.0 |
| Textiles | 0.8 | 0.8 | 1.3 | 1.6 | 1.9 | 1.0 | 5.7 | 4.0 | 2.5 |
| Clothing | 0.8 | 0.7 | 0.5 | 0.8 | 0.6 | 0.9 | 2.7 | 1.8 | 1.3 |
| Primary steel | 0.9 | 1.1 | 0.7 | 0.5 | 1.4 | 2.1 | 2.5 | 4.1 | 3.3 |
| Primary non-ferrous metals | 0.9 | 0.5 | 0.6 | 0.4 | 1.3 | 0.8 | 0.9 | 0.9 | 1.0 |
| Fabricated metal products | 1.5 | 1.6 | 5.0 | 1.9 | 1.9 | 2.3 | 1.7 | 2.3 | 1.2 |
| Chemicals and rubber | 3.2 | 2.9 | 4.5 | 4.8 | 3.2 | 5.9 | 6.7 | 8.6 | 5.7 |
| Transport equipment | 3.5 | 3.3 | 3.0 | 3.4 | 2.3 | 3.1 | 1.2 | 2.4 | 2.4 |
| Other manufactures | 17.6 | 19.8 | 16.2 | 23.6 | 16.2 | 24.2 | 25.9 | 30.5 | 26.9 |
| Trade and transport | 21.3 | 19.4 | 14.6 | 13.1 | 19.2 | 18.8 | 8.6 | 12.2 | 11.7 |
| Other services | 42.5 | 44.8 | 46.9 | 42.9 | 44.1 | 37.8 | 19.7 | 26.9 | 27.0 |

## Table 8b. Sectors's Share of Total Value Added (%)

| | Canada | US | EFTA | EU | A&NZ | Japan | China | Taiwan | Dev/Tra |
|---|---|---|---|---|---|---|---|---|---|
| Grain | 0.4 | 0.1 | 0.4 | 0.4 | 0.8 | 1.4 | 9.3 | 2.7 | 4.2 |
| Other Agricultural products | 1.4 | 0.8 | 1.3 | 2.1 | 4.2 | 1.1 | 13.2 | 3.8 | 7.3 |
| Fishery products | 0.3 | 0.1 | 0.1 | 0.2 | 0.3 | 0.5 | 1.6 | 1.3 | 1.7 |
| Forestry products | 0.6 | 0.2 | 0.8 | 0.1 | 0.3 | 0.3 | 1.9 | 0.3 | 1.3 |
| Mining | 3.8 | 3.5 | 1.8 | 2.5 | 4.0 | 1.0 | 4.3 | 1.9 | 10.4 |
| Textiles | 0.8 | 0.5 | 0.7 | 1.1 | 1.1 | 0.6 | 4.7 | 2.3 | 1.4 |
| Clothing | 0.7 | 0.6 | 0.6 | 0.6 | 0.5 | 0.6 | 1.9 | 1.1 | 0.9 |
| Primary steel | 0.8 | 0.8 | 0.8 | 0.4 | 0.8 | 1.6 | 2.4 | 1.8 | 2.2 |
| Primary non-ferrous metals | 0.8 | 0.3 | 0.4 | 0.4 | 0.7 | 0.5 | 0.6 | 0.7 | 0.6 |
| Fabricated metal products | 1.2 | 1.1 | 6.4 | 1.6 | 1.3 | 1.6 | 1.4 | 1.6 | 0.6 |
| Chemicals and rubber | 3.0 | 1.7 | 2.7 | 3.2 | 2.7 | 4.8 | 6.2 | 5.8 | 4.0 |
| Transport equipment | 2.5 | 2.3 | 2.3 | 2.7 | 1.7 | 2.6 | 1.0 | 1.9 | 1.7 |
| Other manufactures | 13.8 | 13.8 | 8.8 | 18.4 | 11.7 | 18.3 | 22.2 | 22.9 | 19.2 |
| Trade and transport | 22.1 | 22.2 | 17.5 | 13.8 | 19.8 | 20.8 | 8.6 | 17.4 | 14.2 |
| Other services | 47.6 | 52.0 | 55.4 | 52.5 | 50.1 | 44.3 | 20.7 | 34.6 | 30.1 |

