

*Developing Country Interests in Liberalizing Manufactures
Trade*

by

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Abstract

The importance of manufactures trade to the developing countries has increased dramatically since the early 1980s, and developing countries' reliance on each others as markets has also risen sharply. Developing countries face disproportionately high trade barriers in manufactures—relatively in the industrial countries, and absolutely in the developing countries—and barriers to their manufactures exports account for around 70 percent of the total barriers faced by their exports. The inclusion of manufactures trade in the WTO 2000 negotiations is particularly important for developing countries, who would benefit both from improved market access and through greater domestic efficiency. In fact, developing countries capture nearly all the benefits (95%) of manufacturing liberalization. In contrast, comparable cuts in agriculture and services benefit the high-income countries relatively more since only 27% and 30% of the global benefits accrue to developing countries in these two cases.

I. Introduction

A novel feature of preparations for the WTO 2000 negotiations is the presence of a built-in agenda. This agenda includes agriculture and services trade—the two major areas where a framework for liberalization was developed during the Uruguay Round, and the process of liberalization commenced. It does not include trade in manufactures—the trade that was central to all previous rounds of negotiations. A key question in this context is whether the agenda should be broadened to include manufactures trade.

It has been traditional to assume that liberalization of manufactures trade is in the interest of developed countries, and that developing country interests lie predominantly with primary commodities. However, this simple dichotomy is now seriously in question given the relocation of manufacturing industries, particularly those relying heavily on unskilled labor, to developing countries during the past twenty-five years. As a

consequence, developing countries have become much more interested in liberalization of trade in manufactures than was previously the case¹.

Given the dynamics of GATT negotiations, it is probably necessary that there be reciprocal market access gains if liberalization of tariffs on manufactures is to be endorsed by the full WTO membership. This effectively adds a mercantilist constraint to the economist's usual economic efficiency criterion that liberalization should be welfare-enhancing. Whether trade in manufactures meets this criterion will depend heavily upon the pattern of exports, and the pattern of protection in developing countries' export markets. While these same considerations are potentially also important from the viewpoint of economic efficiency, it is likely that these gains will be more heavily dependent upon the extent to which countries liberalize their own imports (Martin and Winters 1996, Ch 1; Bach, Lloyd, and Martin 1995).

Within individual countries, the pattern of protection across countries will also be important. If, for instance, protection is higher in agriculture and services than it is in manufactures, then there may be important second-best consequences from liberalizing manufactures trade as the resulting changes in the patterns of manufacturing protection and trade give rise to changes in the volume of agriculture and services trade. In the presence of significant distortions, the latter will also have an indirect effect on welfare. In the next section of this paper, we consider the patterns of trade and protection, as well as other structural features of the global manufacturing economy that are likely to influence the welfare impacts of liberalizing manufactures trade. Then we consider the implications of liberalizing, or of excluding, an important sector in the negotiations. Since it is clear in a second-best case such as this that the consequences of adding manufactures trade to the negotiations cannot be determined from theory alone, we turn to a numerical general equilibrium model to provide some quantitative estimates of the implications. In the third section, we briefly describe the particular model used for the analysis. Then, in the fourth section, we discuss the nature of the simulations performed. In the fifth section, we discuss the key findings.

II. Patterns of trade and protection

In this section, we briefly review some of the broad features of global production, consumption, trade and protection that bear upon whether manufactures should be included in the WTO 2000 negotiations. We consider first the importance of

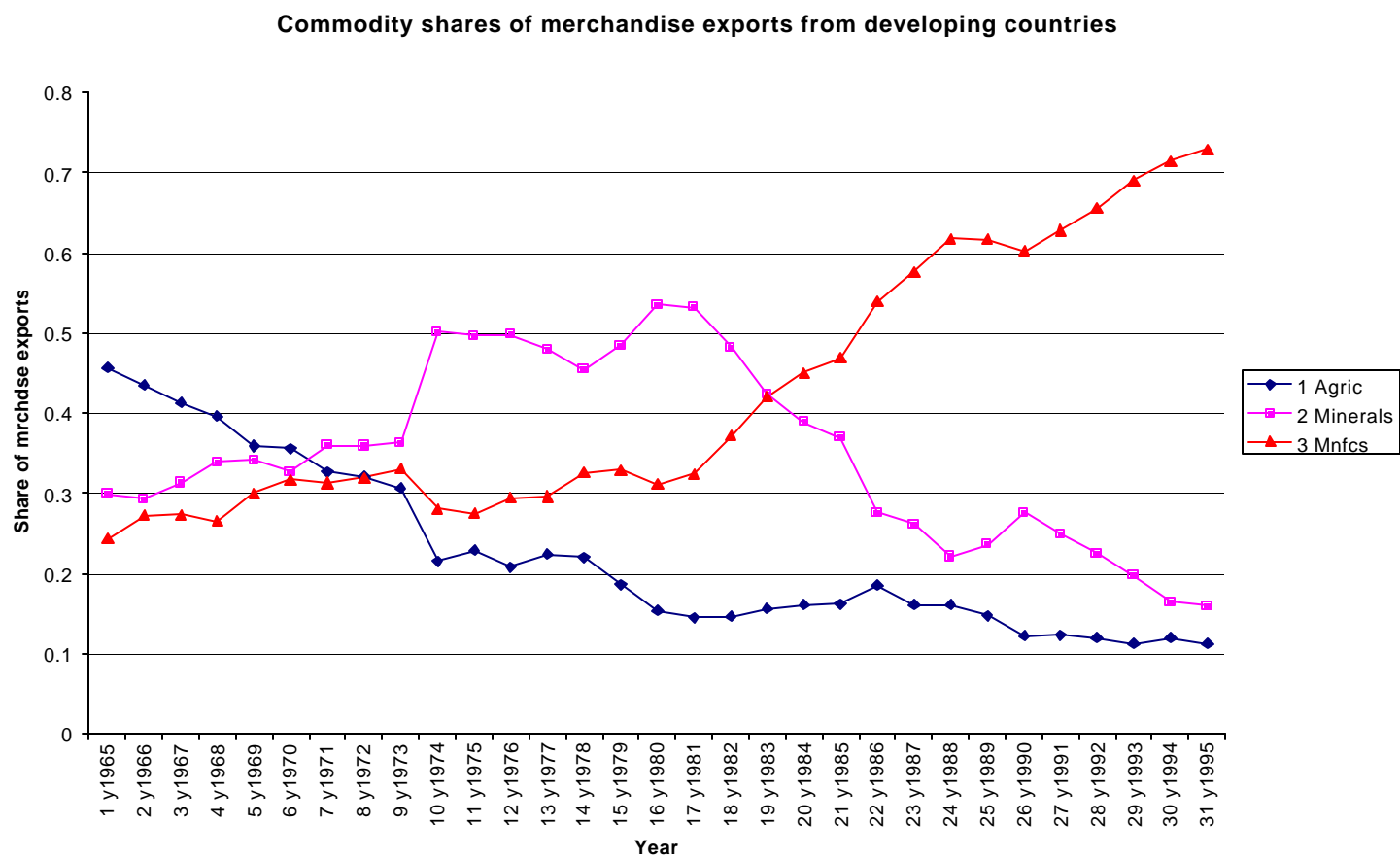
¹ See, for example, the case for reciprocal liberalization in manufactures trade offered by the South Centre (1998, Section 14.2).

manufactures² in the exports of developed and developing countries. Then, we consider the broad structure of protection in each group of countries.

Some very broad statistics on the composition of developing country exports are given in Figure 1. (For a listing of the countries included in the developing country aggregate, see appendix Table A1. Appendix Table A3 gives sectoral definitions.) This figure shows that manufactures made up only around a quarter of developing country merchandise exports in 1965, and that this share had increased to just over thirty percent by 1981, when preparations for the Uruguay Round were getting under way. Since then, however, the share of manufactures in developing country exports has increased dramatically. By 1994, manufactures exports accounted for almost three quarters of developing country exports. The share of mineral exports increased from around 30 percent in 1965 to around half of total exports in the 1974-81 period in response to the oil shock and related commodity prices, but then declined to around 15 percent by 1995. The share of agricultural exports declined more or less continuously to just over 10 percent in 1995. Given the subdued outlook for commodity exports (World Bank 1999), it seems likely that the overall importance of manufactures exports will increase further during the course of the WTO 2000 negotiations.

² The definition of manufactures used follows as closely as possible the definition utilized in the WTO. Thus, agriculture includes the raw and processed agricultural products defined by the WTO agreement on agriculture (WTO 1995, p56)

Figure 1. The changing commodity composition of exports from developing Countries.



Source: GTAP 4 Trade Data Base, Gehlhar (1999).

The change in the structure of merchandise exports has potentially important implications for the developing countries in the negotiations. In the lead up to the Uruguay Round, it might have seemed reasonable for developing countries interested primarily in mercantilist export expansion to focus on improving the market access opportunities for their traditional commodity exports. By now, it is clear from the chart that this situation had changed dramatically at least for the “average” developing country. With such a large share of manufactures in their merchandise exports, it seems likely that the export gains for developing countries, taken as a group, will depend significantly upon the extent of liberalization in these products.

Despite this strong increase in the share of manufactures in total merchandise exports, the aggregated trade balance for the developing countries, *vis à vis* the high income countries, continues to show a deficit in manufactures. This is offset by a trade surplus in primary products (Table 1). Mercantilist logic might lead one to conclude that trade liberalization in manufactures is more likely to benefit the wealthy countries. However, as we shall see, this view is misguided, and ignores the cost of high levels of current protection to developing countries themselves.

Table 1. Trade Balances: 1995 (FOB exports - CIF imports)

	Agric	Minerals	Mnfcs	Svces	Total
Developing	2306	133633	-221289	71237	-14112
HighIncome	-33434	-159297	49822	157021	14112
Total	-31129	-25664	-171466	228258	0

Note: Sectoral trade balances don't sum to zero due to international transport margins

Source: GTAP Version 4 database, McDougall et al., 1999

The direction of exports of manufactures is likely to be important when developing countries are evaluating offers made in a multilateral context. For manufactures trade, Table 2 shows that developing countries are relatively more important destinations for manufactured exports from developing countries than they are for the industrial countries. Almost 40 percent of developing country exports of manufactures were destined for other developing economies in 1995.

Table 2. Destinations (Sources) of Manufactures Trade, 1995

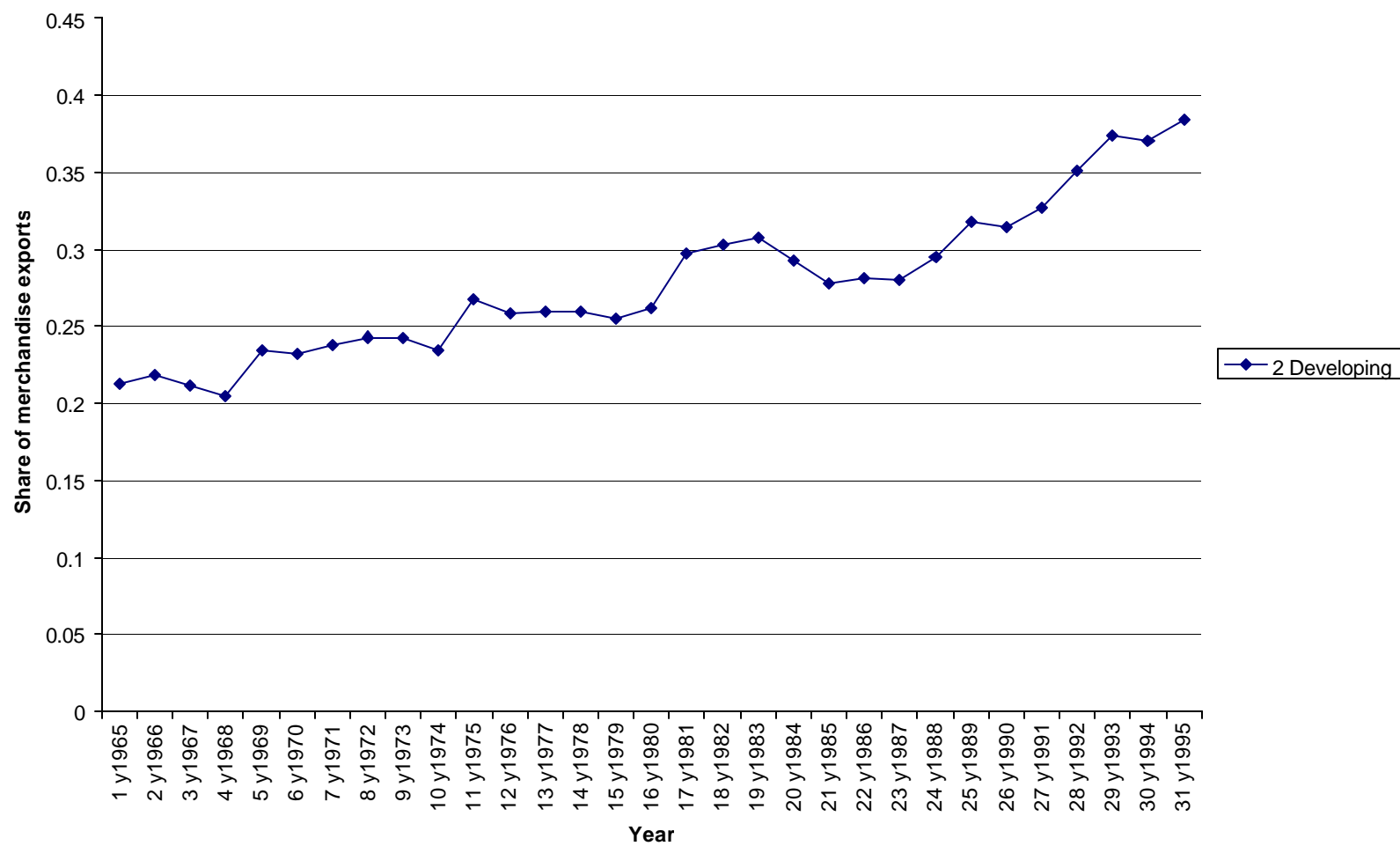
	Industrial	Developing	Total
Industrial	70.2 (74.8)	29.8 (65.7)	100 (71.8)
Developing	60.4 (25.2)	39.6 (34.3)	100 (28.2)
Total	67.4	32.6	100

Source: GTAP Version 4 database, McDougall et al., 1999.