## Table 8c. Share of Economywide Export (%)

| | Canada | US | EFTA | EU | A&NZ | Japan | China | Taiwan | Dev/Tra |
|---|---|---|---|---|---|---|---|---|---|
| Grain | 2.7 | 2.7 | 0.3 | 1.0 | 3.7 | 0.0 | 0.8 | 0.0 | 0.6 |
| Other Agricultural products | 2.1 | 3.5 | 0.6 | 1.3 | 11.2 | 0.2 | 8.0 | 0.6 | 5.1 |
| Fishery products | 1.2 | 0.5 | 0.7 | 0.2 | 1.5 | 0.1 | 1.8 | 1.1 | 1.3 |
| Forestry products | 0.1 | 0.6 | 0.1 | 0.1 | 0.4 | 0.0 | 0.1 | 0.0 | 0.5 |
| Mining | 9.9 | 2.1 | 8.8 | 3.0 | 18.4 | 0.2 | 7.3 | 0.1 | 21.7 |
| Textiles | 0.6 | 1.9 | 1.8 | 2.5 | 7.0 | 1.8 | 10.8 | 8.5 | 3.0 |
| Clothing | 0.2 | 0.5 | 0.9 | 1.7 | 0.2 | 0.2 | 15.8 | 3.9 | 3.7 |
| Primary steel | 1.6 | 1.2 | 2.9 | 2.6 | 1.8 | 3.5 | 1.7 | 1.3 | 1.9 |
| Primary non-ferrous metals | 3.8 | 1.2 | 2.3 | 1.0 | 5.6 | 0.6 | 0.9 | 0.8 | 2.2 |
| Fabricated metal products | 1.5 | 1.6 | 2.2 | 1.9 | 0.9 | 1.3 | 4.2 | 4.2 | 1.9 |
| Chemicals and rubber | 6.2 | 10.5 | 7.2 | 11.0 | 3.0 | 5.5 | 7.4 | 8.3 | 5.0 |
| Transport equipment | 20.9 | 13.1 | 6.1 | 9.3 | 1.4 | 19.1 | 4.8 | 3.5 | 2.2 |
| Other manufactures | 33.2 | 42.7 | 43.3 | 37.1 | 21.6 | 44.0 | 35.6 | 52.4 | 24.1 |
| Trade and transport | 7.3 | 8.4 | 5.9 | 10.1 | 17.3 | 18.9 | 0.2 | 7.7 | 11.8 |
| Other services | 8.7 | 9.5 | 17.0 | 17.2 | 6.0 | 4.6 | 0.6 | 7.7 | 15.0 |

## Table 8d. Share of Sector's Output that is Exported (%)

| | Canada | US | EFTA | EU | A&NZ | Japan | China | Taiwan | Dev/Tra |
|---|---|---|---|---|---|---|---|---|---|
| Grain | 59.0 | 24.3 | 14.4 | 13.5 | 53.8 | 0.0 | 1.5 | 0.0 | 1.9 |
| Other Agricultural products | 13.3 | 10.5 | 6.2 | 3.6 | 29.8 | 1.2 | 9.5 | 3.8 | 9.4 |
| Fishery products | 59.7 | 41.6 | 83.0 | 5.0 | 45.4 | 1.4 | 19.8 | 21.8 | 10.7 |
| Forestry products | 2.2 | 10.0 | 5.1 | 3.5 | 12.3 | 0.0 | 0.7 | 1.3 | 6.2 |
| Mining | 37.1 | 3.8 | 60.5 | 6.0 | 51.6 | 1.7 | 29.5 | 1.5 | 29.7 |
| Textiles | 10.1 | 11.5 | 32.2 | 11.1 | 34.2 | 11.5 | 25.0 | 44.0 | 11.6 |
| Clothing | 3.1 | 3.5 | 41.2 | 15.9 | 3.4 | 1.1 | 76.3 | 46.4 | 26.7 |
| Primary steel | 22.4 | 5.2 | 98.0 | 40.0 | 12.0 | 10.7 | 8.8 | 6.5 | 5.6 |
| Primary non-ferrous metals | 57.1 | 12.2 | 93.3 | 18.6 | 39.1 | 5.2 | 12.8 | 18.2 | 21.1 |
| Fabricated metal products | 13.0 | 4.9 | 10.3 | 7.2 | 4.5 | 3.6 | 32.8 | 38.1 | 14.9 |
| Chemicals and rubber | 24.9 | 17.6 | 37.3 | 16.5 | 8.6 | 5.9 | 14.5 | 20.0 | 8.5 |
| Transport equipment | 76.9 | 19.0 | 47.4 | 19.5 | 5.7 | 39.6 | 53.6 | 30.5 | 8.6 |
| Other manufactures | 24.4 | 10.5 | 62.1 | 11.3 | 12.3 | 11.5 | 18.0 | 35.6 | 8.6 |
| Trade and transport | 4.4 | 2.1 | 9.4 | 5.6 | 8.3 | 6.4 | 0.3 | 13.0 | 9.6 |
| Other services | 2.6 | 1.0 | 8.4 | 2.9 | 1.3 | 0.8 | 0.4 | 5.9 | 5.3 |

## Table 8e. Share of Economywide Import (%)

| | Canada | US | EFTA | EU | A&NZ | Japan | China | Taiwan | Dev/Tra |
|---|---|---|---|---|---|---|---|---|---|
| Grain | 0.1 | 0.1 | 0.1 | 0.2 | 0.1 | 1.6 | 4.8 | 1.6 | 2.1 |
| Other Agricultural products | 2.7 | 2.2 | 2.0 | 4.2 | 1.6 | 4.5 | 4.6 | 3.9 | 2.3 |
| Fishery products | 0.3 | 0.9 | 0.2 | 0.8 | 0.4 | 3.7 | 0.4 | 0.4 | 0.2 |
| Forestry products | 0.2 | 0.0 | 0.3 | 0.2 | 0.0 | 1.8 | 1.3 | 0.7 | 0.1 |
| Mining | 4.9 | 11.1 | 7.6 | 13.8 | 4.0 | 23.7 | 3.2 | 9.2 | 4.1 |
| Textiles | 1.9 | 1.3 | 2.0 | 2.5 | 3.8 | 2.8 | 15.8 | 3.3 | 3.3 |
| Clothing | 1.5 | 3.6 | 3.1 | 2.7 | 1.7 | 3.4 | 0.3 | 0.7 | 1.0 |
| Primary steel | 2.0 | 2.1 | 2.3 | 1.7 | 1.5 | 2.0 | 4.0 | 5.5 | 2.4 |
| Primary non-ferrous metals | 1.5 | 1.9 | 1.5 | 2.2 | 0.8 | 4.0 | 0.8 | 3.6 | 0.9 |
| Fabricated metal products | 2.6 | 1.9 | 2.3 | 1.2 | 2.2 | 1.1 | 3.4 | 1.5 | 2.3 |
| Chemicals and rubber | 8.8 | 7.3 | 7.1 | 6.7 | 12.1 | 7.1 | 11.4 | 13.8 | 7.7 |
| Transport equipment | 20.7 | 15.7 | 9.3 | 5.6 | 15.0 | 4.7 | 8.9 | 7.0 | 6.2 |
| Other manufactures | 45.3 | 45.4 | 43.9 | 33.2 | 47.4 | 28.3 | 40.3 | 44.6 | 28.3 |
| Trade and transport | 3.5 | 2.8 | 4.3 | 9.6 | 3.8 | 8.0 | 0.2 | 1.4 | 19.8 |
| Other services | 4.0 | 3.7 | 14.0 | 15.3 | 5.5 | 3.3 | 0.6 | 2.7 | 19.4 |