The share of developing country manufactures exports going to other developing countries has been increasing steadily over time, as is evident from Figure 2. Presumably, the importance of developing country markets will go on increasing over time. If it increases at anything like the rate observed in the last decade, developing country markets will account for over half of developing country exports of manufactures within the next decade. Some part of this intra-developing country trade involves trade in components³ and may be liable for lower duty rates in the importing economies, particularly if the components are used in the production of exports. However, another important stimulus to the growth in intra-developing country trade in manufactures has undoubtedly been the reductions in developing country rates of protection during the last two decades (Srinivasan, Whalley and Wooton 1993).

³ Yeats (1998) estimates that 30 percent of world trade in manufactures is in parts and components.

Share of developing country merchandise exports to other developing countries



The potential effects of liberalization in particular sectors are also heavily influenced by the height of the initial tariff barriers. With more than one sector subject to distortions, it is necessary to consider the distortions in all sectors if the full effects of liberalization are to be understood. Estimates of the MFN applied rates of protection applying to three major categories of merchandise trade identified in the GTAP model are therefore presented in Table 3. These estimates are taken from the GTAP Version 4 database, which draws on the UNCTAD TRAINS data collection effort for tariffs, and estimates of protection to agriculture originally calculated by Ingco (1996). The patterns of protection are broadly consistent with those presented by Laird (1999).

Table 3. Tariffs on merchandise trade, by commodity, source and destination, 1995

Exporting region	Importing Region		
	High Income	Developing	World
Manufactures	%	%	%
High Income	0.8	10.9	3.8
Developing	3.4	12.8	7.1
World	1.5	11.5	4.7
Agriculture			
High Income	15.9	21.5	17.5
Developing	15.1	18.3	16.4
World	15.6	20.1	17.1
Minerals/Energy			
High Income	0.1	1.3	0.4
Developing	0.4	5.2	2.4
World	0.2	3.0	1.1

Source: GTAP 4 Database, McDougall, et al., 1999.

From the first panel of Table 3, it is clear that, at 3.4 percent, the trade-weighted, aggregate MFN applied tariffs facing developing country exporters of manufactures to high income countries are almost four times higher than the same tariffs facing industrial country exporters to the same markets. This is entirely due to the composition of trade, with higher tariffs being levied on products imported from developing countries. Developing country importers do not discriminate against other developing countries to anything like the same extent, with the average tariff of 12.8 percent against developing countries only around one-sixth above the 10.9 percent applied to exports from industrial countries. However, the average tariff rates to developing country tariffs on imports from other developing countries are still more than two and a half times as high as the high income country tariffs applied to developing countries.

Estimates of the trade-weighted, average tariff rates applying to agricultural products are presented in the second panel of Table 3.⁴ From these data, it appears that average agricultural tariffs in the industrial countries are around ten times as high as those applied in manufactures. Interestingly, there is very little difference between the rates applied against imports from developing and high income countries. In developing countries, average agricultural tariffs are also higher than those on imports of manufactures, but the difference is much smaller, with the average agricultural tariff less than twice that prevailing on manufactures.

The estimates of tariffs on mineral and energy products presented in the bottom panel of Table 3 suggest that trade barriers on these goods are generally relatively low. The only case where these tariffs exceed five percent is on imports by developing countries from other developing countries.

One way to obtain an extremely crude indication of the importance of particular trade flows is to examine the product of the tariff rate and the value of the trade flows, or the implied tariff revenues associated with particular trade barriers. Table 4 presents estimates of the financial implications of these tariffs in the same format as Table 3.

The estimates in Table 4 highlight the importance of the remaining barriers to industrial trade in manufactures to both developing and developed countries. For the world as a whole, manufactures tariffs amounted to almost \$190 billion. Roughly 40 percent of the total tariff impost on manufactures, or \$80 billion, was levied on manufactures exports from developing countries. Interestingly, \$57 billion, or just over 70 percent, of this burden was imposed by developing countries themselves.

The global tariff imposts on agricultural exports, at \$87 billion, were also substantial, with developing country exports facing just over a third of this impost. The total tariff burden on developing country exports was \$115 billion, or 40 percent of the global total—almost double their GDP share of 22 percent.

⁴ Given the continued difficulties in obtaining reliable *ad valorem* tariff rates for agriculture, in many cases, these tariffs have been estimated using price comparison data (McDougall *et al.*, 1999, chp. 13).

Table 4. Implied tariff collections, by commodity, source and destination, 1995

Supplying region	Destination Region		
	High Income	Developing	World
Manufactures	\$bn	\$bn	\$bn
High Income	16	93	109
Developing	23	57	80
World	40	150	190
Agriculture			
High Income	37	20	57
Developing	16	14	30
World	53	34	87
Minerals/Energy			
High Income	0.2	1.2	1.4
Developing	0.5	3.9	4.4
World	0.7	5	5.8
All Merchandise			
High Income	54	114	167
Developing	40	75	115
World	94	189	282

Source: GTAP 4 Database, McDougall *et al.* (1999).

The relatively high level of tariffs in developing countries is that has influenced the cost structure of their manufacturing sectors. Table 5 reports the estimated 1995 share of industrial firms' expenditures on labor, capital, agriculture, minerals, manufacturing and services inputs in the developing and high income regions. Note that developing countries spend more on intermediates, per \$ of output, while they spend less on labor. This difference in cost structure reflects the relatively lower wages (and emphasis on unskilled labor) in lower income countries, as well as the relatively higher tariffs on imported manufactures. We can also we break out the share of total costs devoted to intermediate imports. These are reported in the parenthesis terms of Table 5. From this we see that imported manufactures account for 14.4% of total manufacturing costs in the developing countries, versus only 9% in the high income region.

Table 5. The cost structure of the manufacturing sectors of High Income and Developing countries (import shares of total costs in parentheses)

Input	High Income - Total share	Developing - Total share
Primary Factors:		
Labor	.254	0.131
Capital	.122	0.157
Intermediate Inputs:		
Agric	.006	0.025
	(.002)	(0.005)
Minerals	.035	0.072
	(.018)	(.018)
Mnfcs	.375	0.456
	(.09)	(0.144)
Svces	.207	0.16
	(.01)	(.007)
All Inputs	1	1
	(.119)	(.174)

We can break out consumer expenditure in a similar way. These budget shares (measured at producer prices) are reported in Table 6. From this table, it is clear that manufactures are also relatively more important in the final consumption bundle of developing countries (24% vs. 17% in the high income countries). Despite this heavier reliance on manufactures in both production and consumption, the manufacturing sector's share in aggregate developing country GDP is about the same as that in the high income region (21.5%). This is consistent with the observed manufactures trade deficit for developing countries, reported in Table 1.

Table 6. The structure of private household consumption in High Income and Developing countries (import shares of total costs in parentheses)

Good	High Income	Developing
	Total share	Total share
Agric	.118 (.012)	.304 (.026)
Minerals	.001 (0)	.009 (.001)
Mnfcs	.175 .053	.240 (.064)
Svces	.706 (.015)	.447 (.024)
All goods	1 (.08)	1 (.115)

Of course, these averages mask considerable variation across individual economies. Figures 3-5 display the shares of manufactures in GDP, the share of this production which is exported, and the share of manufactures in total merchandise exports for the 28 countries and regions which we highlight in this paper. (The country/region abbreviations used in these figures are clarified in Table A2. Of these regions, those classified as “high income” are represented by a striped bar. It is clear from the diversity in both the developing and high income regions, that endowments and country size are more important determinants of these GDP and trade shares than is the country’s income level. Focusing on the high income countries in Figure 3, we see that Japan shows a relatively high share of manufacturing in GDP, whereas this share for the natural resource-abundant Australia/New Zealand region is quite low. The export orientation of