## Table 8f. Share of Sector's Demand that is Imported (%)

| | Canada | US | EFTA | EU | A&NZ | Japan | China | Taiwan | Dev/Tra |
|---|---|---|---|---|---|---|---|---|---|
| Grain | 3.5 | 1.0 | 5.3 | 2.9 | 1.9 | 7.0 | 5.7 | 12.6 | 7.5 |
| Other Agricultural products | 14.1 | 7.8 | 16.2 | 10.4 | 4.8 | 12.0 | 4.2 | 13.2 | 4.9 |
| Fishery products | 26.6 | 55.1 | 59.5 | 20.1 | 15.8 | 25.2 | 3.8 | 6.2 | 2.3 |
| Forestry products | 2.2 | 0.4 | 11.0 | 11.7 | 0.2 | 21.8 | 8.9 | 38.3 | 1.3 |
| Mining | 20.0 | 19.7 | 56.1 | 23.1 | 16.7 | 61.8 | 11.4 | 56.5 | 8.2 |
| Textiles | 22.3 | 8.8 | 34.6 | 11.2 | 18.6 | 11.5 | 24.9 | 16.4 | 13.2 |
| Clothing | 17.0 | 20.4 | 67.3 | 21.0 | 17.1 | 13.4 | 4.4 | 8.9 | 9.4 |
| Primary steel | 22.4 | 9.9 | 97.1 | 30.1 | 9.2 | 4.3 | 13.8 | 16.0 | 7.7 |
| Primary non-ferrous metals | 29.6 | 19.1 | 89.1 | 32.8 | 7.7 | 18.1 | 9.2 | 39.8 | 10.3 |
| Fabricated metal products | 17.7 | 6.6 | 10.9 | 4.8 | 8.8 | 2.1 | 21.5 | 12.7 | 18.1 |
| Chemicals and rubber | 28.2 | 14.5 | 37.6 | 10.6 | 24.0 | 5.0 | 15.6 | 21.3 | 13.4 |
| Transport equipment | 70.8 | 24.1 | 57.8 | 12.8 | 33.3 | 9.5 | 58.7 | 36.0 | 21.7 |
| Other manufactures | 26.9 | 12.4 | 62.7 | 10.3 | 20.4 | 5.1 | 15.1 | 23.4 | 10.9 |
| Trade and transport | 1.8 | 0.8 | 7.2 | 5.4 | 1.7 | 1.8 | 0.2 | 1.7 | 16.8 |
| Other services | 1.1 | 0.5 | 7.2 | 2.6 | 1.0 | 0.4 | 0.3 | 1.4 | 7.6 |

## Table 9. Export Volume, (Percentage change)

| | Dynamic Specification | | |
|---|---|---|---|
| | CRTS PC | IRTS PC | IRTS MC |
| Grains | 4.1 | 4.4 | 4.6 |
| Other agricultural products | 21.1 | 21.0 | 22.1 |
| Fishery products | 13.0 | 12.9 | 13.5 |
| Forestry products | 3.7 | 4.1 | 5.6 |
| Mining | 1.6 | 1.8 | 3.1 |
| Textiles | 17.5 | 18.6 | 72.5 |
| Clothing | 69.4 | 87.1 | 191.6 |
| Primary steel | 8.3 | 8.4 | 25.5 |
| Primary non-ferrous metals | 3.6 | 3.9 | 14.2 |
| Fabricated metal products | 5.3 | 5.4 | 16.0 |
| Chemicals and rubber | 5.2 | 5.4 | 21.4 |
| Transport equipment | 11.7 | 13.6 | 30.1 |
| Other manufactures | 4.7 | 4.7 | 12.7 |
| **Total merchandise** | **8.6** | **9.6** | **23.5** |

CRTS = Constant Returns to Scale, PC = Perfect Competition
IRTS = Increasing Returns to Scale, MC = Monopolistic (Imperfect) Competition

## Table 10a. Real export effects at world prices (f.o.b.), billions of 1990 dollars

**(1990 Counterfactual, Model: CRTS, PC, Dynamic)**

| | Canada | US | EFTA | EU | A&NZ | Japan | China | Taiwan | Dev&Tra | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Grains | 0.3 | 1.0 | -0.1 | -0.7 | 0.3 | 0.0 | 0.1 | 0.0 | 0.2 | 1 | ( 4%) |
| Other agricultural products | 0.6 | 3.6 | -0.0 | 1.1 | 0.6 | 0.2 | 0.7 | 0.1 | 12.3 | 19 | ( 21%) |
| Fishery products | 0.1 | 0.3 | 0.8 | 0.4 | 0.1 | 0.1 | -0.0 | 0.1 | 1.1 | 3 | ( 13%) |
| Forestry products | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | -0.0 | -0.0 | -0.0 | 0.2 | 0 | ( 4%) |
| Mining | 0.2 | 0.4 | 0.8 | 0.6 | 0.2 | 0.0 | -0.6 | -0.0 | 3.3 | 5 | ( 2%) |
| Textiles | 0.1 | 1.1 | 0.2 | 3.5 | 0.3 | 1.0 | 1.3 | 1.1 | 7.7 | 16 | ( 18%) |
| Clothing | -0.0 | 0.2 | -0.5 | -0.1 | 0.0 | -0.1 | 5.2 | 2.1 | 51.8 | 59 | ( 69%) |
| Primary steel | 0.3 | 0.5 | 0.2 | 1.6 | 0.1 | 0.9 | -0.0 | 0.0 | 2.2 | 6 | ( 8%) |
| Primary non-ferrous metals | 0.2 | 0.3 | 0.1 | 0.4 | 0.2 | 0.0 | -0.0 | 0.0 | 0.9 | 2 | ( 4%) |
| Fabricated metal products | 0.2 | 0.5 | 0.3 | 0.9 | 0.0 | 0.1 | -0.2 | -0.0 | 1.5 | 3 | ( 5%) |
| Chemicals and rubber | 0.5 | 3.0 | 0.9 | 5.0 | 0.1 | 0.8 | -0.2 | 0.1 | 2.8 | 13 | ( 5%) |
| Transport equipment | 1.8 | 6.0 | 1.3 | 10.6 | 0.1 | 10.2 | 0.3 | -0.1 | 2.3 | 33 | ( 12%) |
| Other manufactures | 2.3 | 11.3 | 3.8 | 14.0 | 1.6 | 8.0 | -1.5 | -0.2 | 12.9 | 52 | ( 5%) |
| **Total merchandise** | **6** | **28** | **8** | **37** | **4** | **21** | **5** | **3** | **99** | **213** | |
| | **( 5%)** | **( 7%)** | **( 3%)** | **( 7%)** | **( 8%)** | **( 7%)** | **( 6%)** | **( 4%)** | **( 14%)** | | **( 9%)** |

## Table 10b. Real export effects at world prices (f.o.b.), billions of 1990 dollars

**(1990 Counterfactual, Model: IRTS, MC, Dynamic)**

| | Canada | US | EFTA | EU | A&NZ | Japan | China | Taiwan | Dev&Tra | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Grains | 0.3 | 1.1 | -0.1 | -0.7 | 0.4 | 0.0 | 0.0 | 0.0 | 0.2 | 1 | ( 5%) |
| Other agricultural products | 0.5 | 4.0 | -0.0 | 1.3 | 0.7 | 0.3 | 0.3 | 0.1 | 12.9 | 20 | ( 22%) |
| Fishery products | 0.1 | 0.3 | 0.8 | 0.5 | 0.1 | 0.1 | -0.1 | 0.1 | 1.3 | 3 | ( 14%) |
| Forestry products | -0.0 | 0.2 | -0.0 | 0.0 | 0.0 | -0.0 | -0.0 | -0.0 | 0.3 | 1 | ( 6%) |
| Mining | 0.4 | 0.7 | 0.9 | 0.5 | 0.3 | -0.0 | -0.8 | -0.0 | 7.5 | 10 | ( 3%) |
| Textiles | -0.4 | -2.2 | -0.2 | 5.1 | 0.2 | -0.4 | 9.9 | 10.6 | 44.5 | 67 | ( 73%) |
| Clothing | -0.2 | -2.1 | -2.5 | -10.6 | -0.0 | -0.4 | 21.5 | 5.8 | 150.1 | 162 | ( 192%) |
| Primary steel | 1.4 | 1.6 | -0.2 | 6.6 | 0.4 | 3.0 | -0.2 | -0.1 | 5.8 | 18 | ( 26%) |
| Primary non-ferrous metals | 1.5 | 1.1 | -0.2 | 0.5 | 1.4 | -0.2 | -0.2 | -0.2 | 4.1 | 8 | ( 14%) |
| Fabricated metal products | 0.6 | 1.9 | 0.5 | 2.9 | 0.2 | 0.2 | -1.2 | -0.8 | 5.6 | 10 | ( 16%) |
| Chemicals and rubber | 1.1 | 17.3 | 3.9 | 21.9 | 0.3 | 2.1 | -1.2 | 0.8 | 6.8 | 53 | ( 21%) |
| Transport equipment | 8.4 | 18.7 | 2.7 | 23.5 | 0.0 | 33.3 | 1.8 | -0.6 | -3.9 | 84 | ( 30%) |
| Other manufactures | 6.4 | 39.3 | 9.8 | 48.0 | 6.8 | 14.5 | -7.8 | -5.2 | 30.8 | 143 | ( 13%) |
| **Total merchandise** | **20** | **82** | **15** | **99** | **11** | **52** | **22** | **10** | **266** | **579** | |
| | **( 17%)** | **( 22%)** | **( 6%)** | **( 19%)** | **( 24%)** | **( 18%)** | **( 27%)** | **( 14%)** | **( 37%)** | | **( 23%)** |