Figure 3. The share of manufactures in GDP

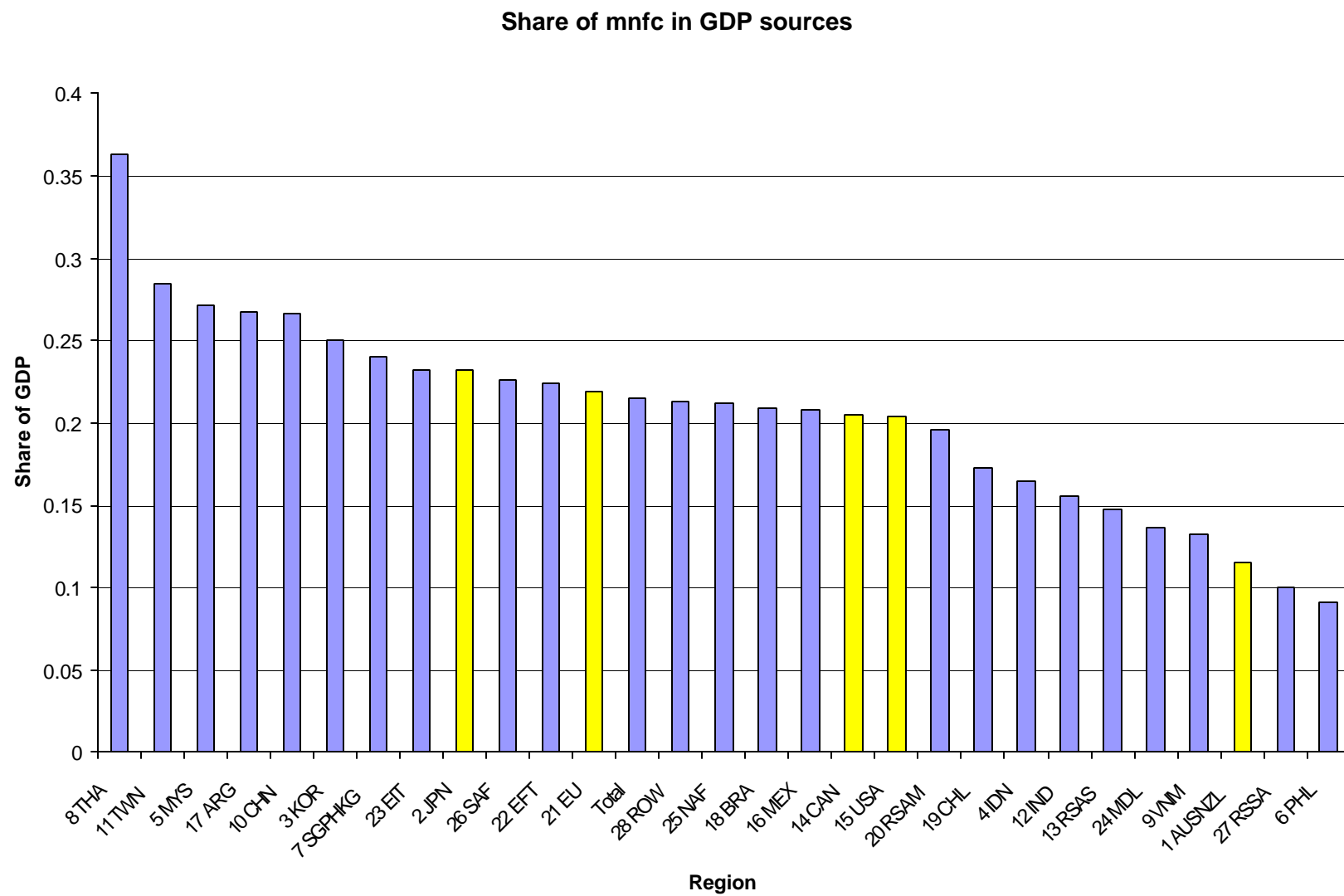


Figure 4. Shares of manufacturing output sold to export markets

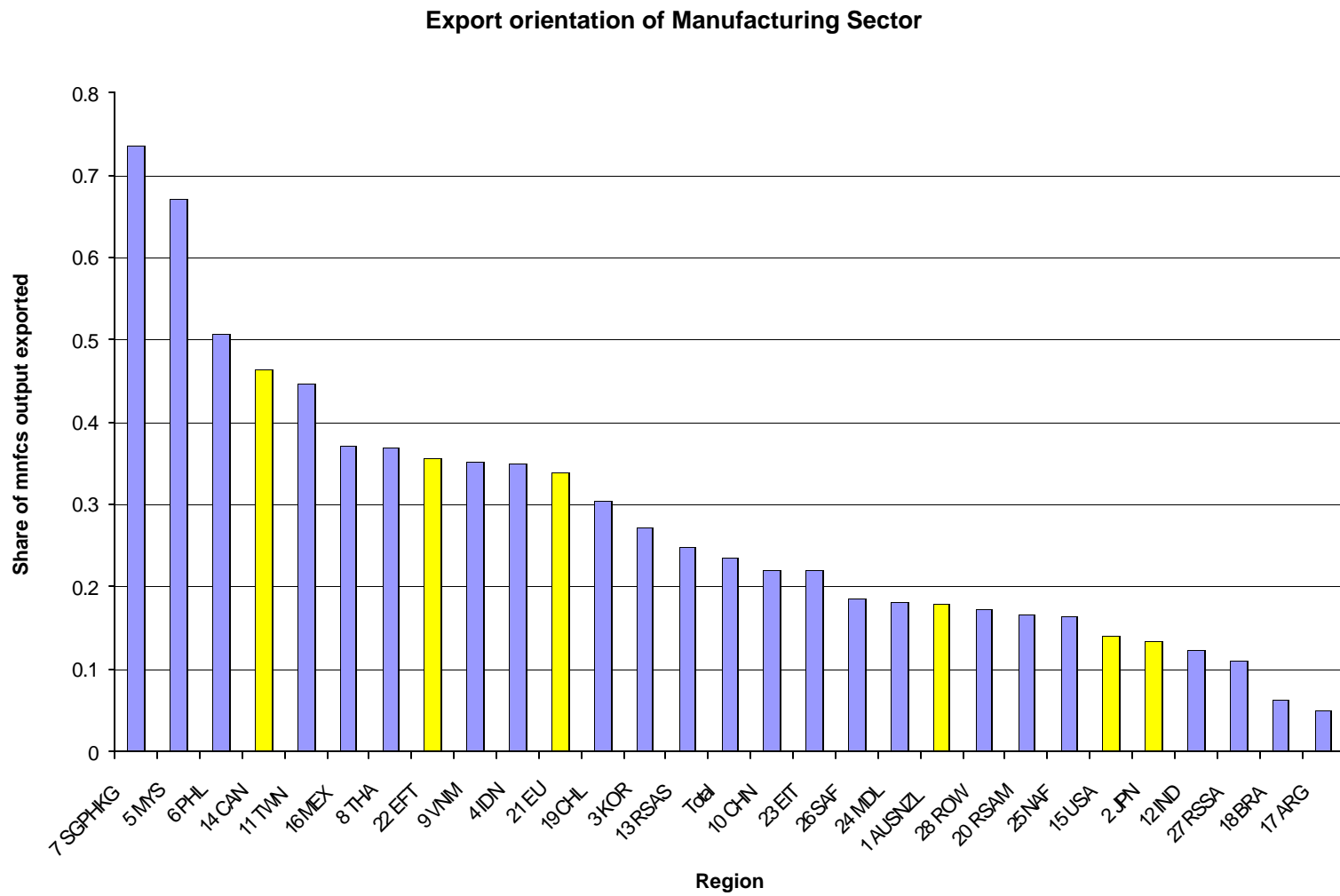
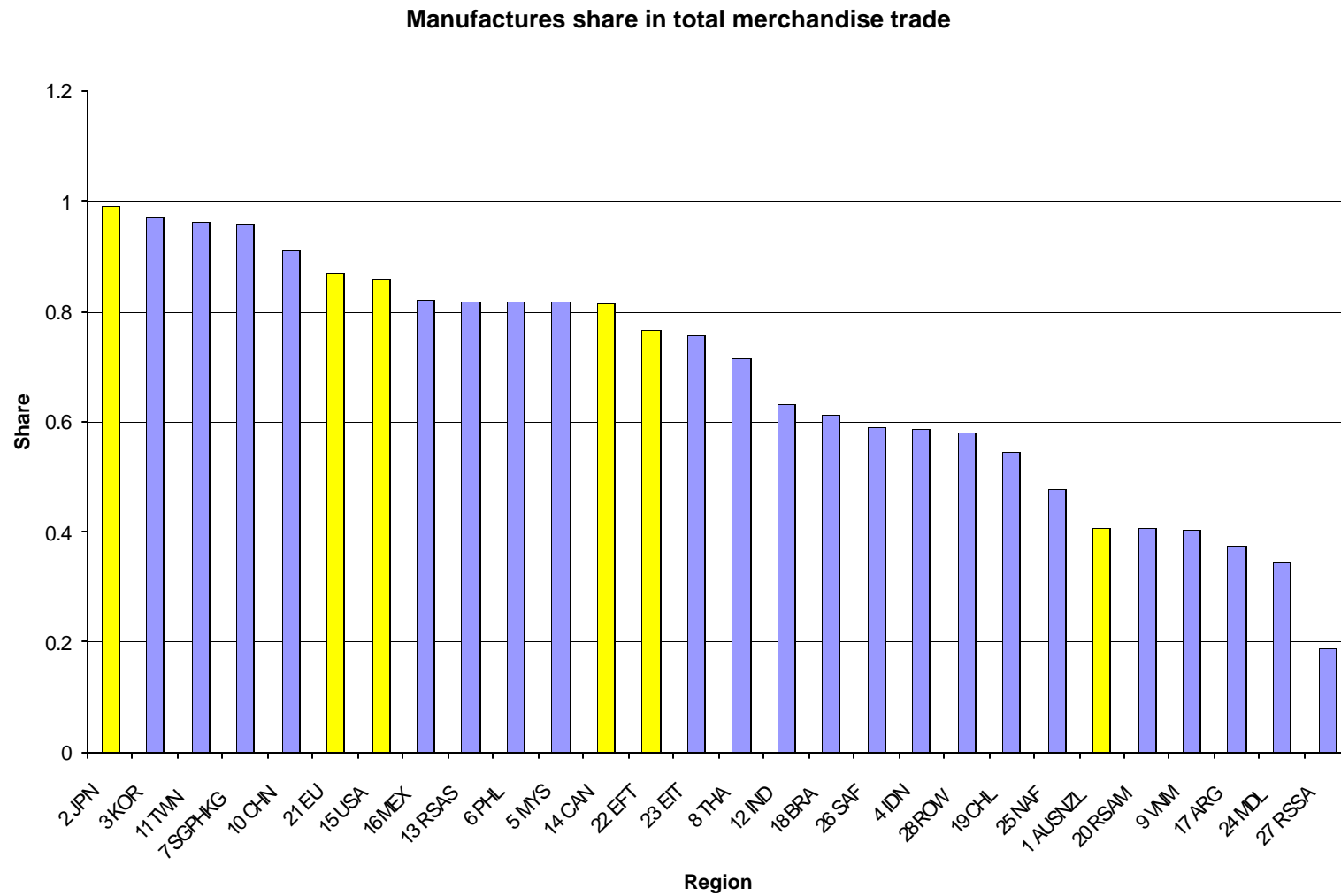


Figure 5. The share of manufactures in total merchandise trade



manufacturing (Figure 4) is relatively low for the largest high income economies (USA, Japan), and larger for the smaller, high income economies (Canada, EFTA). Developing countries' GDP shares of manufactures range from a high of 36% in Thailand, to a low of less than 10% in the Philippines. The export orientation of manufacturing activity ranges from negligible in the case of Argentina, to very important in the case of the Southeast Asian economies.

These differences in GDP and export shares are also reflected in the observed variation in the share of manufacturing in total merchandise exports. Figure 5 reports this share for the 28 individual countries and regions. From this figure, it is clear that a large number of the economies that would be likely to elect for developing country status in the WTO rely very heavily on manufactures trade. Of these, Korea, Hong Kong and Singapore, Taiwan(China), and China all have manufactures shares that are above 80 percent, and above that of the EU and the United States. At the other extreme, in only one of the 28 countries/regions identified in the chart was the share of manufactured exports less than a quarter. This group is the Sub-Saharan African countries outside the Southern African Customs Union, where manufactures accounted for only 19 percent of total merchandise exports.

Clearly, the simple numbers on manufactures tariffs presented above suggest that the issue of manufactures trade liberalization should be very important in the negotiations. However, such numbers can only be suggestive, since the true benefits of liberalization depend not only on the burden imposed by the tariff, but also on the dispersion of tariff rates, and the relationship between the rates of protection in the sector being liberalized and in other sectors. In the next section, we provide a heuristic guide to the factors that will determine the welfare gains from liberalization.

III. Welfare impacts of liberalization

Before examining the results from an empirical model, it is frequently very helpful to examine the expected results of liberalization using simple, diagrammatic tools. To maintain consistency with the full general equilibrium framework to be applied in the paper, we begin the welfare evaluation with a balance of trade function⁵ (Anderson and Neary 1992) that parallels the framework for evaluation used in the Global Trade Analysis Project (GTAP) model⁶.

The welfare effects of liberalization can be evaluated using a balance of trade function that incorporates: a consumer expenditure function, e , to track impacts of

⁵ Lloyd and Schweinberger (1988) termed this a distorted trade expenditure function.

⁶ There is a minor difference in that the approach used for the graphical analysis is a compensated welfare measure, while the GTAP model allows welfare changes to induce changes in the tax revenues associated with distortions. Anderson and Martin (1996) advocate the use of compensated measures but, for this particular application, there should be little difference since the income effects are small.

domestic price changes on consumers; a producer revenue function, r , to track impacts on producers; and a trade tax revenue function to track the government revenues raised from tariffs⁷. This function may be written for a single small country as:

$$(1) B(p, p^*, v, u) = e(p, u) - r(p, v) - (p - p^*)z_p(p, v, u)$$

where B is the balance of trade function; p is a vector of domestic prices; p^* is a vector of world prices; u is the exogenous level of utility; v is the economy's vector of resources; $z = e - r$ is the economy's net expenditure on goods and services, and the subscript p denotes differentiation with respect to the vector p .

Using a second order Taylor Series expansion of equation (1), it is straightforward to obtain a series of decompositions that provide a simple, graphical interpretation of the welfare gains from partial liberalizations such as those considered in this paper. As is shown in Martin (1997), the direct impact of a reduction in a single tariff⁸ that reduces the domestic price of the good from p_0 to p_1 can be represented by:

$$(2) B_1 - B_0 = -(p_0 - p^*)z_{pp}(p_1 - p_0) - \frac{1}{2}(p_1 - p_0)z_{pp}(p_1 - p_0)$$

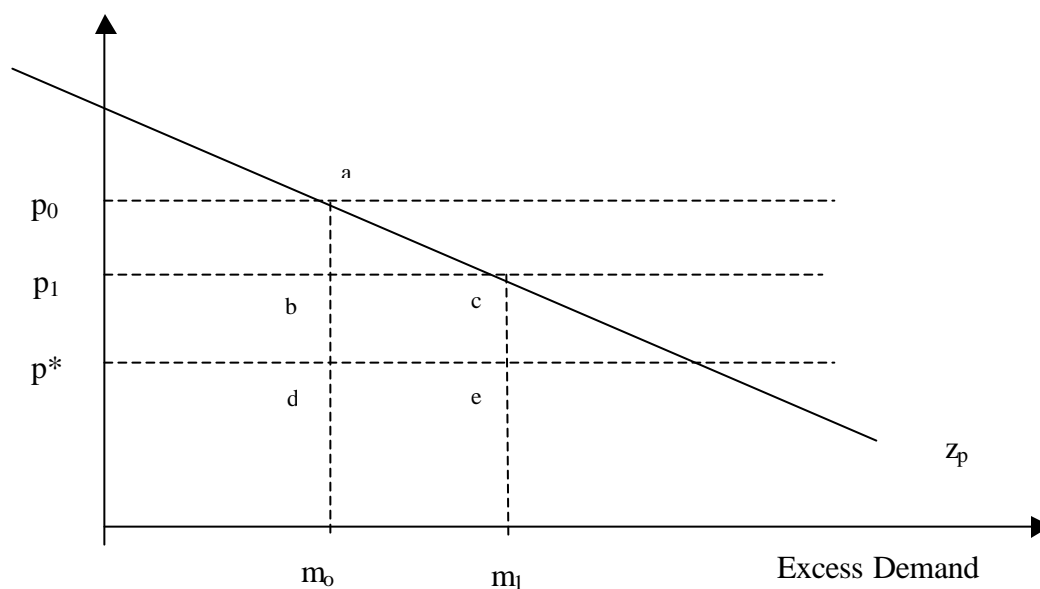
where the subscripts 1 and 0 refer to the initial and final levels of each variable.

If there is a change in a single tariff, equation (2) lends itself to the simple graphical interpretation given in Figure 6. The expression that gives rise to Figure 6 is based on a single, diagonal element of the z_{pp} matrix and will completely account for the welfare impacts only if there are no distortions on products with nonzero cross-price impacts.

⁷ In standard formulations, tariff revenues are assumed to be redistributed costlessly to consumers. Alternative formulations involving redistribution to foreign agents, or deadweight losses, can readily be incorporated.

⁸ Assuming the conditions for aggregation hold, this might be the average tariff on manufactures.