**Table 11a. Income Effects in 1990, Counterfactual (Billions of 1990 Dollars)**

| | Static specifications | | | Dynamic specifications | | |
|---|---|---|---|---|---|---|
| | CRTS PC | IRTS PC | IRTS MC | CRTS PC | IRTS PC | IRTS MC |
| Canada | 1.4 | 1.9 | 4.9 | 2.3 | 3.1 | 7.6 |
| United States | 18.7 | 22.0 | 46.5 | 30.2 | 36.5 | 75.2 |
| EFTA | 6.2 | 8.2 | 14.2 | 10.8 | 11.0 | 20.6 |
| European Union | 29.3 | 36.0 | 63.5 | 48.2 | 53.6 | 100.5 |
| Australia and New Zealand | 0.9 | 1.2 | 1.9 | 1.5 | 2.2 | 3.6 |
| Japan | 7.3 | 9.3 | 10.5 | 13.0 | 11.8 | 16.4 |
| China | 1.2 | 2.6 | 3.0 | 2.0 | 4.2 | 5.5 |
| Chinese Taipei | 1.1 | 2.1 | 2.0 | 2.2 | 3.7 | 4.5 |
| Developing and transition | -0.9 | 2.1 | 34.8 | -0.4 | 1.3 | 57.5 |
| **Total** | **65** | **85** | **181** | **110** | **128** | **291** |

**Table 11b. Income Effects in 2005, Estimated (Billions of 1990 dollars)**

| | Static specifications | | | Dynamic specifications | | |
|---|---|---|---|---|---|---|
| | CRTS PC | IRTS PC | IRTS MC | CRTS PC | IRTS PC | IRTS MC |
| Canada | 2.3 | 3.0 | 8.0 | 3.8 | 5.0 | 12.4 |
| United States | 30.4 | 35.9 | 75.6 | 49.2 | 59.5 | 122.4 |
| EFTA | 10.1 | 13.4 | 23.1 | 17.5 | 18.0 | 33.5 |
| European Union | 47.7 | 58.6 | 103.3 | 78.5 | 87.2 | 163.5 |
| Australia and New Zealand | 1.5 | 1.9 | 3.1 | 2.4 | 3.6 | 5.8 |
| Japan | 11.9 | 15.2 | 17.0 | 21.2 | 19.3 | 26.7 |
| China | 4.1 | 8.9 | 10.1 | 6.9 | 14.3 | 18.7 |
| Chinese Taipei | 2.6 | 4.7 | 4.5 | 5.1 | 8.4 | 10.2 |
| Developing and transition | -1.9 | 4.1 | 70.2 | -0.7 | 2.7 | 116.1 |
| **Total** | **109** | **146** | **315** | **184** | **218** | **510** |

Note: Estimates for 2005 are based on World Bank and OECD real growth projections, applied to the 1990 counterfactual effects.

Table 12a. Decomposition of Welfare Effects, 1990 Counterfactual
(Billions of 1990 Dollars)

| | CRTS, PC, Dynamic | | | | IRTS, MC, Dynamic | | | |
|---|---|---|---|---|---|---|---|---|
| | Ind. tariffs | Ind. NTBs | Agri-culture | Total | Ind. tariffs | Ind. NTBs | Agri-culture | Total |
| Canada | -0.3 | 1.7 | 1.0 | 2.3 | 0.4 | 6.3 | 0.9 | 7.6 |
| United States | 4.3 | 23.6 | 2.3 | 30.2 | 8.4 | 62.9 | 3.9 | 75.2 |
| EFTA | 3.4 | 2.6 | 4.8 | 10.8 | 6.0 | 10.9 | 3.7 | 20.6 |
| European Union | 10.4 | 26.4 | 11.5 | 48.2 | 20.8 | 70.7 | 9.0 | 100.5 |
| Australia and New Zealand | 0.3 | 0.2 | 1.1 | 1.5 | 1.9 | 0.4 | 1.3 | 3.6 |
| Japan | 6.2 | -0.3 | 7.1 | 13.0 | 11.1 | 1.3 | 4.0 | 16.4 |
| China | 2.8 | -1.0 | 0.2 | 2.0 | 3.4 | 1.6 | 0.5 | 5.5 |
| Chinese Taipei | 2.5 | -0.6 | 0.2 | 2.2 | 3.4 | 0.9 | 0.2 | 4.5 |
| Developing and transition | 0.1 | -6.0 | 5.5 | -0.4 | 16.5 | 33.9 | 7.1 | 57.5 |
| Total | 30 | 47 | 34 | 110 | 72 | 189 | 31 | 291 |
| (Percent of total gain) | ( 27%) | ( 42%) | ( 31%) | | ( 25%) | ( 65%) | ( 10%) | |