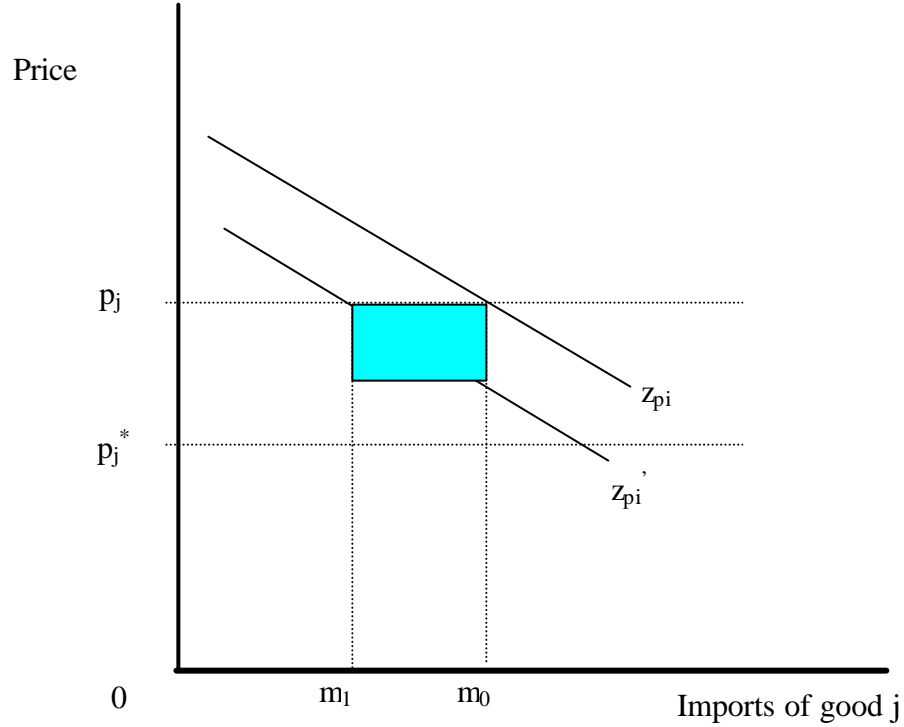
Figure 6. Welfare impacts of liberalization in a single market.



The first term on the right hand side of (1) is an induced revenue effect (at initial tariff rates) associated with the increase in the volume of imports resulting from the reduction in the tariff. The second term is the negative of the Harberger triangle (abc) associated with the change in consumer prices. Adding the two gives a total welfare effect, in the market for manufactures equal to the welfare triangle abc plus the tariff revenue rectangle bcde. This diagrammatic treatment has several interesting interpretations. Clearly, this direct gain from the trade created by the tariff reduction will be positive. Further, it will tend to be larger for any given tariff reduction the higher is the final tariff rate. This implies that the gains from the initial increment of liberalization will be larger than the gains from subsequent steps.

Whenever there are distortions in related markets, the direct market linkage considered above is not sufficient to evaluate the consequences of liberalization. In this more realistic case, it is necessary to take into account the implications of the fall in the price of this good for the quantities of other goods. Since the prices of the other goods are not changing in this small country case, attention focuses only on the first term in equation (2). The effects of interest are those associated with the off-diagonal elements of the z_{pp} matrix. For a single price change in market i , the welfare impact in market j will be negative if the goods are general equilibrium substitutes, and positive if they are complements.

Figure 7. Impact of liberalization on related markets



The two effects outlined above are estimated on the assumption that world prices of all goods are constant. However, whenever there is significant multilateral liberalization, or the liberalizing countries are large⁹, there will also be impacts on the terms of trade to consider. A graphical interpretation of these terms-of-trade impacts can be obtained using a second-order Taylor Series expansion of equation (1):

$$(3) \quad B_1 - B_0 = [z_p' - (p - p^*)z_{pp}](p_1^* - p_0^*) + \frac{1}{2} (p_1^* - p_0^*)' z_{pp} (p_1^* - p_0^*)$$

If all tariffs were zero, then equation (3) can be simplified to two terms. The first, $z_p'(p_1^* - p_0^*)$, is the initial net trade position of each good times the change in world prices. The second expression, $\frac{1}{2} (p_1^* - p_0^*)' z_{pp} (p_1^* - p_0^*)$, measures the extent to which any

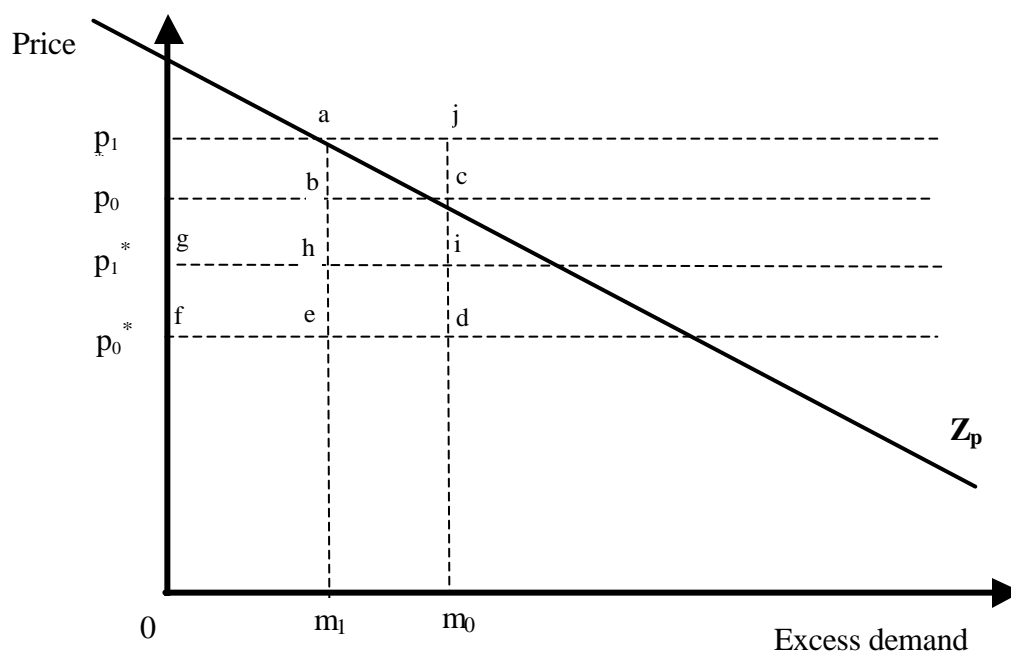
⁹ If products are differentiated by country or by firm, all countries are “large” in the markets for their goods, there may be terms of trade impacts to consider even for countries with small overall shares in world goods markets.

losses resulting from price increases for importables are offset by reductions in the quantities imported or gains from increases in the prices of exportables augmented by increases in the supply of exports.

Where there are non-zero tariffs, we must use the full version of equation (3) to calculate the welfare impacts. The second term in the square brackets adds the second-best welfare impacts associated with changes in the volumes of imports passing across trade barriers. These welfare impacts arise both in the market for the good whose world price has changed, and for other goods whose prices are linked through substitution effects. The impacts on markets for goods that are linked through substitution effects turn out to be very simple—they are exactly the same as the effects depicted in Figure 7. In Figure 8, the second-best welfare impacts in the market for the good that is being liberalized are shown together with the simple terms of trade effects discussed in the previous.

Figure 8 is drawn to illustrate the impacts of a rise in the world price of a commodity for which the country in question is a net importer. However, the mode of analysis applies equally well when the country is a net exporter of the good, or when the world price of

Figure 8. Own-Market Welfare Impacts of a Change in World Prices



the good falls. In Figure 8, the external price of the good rises from p_0^* to p_1^* . This causes the quantity of the good imported to decline from m_0 to m_1 . We can readily interpret the welfare effects using three areas in the diagram. Area $gidf$ represents

the simple terms-of-trade impact of the change in world prices. The increase in the price of this importable reduces welfare by an amount equal to the change in price times the

base quantity of imports. The second-best welfare impact is given by the reduction in import volume times the (unchanging) tariff rate, that is by area *hija*. Finally, there is a welfare gain associated with the reduction in the volume of imports in response to the crisis, measured by the area *abc*.

The welfare implications of a given policy change on any region will depend upon all of the interactions considered above. We can gain some useful insights into the nature of the interactions and welfare effects by using a highly aggregated version of the global GE model which will be employed in the empirical analysis below. The following table reports the resulting elasticities of import volumes in both regions, with respect to a 1% change in the power of the manufactures import tariff in developing countries¹⁰.

From this table, it is clear that the resulting fall in the price of manufactures imports causes services and agricultural imports in developing countries to fall. The primary mechanisms behind this change are the conditions for factor market equilibrium and balance of payments equilibrium. When manufactures imports rise, domestic production is displaced, thereby releasing labor and capital to other sectors. This in turn fuels their production, thereby cutting into imports' share of the domestic market. In addition, in order to return to external balance, some real depreciation is required. This decline in factor prices also contributes to the competitiveness of domestic, relative to foreign sources of services and primary production. The fact that imports of agriculture, minerals and services all decline means that the direct welfare gains from liberalizing manufactures in developing countries must be offset by losses in other markets and so a full second-best welfare analysis is required.

Table 6. Responsiveness of import volumes to a 1% reduction in the power of the tariff on developing country manufactures imports

import volume	High Income	Developing
Agriculture	0.02	-0.04
Minerals	0.05	-0.12
Manufactures	0.1	1.73
Services	0.02	-0.05

The positive impacts of developing country liberalization on import volumes into developed countries evident in the first column of Table 6 are also of interest, even though they are quite small. At first blush, developing country liberalization of manufactures imports might be expected to reduce developed country imports because of increased competition for exports of manufactures. However, developed country imports actually increase. This result arises from linkages through the export markets. Increases in export demand tend to strengthen real exchange rates in the industrial countries, and to

¹⁰ If international prices were constant, this would imply a one percent fall in the price of the imported good.

increase imports. This stylized result suggests that potential adverse second-best welfare impacts in partner countries are likely to be small in our application.

The GTAP model (Hertel 1997) measures the welfare changes depicted in Figures 6 to 8 by direct evaluation of the impacts on the expenditure and production revenue functions included in the structure of the model. It also tracks the consequences for government revenues of the changes in volumes of import volumes (and domestic taxes if present). Auxiliary software developed for the model (Huff and Hertel 1996) also allows the overall welfare changes resulting from trade policy to be decomposed into components analogous to those presented diagrammatically above: the direct welfare impacts, the terms of trade changes, and any induced changes in productivity or factor endowments.

IV. Empirical Implementation

Simulation model: In order to reach beyond the simple, graphical analysis of Section III, it is necessary to adopt a formal empirical simulation framework for analysis of multilateral manufacturing trade liberalization and the associated second best effects. In this paper we employ the widely used GTAP model of global trade (Hertel, 1997). This is a relatively standard, multi-region, applied general equilibrium model which features explicit modeling of international transport margins, a global “bank” designed to mediate between world savings and investment, and a relatively sophisticated consumer demand system designed to capture differential price and income responsiveness across countries. Throughout the paper we employ the simplistic, but robust assumption of perfect competition and constant returns to scale. For purposes of comparison we also discuss results generated from a model in which manufactures are treated as a monopolistically competitive following Venables (1988) and using empirical techniques developed by Francois (1998).

We supplement the standard model with the welfare decomposition module of Huff and Hertel (1996), implemented using GEMPACK, (Harrison and Pearson, 1996), in order to gain further insight into the sources of regional welfare gains and losses from manufacturing tariff cuts. This decomposition approach may be viewed as a generalization of Baldwin and Venables’ analytical decomposition which accommodates domestic distortions and handles large changes via numerical integration.

Data base: For this study we employ the GTAP, version 4 data base, which represents an internally consistent snapshot of global production, consumption and trade in the year 1995, at the level of 45 regions and 50 commodities. Given the focus of this study (and our computational limitations), we aggregate these data up to the level of the 28 regions and 19 commodities Appendix tables A1 and A2. Given our interest in second-best effects – particularly with respect to the services sector – we supplement the

GTAP version 4 data with the best available estimates of services trade barriers (Hoekman 1995).¹¹

Simulation Experiments: We focus most of our attention in this paper on analysing the impact of across-the-board, 33% cuts in post-UR manufacturing tariffs. While arbitrary, this cut is broadly in line with the depth of cuts agreed in agriculture and manufactures trade during the Uruguay Round. More liberalization, and greater welfare gains, could be achieved by cuts that go deeper than this, or focus more on reducing peak tariffs. The estimates presented in the paper are intended only to provide a benchmark for comparing liberalization in the manufacturing sector with liberalization in other sectors.

The sequence of experiments used to conduct the analysis is presented in Table 7. The first stage in the analysis was to introduce estimates of the trade barriers prevailing in services. It is important to include them in the simulation since liberalization of this sector is included in the built-in agenda for the negotiations. Then, the baseline needed to be adjusted to take into account the reductions in manufactures tariffs being phased in after 1995 as a result of the Uruguay Round. This was done following Francois and Strutt (1999) by reducing tariff rates on all those goods whose tariffs in Version 3 of GTAP were lower than the applied rates prevailing in 1995. Furthermore, we eliminate the remaining quotas under the Agreement on Textiles and Clothing.¹² These adjustments were made because the reductions to be agreed as part of the WTO 2000 negotiations will not come into effect until after the completion of the Uruguay Round phase-in.

The first experiment of interest for this paper (MNFC33) performs a partial liberalization of manufactures from the database adjusted as described in the previous paragraph. Then, two experiments involving the same percentage reductions in the protection to agriculture and services were introduced. Finally, the manufactures liberalization experiment was repeated taking into account from a database that incorporated the prior liberalization of agriculture and manufactures. This experiment addresses a central question for negotiators at this stage of the negotiations—should reductions in manufactures protection be included given that negotiations on agriculture and services, and presumably reductions in their protection, are on the agenda. Because, as discussed above, second-best welfare results can depend heavily upon changes in the

¹¹ We utilize their country-level estimates of country-by-country services protection at the ISIC 1-digit level. Where multiple countries are included in one of our regions, we took a simple average of the available countries for that region. The sector mapping was as follows: ISIC 5: Construction to GTAP sector Construction. ISIC 7 Transport, storage and communications to GTAP sector trade and transport (this assumes wholesale and retail services trade are a limited part of the GTAP trade statistics). ISIC 8 Business and financial services to GTAP sector Other service private. ISIC 9 Social and Personal Service, incl. Health, Education and Entertainment to GTAP sector other services, government.

¹² We do not implement the Francois and Strutt estimates of post-UR protection levels in food and agriculture, as they are the weakest part of that data set. Rather, we simply assume that the observed level of agricultural protection in 1995 was already in compliance with the Uruguay Round agreement. This seems a reasonable assumption, since the base period tariff rates were selected in order to minimize the need for real adjustment in agricultural protection.

volumes of imports passing trade barriers in related markets, the welfare results from this experiment may differ from those obtained using the original protection rates.

In order to facilitate our analysis of the manufacturing tariff cuts, we first examine the level of the post-UR tariffs themselves. Figure 9 reports the trade-weighted, average tariffs by importing region.¹³ From this, we see that manufacturing tariffs in the high income countries have almost disappeared. (The one exception is Australia/New Zealand, where average manufacturing tariffs were about 7 percent in 1995). This is in sharp contrast to some of the developing countries. Despite dramatic reforms in the early 1990's, industrial tariffs in India were still nearly 40% on a trade-weighted basis. China's tariffs are also quite high – although tariff collections are much lower than this because of the prevalence of duty exemptions and reductions for investment and export processing purposes¹⁴. Brazil's average tariffs are also still in excess of 15%. In sum, there are still substantial trade gains to be had from manufacturing tariff cuts in the developing countries, whereas such cuts are expected to have only a modest impact on the imports of most high income countries.

In order to ascertain how such cuts would affect the demand for a region's exports, it is instructive to look at the trade-weighted average tariffs, *by exporter*. This provides a gauge of how much each region is exporting to the more heavily protected markets. From Figure 10 it is clear that the US, Europe and Canada are not exporting a large share of their manufactures to heavily protected markets. The trade-weighted average tariff facing them is 4% or less. However, the trade-weighted average tariff

¹³ These tariffs are based on applied MFN rates and do not reflect the presence of trade preferences, excepting in the case of intra regional trade in NAFTA, the EU, and the EU/EFTA region.

¹⁴ Collections of tariffs and VAT on imports amounted to less than a fifth of the combined tax rate in 1996 (World Bank 1997, p13). The IMF estimated China's actual tariff revenues at 2.6 percent of the value of imports in 1995.

Table 7. Database Preparation and Experimental Design

1. Preliminary manipulations to introduce the services distortions
 2. Completion of the Uruguay Round – lower remaining manufacturing tariffs to the level dictated by the final UR commitments. Abolish the ATC. (No change to agriculture, assuming no further adjustment beyond that already attained by 1995.)
 3. MNFC33: Manufacturing cuts of 33% from post-UR, services distorted data base.
 4. SVCES33: services cuts of 33% from post-UR, services distorted data base.
 5. FOOD33: food and agr cuts of 33% from post-UR, services distorted data base
 6. AGRSERV33: combination of agr and services cuts – establishes a base from which to explore post-WTO2000 cuts in mnfc.
 7. POSTLIBMNFC33: Same as MNFC33, only now following the agr and services cuts –
-

Figure 9. Average Post-Uruguay Round MFN Tariffs levied on manufactures in each importing region.

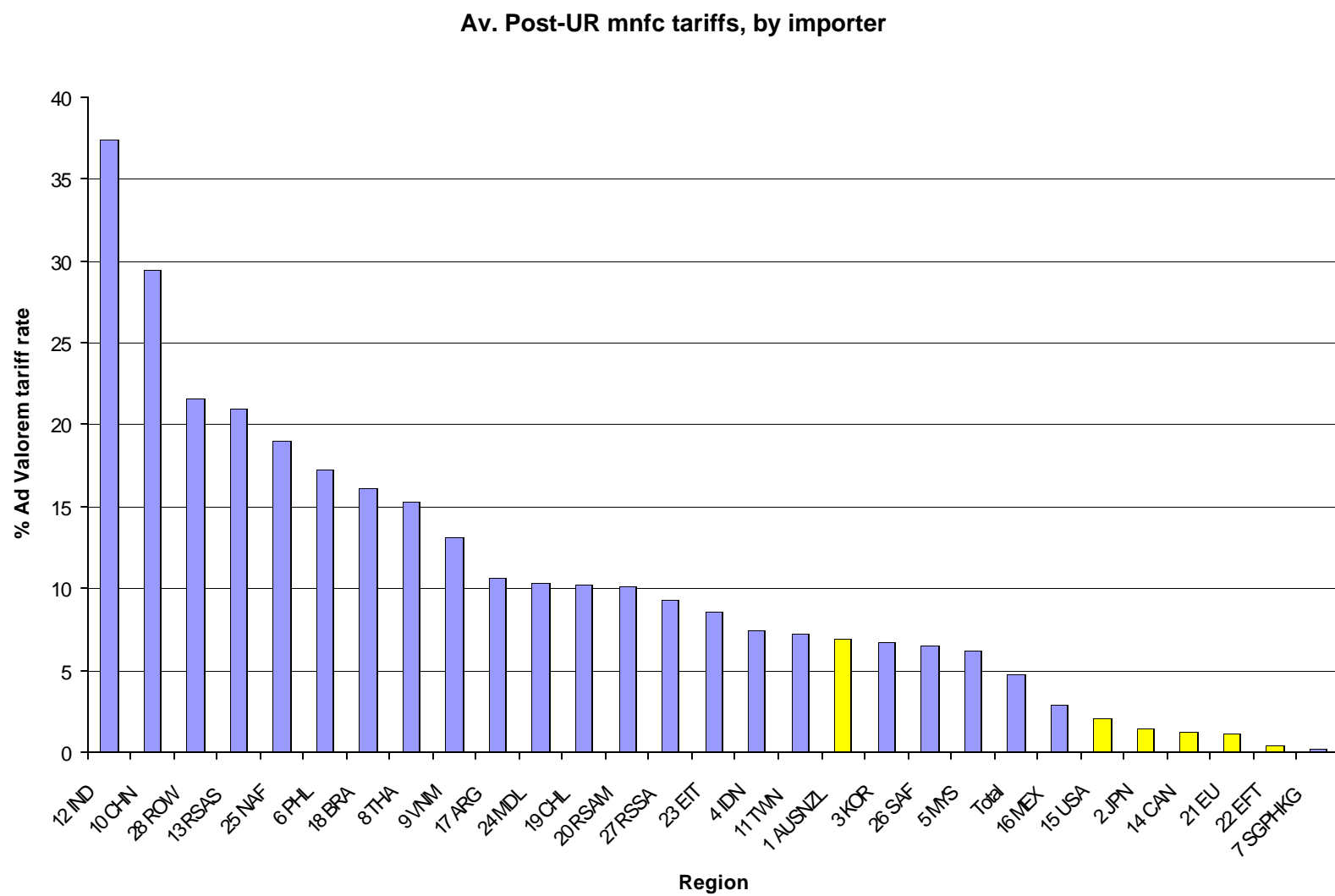


Figure 10. The average tariff rate faced by exporters of manufactures from each region.