Table 12b. Decomposition of Welfare Effects, 2005 Estimates
(Billions of 1990 Dollars)

| | CRTS, PC, Dynamic | | | | IRTS, MC, Dynamic | | | |
|---|---|---|---|---|---|---|---|---|
| | Ind. tariffs | Ind. NTBs | Agri-culture | Total | Ind. tariffs | Ind. NTBs | Agri-culture | Total |
| Canada | -0.5 | 2.7 | 1.6 | 3.8 | 0.7 | 10.2 | 1.5 | 12.4 |
| United States | 7.0 | 38.4 | 3.8 | 49.2 | 13.7 | 102.3 | 6.3 | 122.4 |
| EFTA | 5.5 | 4.2 | 7.7 | 17.5 | 9.8 | 17.7 | 6.0 | 33.5 |
| European Union | 16.8 | 42.9 | 18.7 | 78.5 | 33.8 | 115.1 | 14.6 | 163.5 |
| Australia and New Zealand | 0.4 | 0.3 | 1.7 | 2.4 | 3.1 | 0.6 | 2.1 | 5.8 |
| Japan | 10.1 | -0.4 | 11.5 | 21.2 | 18.1 | 2.1 | 6.5 | 26.7 |
| China | 9.5 | -3.5 | 0.8 | 6.9 | 11.6 | 5.4 | 1.7 | 18.7 |
| Chinese Taipei | 5.9 | -1.3 | 0.5 | 5.1 | 7.7 | 2.1 | 0.4 | 10.2 |
| Developing and transition | 0.3 | -12.2 | 11.2 | -0.7 | 33.4 | 68.4 | 14.3 | 116.1 |
| Total | 55 | 71 | 58 | 184 | 132 | 324 | 53 | 510 |
| (Percent of total gain) | ( 30%) | ( 39%) | ( 31%) | | ( 26%) | ( 64%) | ( 10%) | |

Table 12c. Decomposition of Welfare Effects, Percent of GDP

| | CRTS, PC, Dynamic | | | | IRTS, MC, Dynamic | | | |
|---|---|---|---|---|---|---|---|---|
| | Ind. tariffs | Ind. NTBs | Agri-culture | Total | Ind. tariffs | Ind. NTBs | Agri-culture | Total |
| Canada | -0.05 | 0.29 | 0.17 | **0.40** | 0.08 | 1.09 | 0.16 | **1.32** |
| United States | 0.08 | 0.42 | 0.04 | **0.54** | 0.15 | 1.13 | 0.07 | **1.35** |
| EFTA | 0.39 | 0.30 | 0.55 | **1.24** | 0.70 | 1.25 | 0.42 | **2.37** |
| European Union | 0.18 | 0.46 | 0.20 | **0.83** | 0.36 | 1.22 | 0.16 | **1.73** |
| Australia and New Zealand | 0.08 | 0.05 | 0.31 | **0.44** | 0.57 | 0.11 | 0.38 | **1.07** |
| Japan | 0.21 | -0.01 | 0.24 | **0.45** | 0.38 | 0.05 | 0.14 | **0.57** |
| China | 1.04 | -0.38 | 0.09 | **0.75** | 1.26 | 0.58 | 0.19 | **2.03** |
| Chinese Taipei | 1.71 | -0.37 | 0.16 | **1.49** | 2.26 | 0.61 | 0.12 | **2.99** |
| Developing and transition | 0.00 | -0.14 | 0.12 | **-0.01** | 0.37 | 0.76 | 0.16 | **1.29** |
| Total | 0.14 | 0.22 | 0.16 | 0.52 | 0.34 | 0.88 | 0.14 | 1.36 |
| (Percent of total gain) | ( 27%) | ( 42%) | ( 31%) | | ( 25%) | ( 65%) | ( 10%) | |