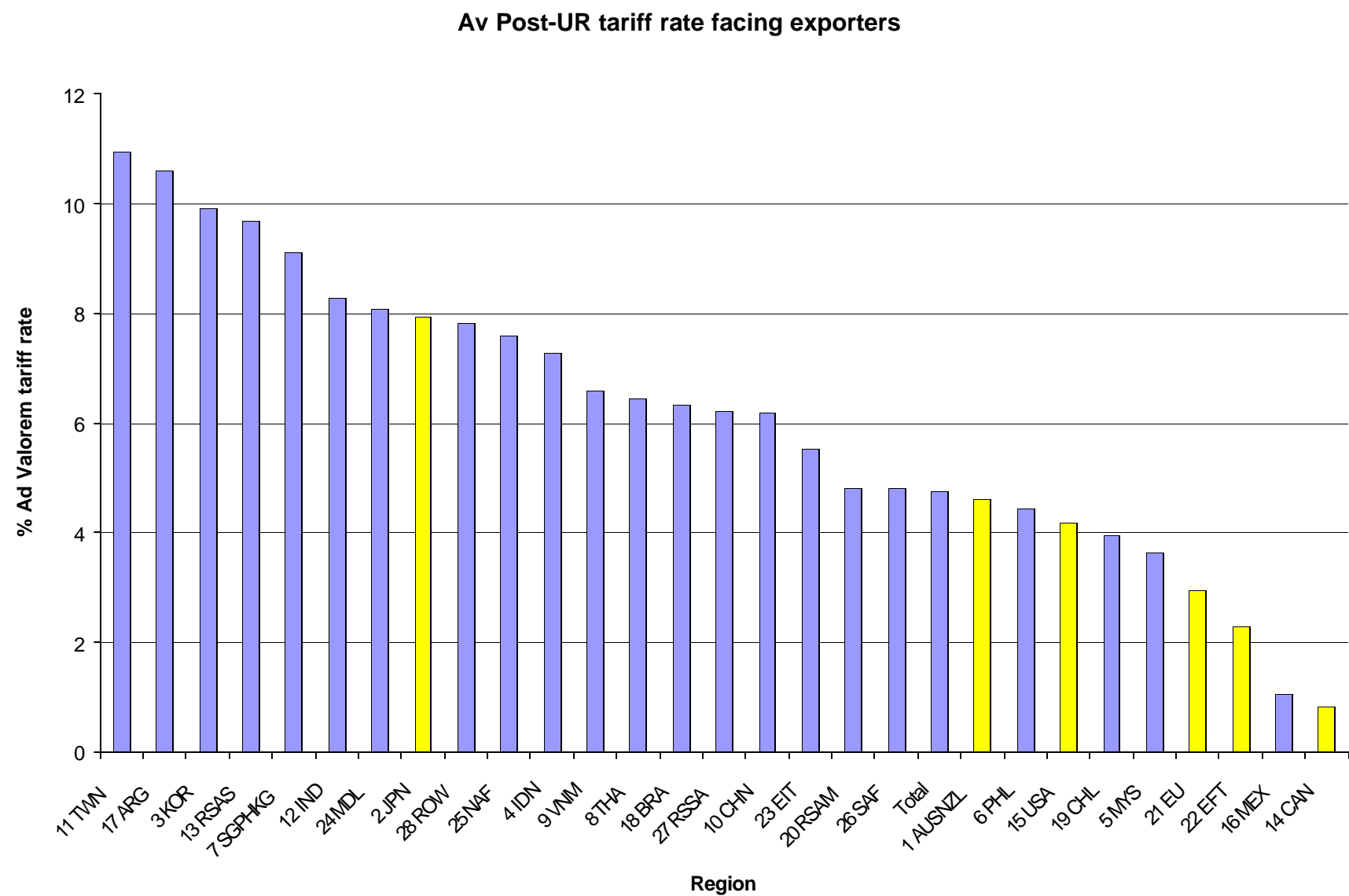


Figure 11

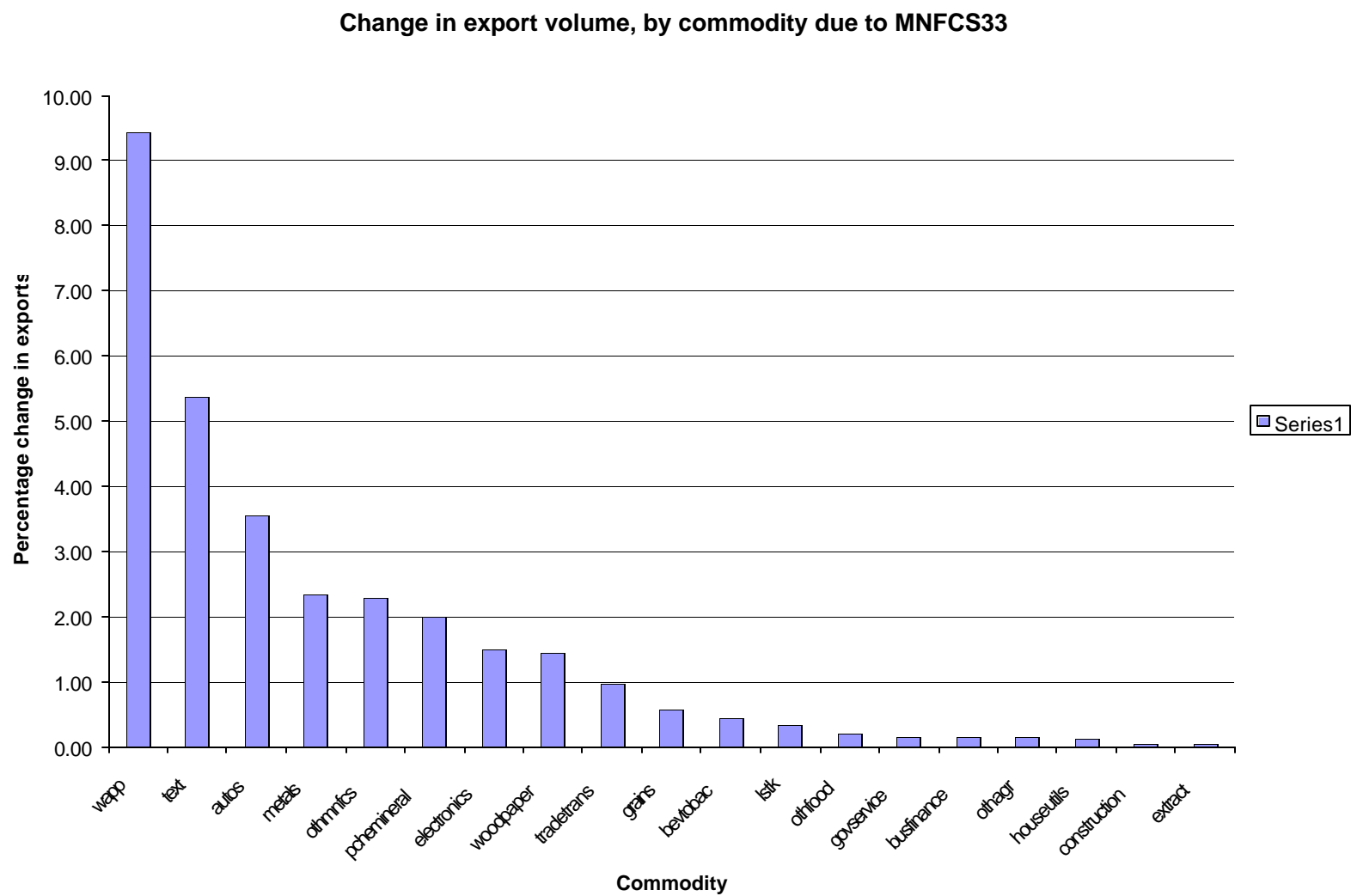


Figure 12

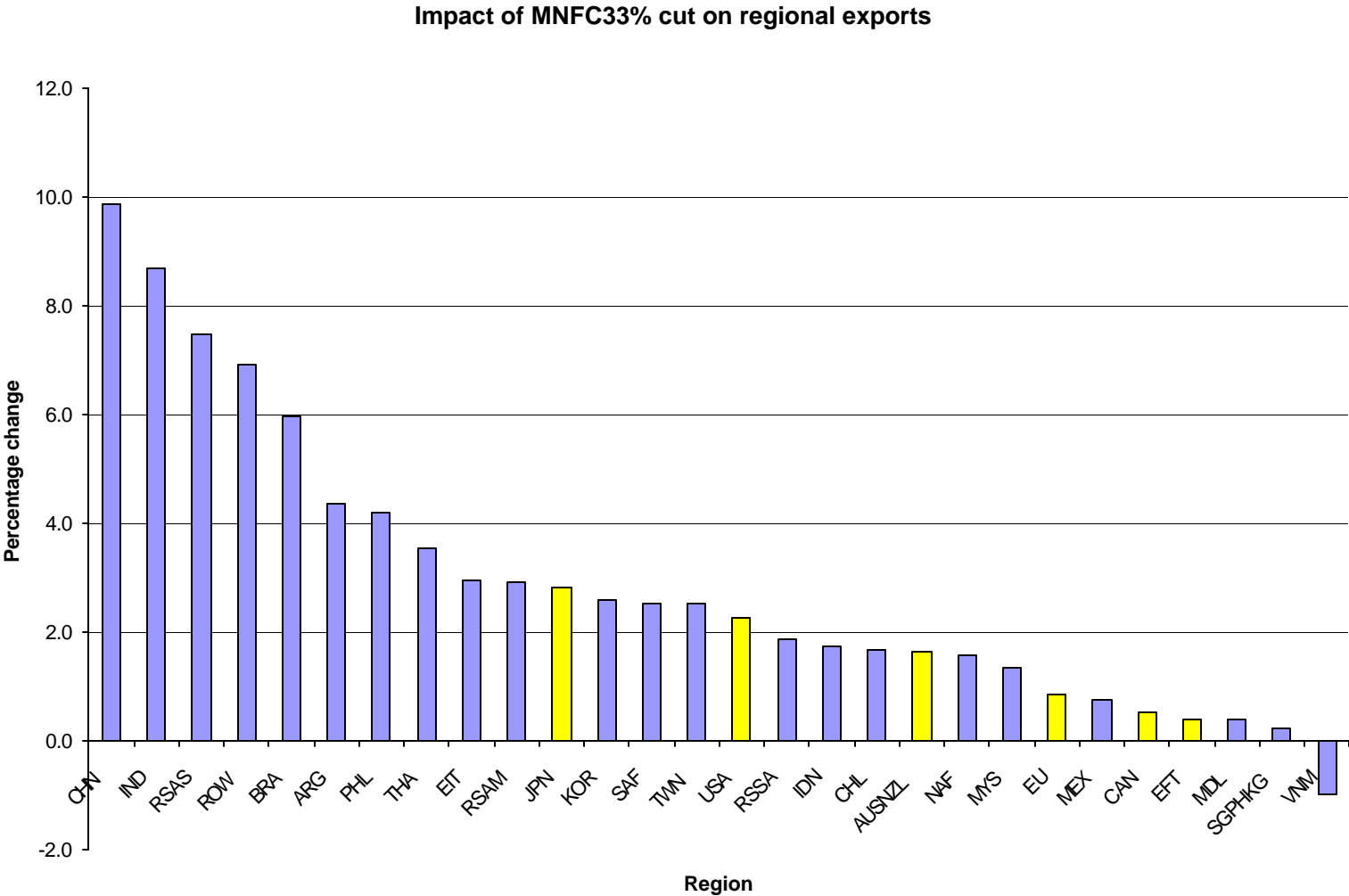
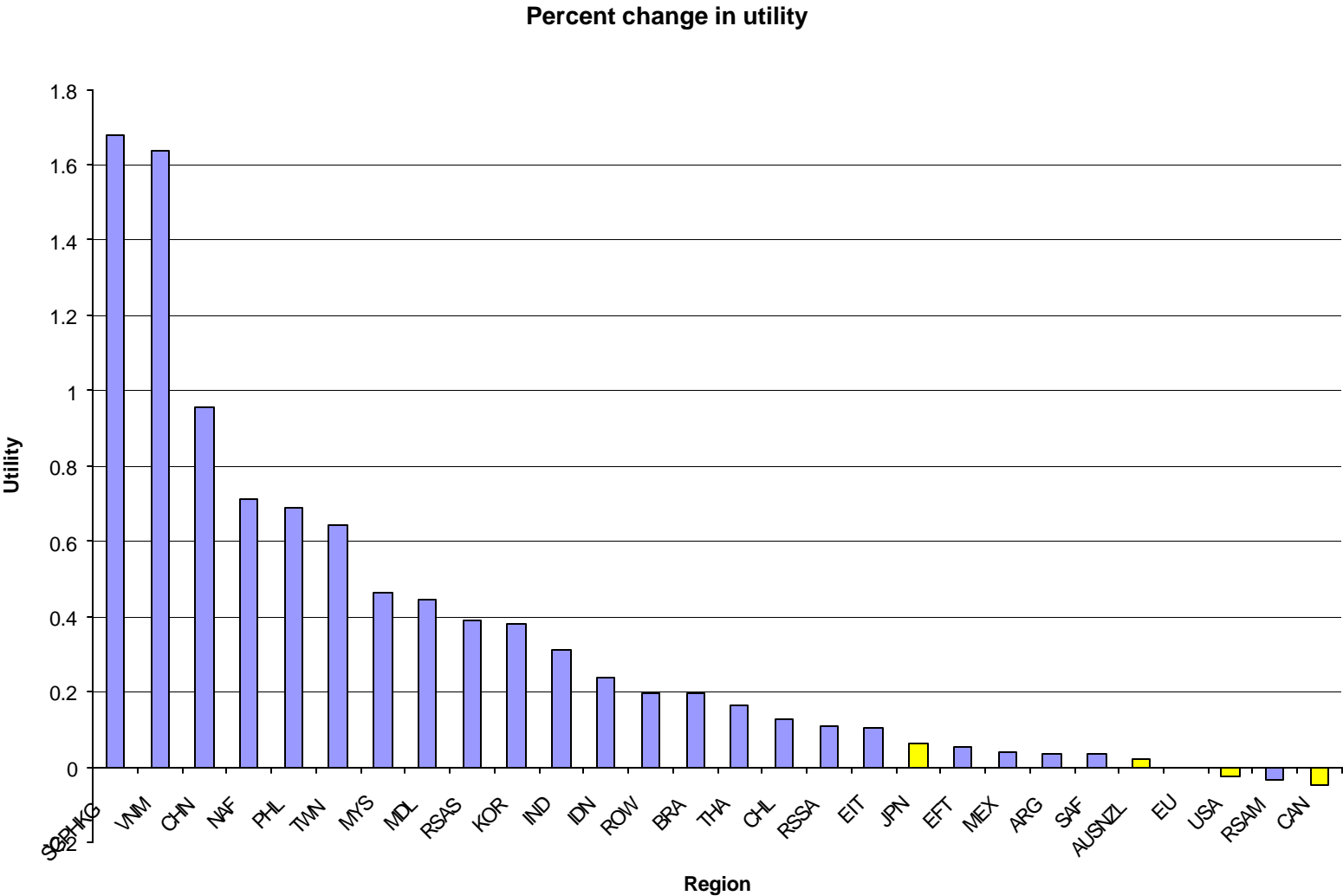


Figure 13



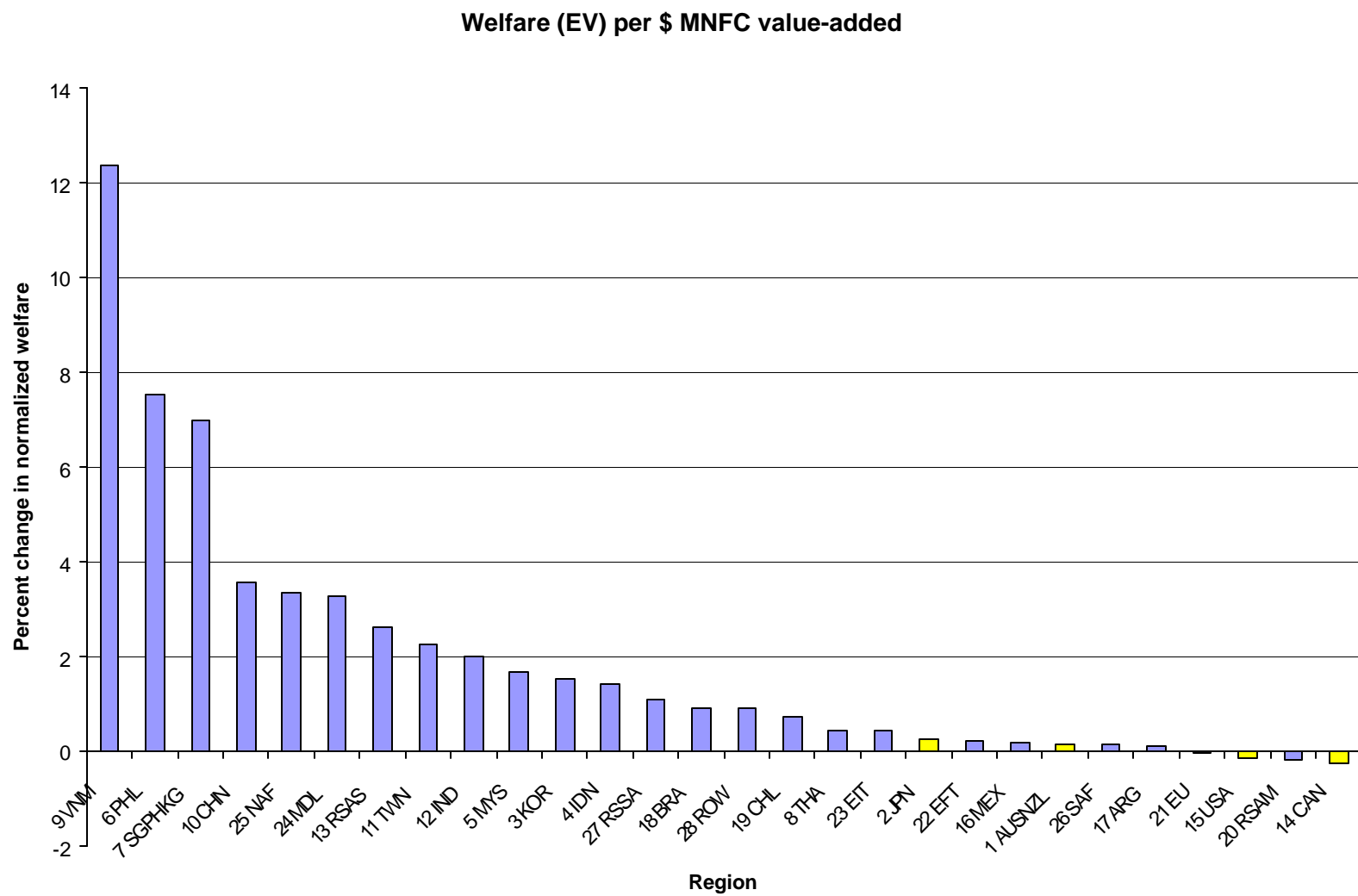
Results: The 33% cut in manufacturing tariffs, worldwide, generates an increase in global trade volume of \$107.4 billion – or about 2% of merchandise and non-factor service trade in 1995. This increase is reflected in virtually all products, including non-manufactures, as shown in Figure 11. The largest increase is for wearing apparel, where trade volume rises by nearly 10%. This is due to the fact that this politically sensitive commodity is still highly protected, even in the high income countries. Textiles and autos follow in importance. Metals, other manufactures and manufactured petrol-chemical and mineral products experience an increased trade flow of 2%/year.

When viewed on a regional basis, export volumes rise in almost all regions (Figure 12). The ordering of these regions is not unrelated to the ordering of countries in Figures 9 and 10. For example, among the high income regions, Japan faces the largest average import tariffs on her exports, and she also experiences the largest increase in export volume following liberalization. Canada and EFTA are at the low end of the spectrum of tariffs on exports and their volume increases are also very low. Only Vietnam experiences a decline in export volume. Vietnam and Singapore are the regions with the strongest terms of trade gains – following this experiment. These higher export prices choke off potential export volume increases through real exchange rate appreciation. However, they also hint at the potential for strong terms of trade gains for these same regions. This leads us naturally into an analysis of the welfare consequences of manufacturing tariff cuts.

The distribution of welfare gains (change in aggregate utility) from MNFC33 across regions is shown in Figure 13. From this it is clear that the biggest gainers, *in relative terms*, are the developing countries, as opposed to the high income countries. With the exception of Japan, the gains to the latter group are barely visible in this figure! No wonder there is little interest among the major players in the WTO negotiations in including manufactures on the agenda. However, the same cannot be said for the developing countries, where these modest cuts in tariffs protecting about 20% of the productive activity in their combined economies generates a substantial boost to the annual flow of real income. When measured against value-added in this sector, as opposed to total expenditure (Figure 14), the equivalent variation of these annual gains exceed 12% in the case of Vietnam and are in the neighborhood of 2 – 4 % for many of the developing countries. This is a substantial boost to their economy.

What about the absolute gains from this cut in manufacturing tariffs? Since the high income countries dominate global GDP, it is possible that they still capture a large share of the absolute gains in global welfare following these tariff cuts. Figure 15 reports the distribution of welfare gains from the 33% cut in manufacturing tariffs, across regions. Nearly 95% of the gains are captured by the developing countries! Given the continued dominance of the high income countries in global manufactures trade, this figure is quite striking, and it bears further investigation.

Figure 14



On a global basis, the terms of trade (TOT) effects of manufactures liberalization cancel out, since one region's TOT gains are another region's losses. In our perfect competition, constant returns to scale model, the absence of variety or scale effects, means that allocative efficiency effects are the sole determinant of global welfare gains. In terms of our earlier analysis, these are the Harberger triangles in figures 6 – 8. However, given the presence of domestic distortions in the data base, analogous “volume effects” also appear in the input markets and final consumption. Figure 15 reports the distribution of allocative efficiency gains between these two regions of the world. About 92% of the efficiency gains are generated in the developing countries themselves. Therefore, the TOT effects don't play a major role in determining the distribution of gains between the high income and developing regions as a whole.

What about on a country-by-country basis? Do TOT effects play a role here? Figure 16 once again shows the gains by region (recall Figure 13), but this time, the allocative efficiency effects are also shown – based on the region in which they are generated. Where there are large discrepancies between these two bars, the TOT effects play an important role in the welfare change. This is clearly the case in Singapore/Hong Kong and Vietnam. In both regions, the welfare gain is quite a bit higher than the efficiency gain, indicating a substantial terms of trade gain. However, viewed as a group, we see that, on balance, most of the developing countries generate the bulk of their welfare gains themselves. That is, they gain from trade liberalization due to an improved allocation of resources within their economy.

Comparison with Agriculture and Services Liberalization: Given the emphasis on agriculture and services trade liberalization in the upcoming round of trade talks, it is of some interest to compare the distribution of gains from manufacturing tariff cuts to those offered by comparable relative reductions in agriculture and services protection. Given past successes in manufacturing trade negotiations, the average level of manufacturing protection is lower than for agriculture and services. This in turn generates larger annual world welfare gains -- \$27 billion for the food cuts and \$140 billion for the services cuts, vs. \$22 billion from manufacturing tariff cuts of 33%. However, it is not clear how the distribution of gains will look.

Figure 15 contrasts the distribution of manufacturing gains with those from agriculture and services cuts of 33%. The most striking point is that *these liberalization packages yield disproportionate benefits to the high income countries*. Whereas 95% of the gains from manufacturing tariff cuts accrue to the developing countries, only 27% of the gains from food and agricultural cuts and 30% of the gains from services cuts accrue to these same developing countries. This same distribution of gains can perhaps help to explain the much greater interest in agriculture and services liberalization by the high income countries in the current Round of negotiations.

Figure 15

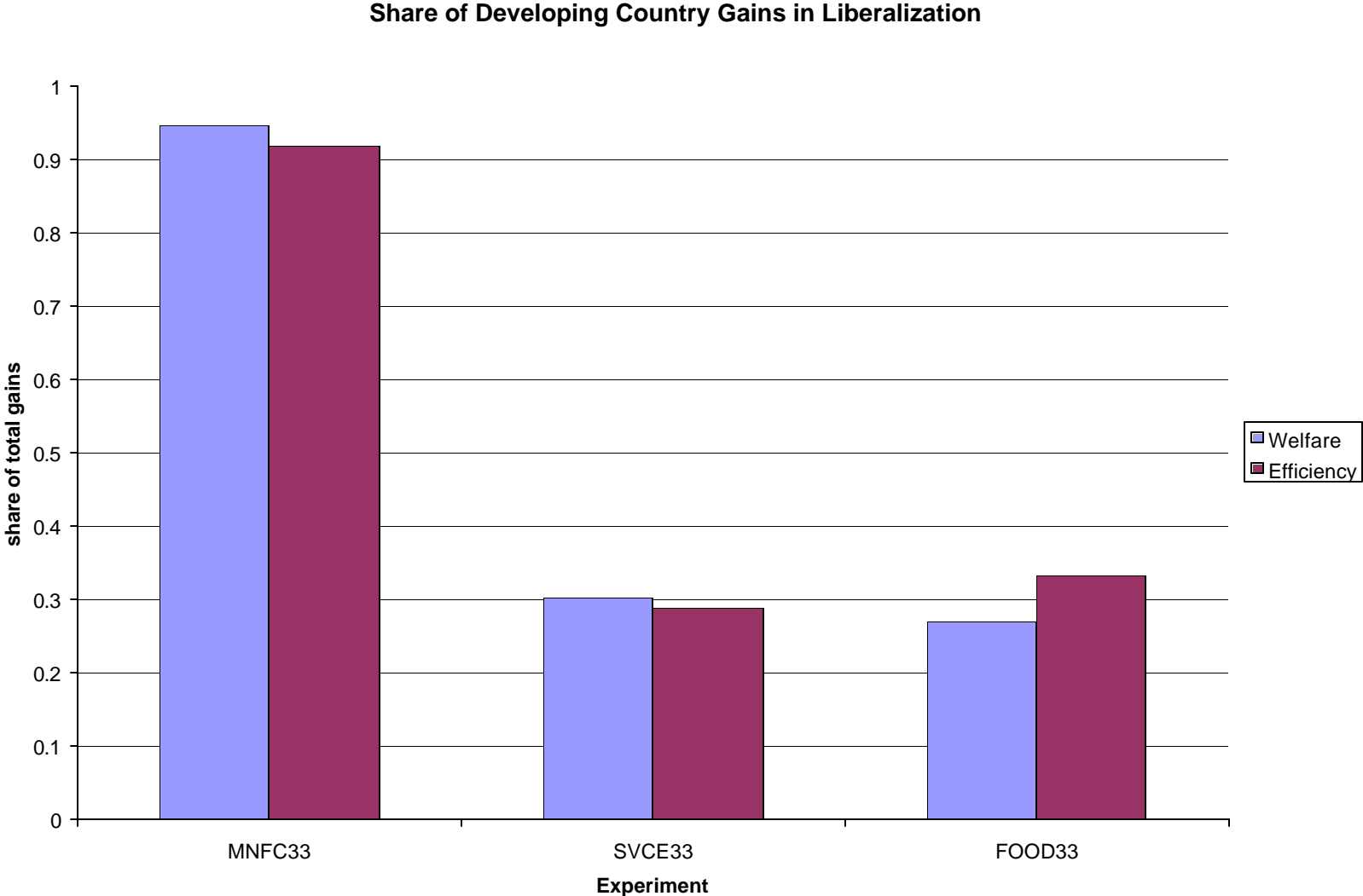
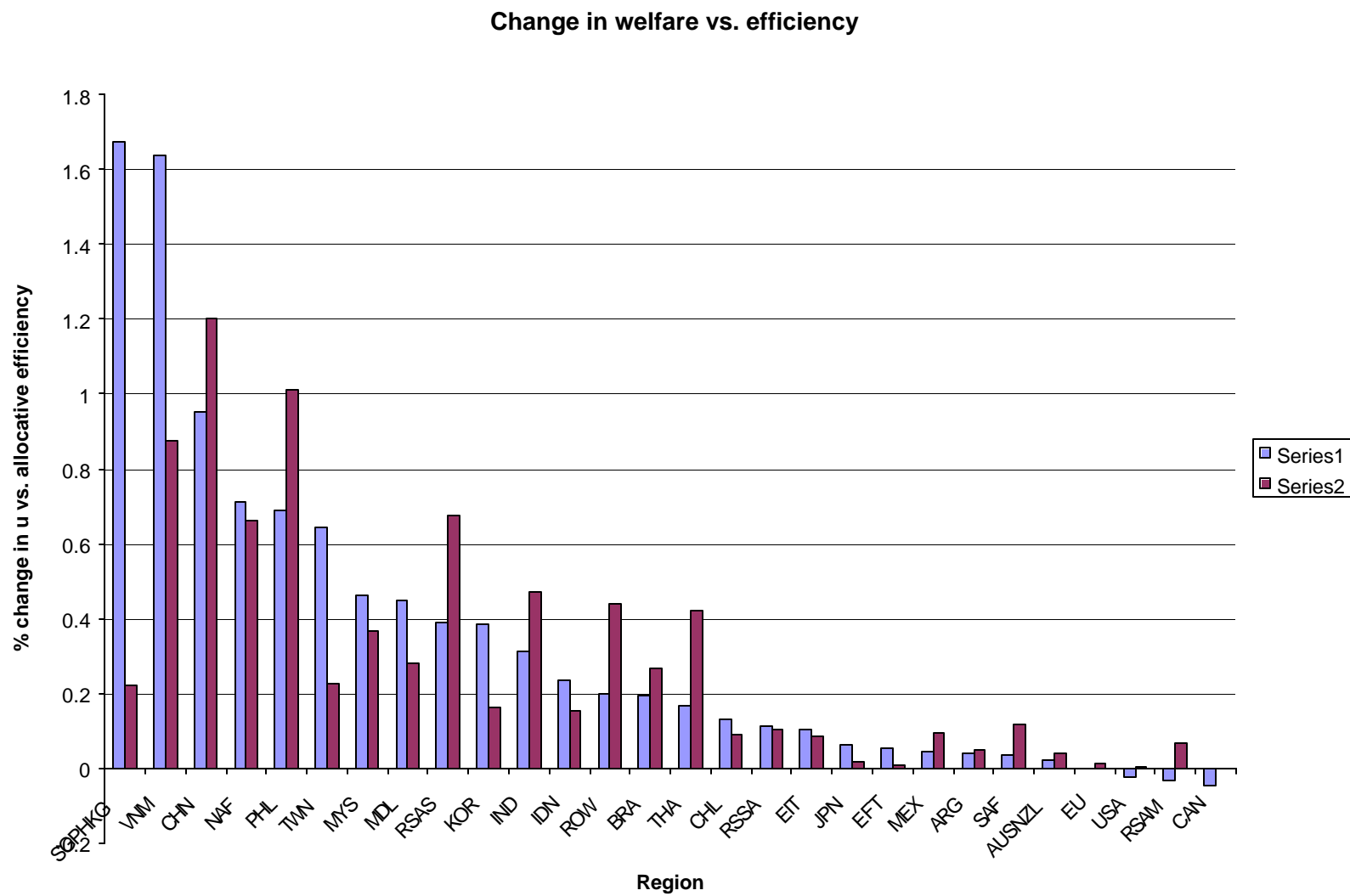


Figure 16



Introducing Monopolistic Competition: We also conducted the MNFC33 experiment in the presence of monopolistically competitive manufacturing, following Venables (1987).¹⁵ This boosts the global welfare gains by about 50%. It also dilutes the share of the gains going to developing countries (62% vs. 95%). The reason for this has to do with the fact that each country exhibits a significant preference for domestic varieties. This follows from the predominance of domestic sales in the observed data. As Venables has shown in this context, countries cutting tariffs will lose more due to the exit of domestic firms, whose varieties are relatively highly preferred. In the context of the MNFC33 experiment, relatively deeper cuts in the developing countries results in the exit of manufacturing firms and hence a smaller share of the total gains.