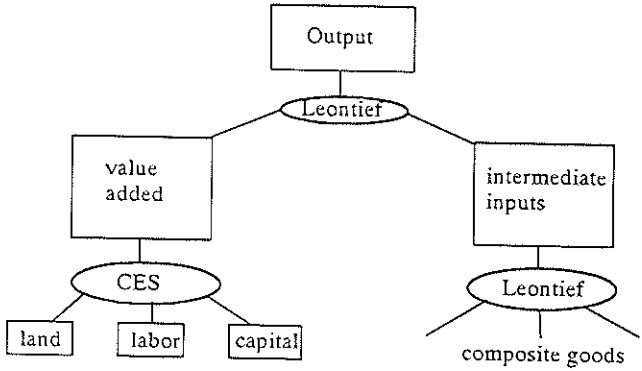
## Table A1. Trade and Scale Elasticities

| | Trade Substitution Elasticities | | Scale Elasticities |
|---|---|---|---|
| | Upper-tier | Lower-tier | CDR |
| Grain | 2.20 | 4.40 | * |
| Other Agricultural products | 2.49 | 4.56 | * |
| Fishery products | 2.80 | 5.60 | * |
| Forestry products | 2.80 | 5.60 | * |
| Mining | 2.80 | 5.60 | 0.05 |
| Textiles | 2.20 | 4.40 | 0.14 |
| Clothing | 4.40 | 8.80 | 0.13 |
| Primary steel | 2.80 | 5.60 | 0.13 |
| Primary non-ferrous metals | 2.80 | 5.60 | 0.13 |
| Fabricated metal products | 2.80 | 5.60 | 0.12 |
| Chemicals and rubber | 1.90 | 3.80 | 0.15 |
| Transport equipment | 5.20 | 10.40 | 0.12 |
| Other manufactures | 2.47 | 5.43 | 0.15 |
| Trade and transport | 1.90 | 3.80 | * |
| Other services | 1.96 | 3.84 | * |

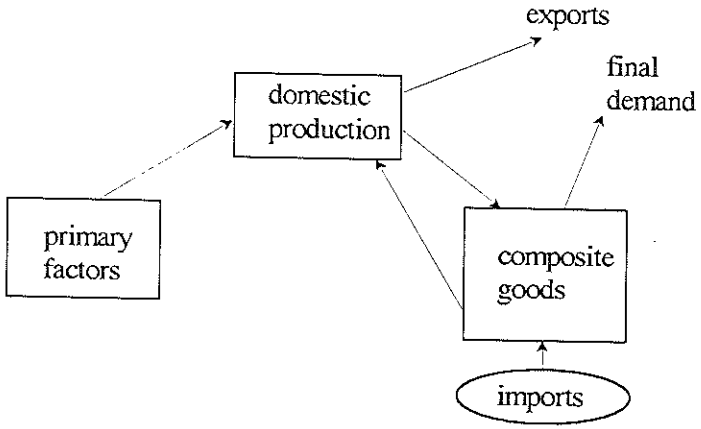
Note: Scale elasticities are from Pratten (1988), Reinert, Roland-Holst and Shiells (1994), and Halland and Tollefsen (1994). CDRs = (AC-MC)/AC, where AC is average cost and MC is marginal cost.

# Basic features of the simulation model

## Figure A-1
Specification of production in a representative sector

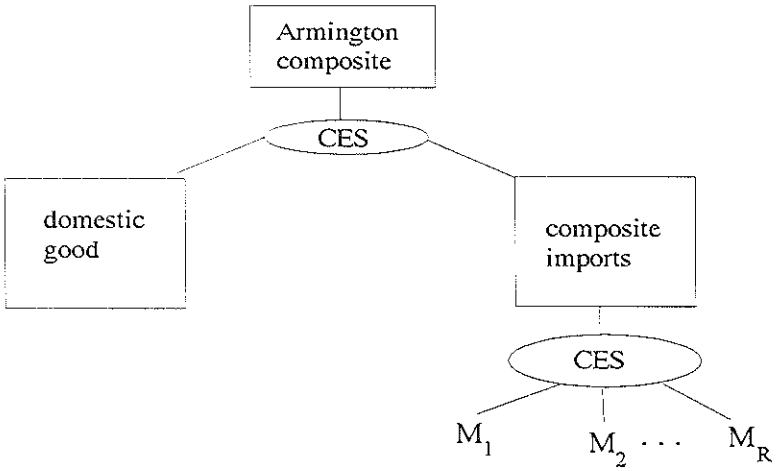



## Figure A-2
Production and trade flows



# Figure A-3

Armington aggregation nest



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