Second-best Effects: Now let us return to the question of second-best effects. How is manufacturing liberalization likely to interact with these other liberalization measures? Recall the one region, graphical analysis earlier in the paper. The key question was whether manufactures and services were general equilibrium substitutes or complements. As we saw from the simple numerical simulations introduced at that point, it appears likely that services will be a GE substitute with manufactures, so that the increase in manufactures imports will be accompanied by a reduction in service imports. This would naturally lead to an adverse interaction with the very high services distortions which have been estimated and incorporated into our data base.

However, as has been seen above, the individual countries in each of these regions are quite heterogeneous – both in their structure of production and consumption, as well as their pattern of protection. Furthermore, the manufactures cuts are not being implemented unilaterally. Thus, it is still quite difficult to generalize about the interactions between manufactures and services. By way of illustration, we have chosen to examine the results for a specific region in the model. Here, we have chosen the EU, since it is the largest single region, and it is also a dominant force in international trade – especially when intra-EU trade is taken into account.

Table 8 summarizes the impact of an across-the-board 33% cut in global manufactures tariffs on the EU under two alternative states of the world economy. The first of these is based on an updated version of the 1995 GTAP data base – which is obtained after simulating completion of the manufacturing and minerals UR commitments. This is the experiment that we have already analyzed in depth above. The second of these is a post-“Millenium Round” data base which is obtained by cutting agriculture and services protection by 33%, but leaving manufactures protection unchanged. Thus a comparison of these two sets of results permits us to assess the degree of interaction between manufactures tariff cuts and reductions in protection in agriculture and services. The first point to note is that, as seen above in the MNFC33 experiment, EU welfare falls slightly (-\$232 million) in the pre-liberalization data base. Why is this?

¹⁵ In order to stabilize the model in the presence of non-convexities, we were forced to restrict the mobility of skilled labor and capital in the monopolistically competitive model. This limits the potential gains from intersectoral reallocation of factors of production.

There is a negative terms of trade effect. However, another major contributor to this loss is the diversion of trade away from services.

Table 8. Summary of impact on EU of MNFC33 pre- and post- AGSERV lib (\$Usmillion)

	Preliberalization effects			Postliberalization effects		
	efficiency	TOT	Total	efficiency	TOT	Total
EU	699.96	-932.11	-232.15	910.68	-871.33	39.35
World	22364.46	0	22364.46	22382.31	0	22382.31

Table 9 analyses this trade diversion phenomenon in more detail for the trade and transport services sector, which comprises the largest services trade flows for the EU. Column one reports the welfare gain/loss associated with bilateral imports from each of the EU's trading partners. As can be seen, some of these contribute positively, while others contribute negatively. Since all of these import flows are taxed at an equal rate (182% based on Hoekman 1995.), the sign of the welfare effect simply hinges on the sign of the trade volume change. When trade volume increases, domestic consumers enjoy more of the high-value imported services and welfare rises. When trade volume falls, the opposite is true. If we look at the sum of the volume changes in this table, we see that it is negative (-\$289million). The associated welfare loss is even greater (-\$535million). This is larger than the EU's overall welfare loss in this experiment. Thus this second-best effect appears to be significant in the case of the EU.

What happens when the cut in manufactures tariff *follows* cuts in services protection? In this case, the tariff in this market will be lower and the welfare cost might be expected to also be lower. The results from this experiment are reported in the second set of columns in Table 9. Note that the volume changes in services trade are all larger now. This follows from the increased trade exposure of the services sector, in the wake of the 33% cuts in services trade barriers. As a consequence the trade volume diversion is now - \$388 million – or about one-third larger. However, the welfare cost is smaller (-\$474 million) due to the lower tariff rates. A similar phenomenon occurs in the other import markets related to services and agriculture. As a result, the allocative efficiency gains are now more than \$200 million higher and EU welfare increases following liberalization in manufactures trade.

Table 9. Analysis of the second best effects of MNFC33 on the EU T&T sector

Welfare impact prior to agr and services liberalization				Welfare impact following agr and services 33% cuts			
	chg welfare	chg volume	tariff		chg welfare	chg volume	tariff
AUSNZL	2.7	1.5	182	AUSNZL	2.7	2.2	121.9
JPN	-115.1	-63.0	182	JPN	-122.7	-100.3	121.9
KOR	-61.0	-33.2	182	KOR	-61.2	-49.8	121.9
IDN	-24.0	-13.1	182	IDN	-23.6	-19.2	121.9
MYS	-48.0	-26.2	182	MYS	-45.7	-37.2	121.9
PHL	-56.2	-30.3	182	PHL	-50.4	-40.7	121.9
SGPHKG	-374.9	-204.2	182	SGPHKG	-307.6	-250.3	121.9
THA	-26.9	-14.7	182	THA	-26.8	-21.9	121.9
VNM	-30.8	-16.6	182	VNM	-25.0	-20.2	121.9
CHN	-23.3	-12.8	182	CHN	-23.3	-19.1	121.9
TWN	-35.6	-19.4	182	TWN	-35.4	-28.7	121.9
IND	3.6	2.0	182	IND	3.2	2.7	121.9
RSAS	-5.0	-2.7	182	RSAS	-5.0	-4.1	121.9
CAN	14.5	8.0	182	CAN	13.8	11.3	121.9
USA	170.4	93.7	182	USA	160.0	131.3	121.9
MEX	5.4	3.0	182	MEX	4.9	4.0	121.9
ARG	1.1	0.6	182	ARG	1.1	0.9	121.9
BRA	24.1	13.3	182	BRA	22.9	18.8	121.9
CHL	-0.5	-0.3	182	CHL	-0.5	-0.4	121.9
RSAM	18.4	10.1	182	RSAM	17.2	14.2	121.9
EU	326.7	179.5	182	EU	304.2	249.4	121.9
EFT	14.3	7.9	182	EFT	12.8	10.5	121.9
EIT	-19.9	-10.9	182	EIT	-20.2	-16.6	121.9
MDL	-319.2	-174.1	182	MDL	-293.0	-238.7	121.9
NAF	-22.5	-12.3	182	NAF	-19.9	-16.2	121.9
SAF	8.3	4.5	182	SAF	8.0	6.5	121.9
RSSA	1.6	0.9	182	RSSA	1.8	1.5	121.9
ROW	36.4	20.0	182	ROW	33.7	27.7	121.9
Total	-535.4	-289.0		Total	-474.0	-382.4	

Overall, however, the impact of these second best effects is quite modest. Indeed, when viewed on a global basis, the change in worldwide efficiency following this cut in manufactures tariffs is almost identical in the two experiments (Table 8, second row). This suggests that the overall welfare consequences of liberalizing manufactures trade are not strongly dependent upon the level of the remaining barriers in agriculture and services. This reduces the uncertainty about the benefits associated with manufactures liberalization in a situation where the extent of the liberalization outcome in agriculture and services is unknown.

V. Summary and Conclusions

The objective of this study was to evaluate the implications of including manufactures trade liberalization in the WTO 2000 negotiations for the developing countries. The approach used takes into account the dramatic changes in the pattern of trade since the lead-up to the Uruguay Round of particular note is the sharp increase in the importance of manufactures exports for developing countries, as well as the current pattern of protection across sectors and the implications for partial liberalization.

Examination of the data reveals that most of the countries likely to classify themselves as developing in the WTO 2000 negotiations are heavily dependent on exports of manufactures. The share of manufactures in developing country exports has increased almost continuously since the early 1980s, when it was around 30 percent, to 70 percent in 1995. There has also been a rapid increase in trade in manufactures between developing countries. Close to 40 percent of developing countries exports of manufactures were directed to other developing countries in 1995.

Developing country exports of manufactures face much higher trade barriers than exports from developed countries. Their exports to industrial countries face average tariffs of 3.8 percent, a barrier four times as high as those facing developed country exports to these markets. The barriers that developing countries face in other developing countries are even higher at an average of 12.8 percent. Developing country exports were found to suffer disproportionately from tariffs . Over 40 percent of total tariffs (42% for manufacturers) were imposed on developing country exports in 1995—as against a GDP share of 22 percent.

The welfare effects of liberalizing manufactures trade cannot be considered in isolation, and must take into account the second-best welfare consequences resulting from impacts on other distorted markets. These second-best implications are likely to be relatively important in developed countries, where protection in manufactures is lower than in agriculture or services. However, they could be significant in developing countries where protection of the services sector is particularly high. Terms of trade impacts are also potentially very important.

Quantitative analysis of the implications of liberalizing manufactures trade reveals that developing countries stand to make substantially larger gains than developed countries. In fact, 95 percent of the gains from manufacturing sector liberalization would

accrue to the developing countries. These disproportionately large gains to the developing countries reflect a combination of the greater reductions in export market access that they experience, and the greater efficiency gains from reducing their own protective barriers. They stand in sharp contrast to agriculture and services, where the majority of the welfare gains are predicted to accrue to developed countries.

Overall, the results of this study suggest that it is very important for developing countries to ensure that liberalization of developing country trade is included in the agenda for the WTO 2000 negotiations. The gains to developing countries are relatively large, and broadly based. They also appear to be robust to assumptions about the extent of liberalization achieved in the non-manufacturing sectors currently included in the built-in agenda.

References

- Abreu, M. (1996), 'Trade in manufactures: the outcome of the Uruguay Round and developing country interests' in Martin, W. and Winters, L. A. eds. (1996), *The Uruguay Round and the Developing Countries*, Cambridge University Press, Cambridge.
- Anderson, J. and Martin, W. (1996), 'The welfare analysis of fiscal policy: a simple unified account', Working Paper 316, Department of Economics, Boston College.
- Anderson, J. and Neary, J.P. (1992), 'Trade reform with quotas, partial rent retention, and tariffs' *Econometrica* 60:57-76.
- Bach, C., Lloyd, P. and Martin, W. (1995), 'The Uruguay Round, WTO and Asia-Pacific Liberalisation', Second APEC Roundtable, "
- Baldwin, Richard E. and Anthony J. Venables (1995), "Regional Economic Integration," in Gene Grossman and Kenneth Rogoff, eds., *Handbook of International Economics, Vol. III*. Elsevier, Amsterdam.
- Francois, J. and Strutt, A. (1999), Post Uruguay Round Tariff Vectors for GTAP Version 4, Mimeo, Global Trade Analysis Project, Purdue University, West Lafayette.
- Harrison, W J and Pearson, K R (1996), "Computing solutions for large general equilibrium models using GEMPACK", *Computational Economics* 9:83-127.
- Hertel, T. (1997), *Global Trade Analysis: Modeling and Applications*, Cambridge University Press, Cambridge.
- Hoekman, B. (1995), 'Assessing the General Agreement on Trade in Services' in Martin, W. and Winters, L. A. eds. *The Uruguay Round and the Developing Economies*, World Bank Discussion Paper 307, World Bank, Washington DC.
- Huff, K. and Hertel, T. (1996), Decomposing welfare changes in GTAP, GTAP Technical Paper No 5, Global Trade Analysis Project, Purdue University.
- Laird, S. (1999), 'Patterns of protection and approaches to liberalization', Paper presented to CEPR Workshop on "New Issues in the World Trading System", Centre for Economic Policy Research, London.
- Lloyd, P. and Schweinberger, A. (1988), 'Trade expenditure functions and the gains from trade' *Journal of International Economics* 24:111-119.
- Martin, W. (1997), 'Measuring welfare changes with distortions' , in Francois, J. and Reinert, K. eds. *Applied Methods for Trade Policy Analysis: A Handbook*, Cambridge University Press, Cambridge.

- Martin, W. and Winters, L. A. eds. (1996), *The Uruguay Round and the Developing Countries*, Cambridge University Press, Cambridge.
- Srinivasan, T. N., Whalley, J. and Wooton, I. (1993) 'Measuring the effects of regionalism on trade and welfare' in Anderson, K. and Blackhurst, R. eds., *Regional Integration and the Global Trading System*, Harvester Wheatsheaf, London.
- South Centre (1998), *The WTO Multilateral and the South*, The South Centre, Geneva (Available from www.southcentre.org/publications/wto).
- Venables, A.J. (1987), Trade and trade policy with differentiated products: "Chamberlinian-Ricardian Model", *Economic Journal*, 97, pp 700-717
- World Bank (1997), *China Engaged*, World Bank, Washington DC.
- World Bank (1999), *Global Commodity Markets*, World Bank, Washington DC.
- WTO (1995), *The Results of the Uruguay Round of Multilateral Trade Negotiations*, World Trade Organization, Geneva.
- Yeats, A. (1998), 'Just how big is global production sharing', Policy Research Working Paper 1871, World Bank, Washington DC.

Appendix Tables:

Definitions of regions and sectors used in this paper

Appendix Table A1. List of regions included in developing country aggregate (extracted from the GTAP, version 4 mapping file)

Aus	Australia	HighIncome
Nzl	New Zealand	HighIncome
Jpn	Japan	HighIncome
Kor	Korea	Developing
Idn	Indonesia	Developing
mys	Malaysia	Developing
phl	Philippines	Developing
sgp	Singapore	Developing
tha	Thailand	Developing
vnm	Viet Nam	Developing
chn	China	Developing
hkg	Hong Kong	Developing
tw	Taiwan	Developing
ind	India	Developing
lka	Sri Lanka	Developing
ras	Rest of South Asia	Developing
can	Canada	HighIncome
usa	United States of America	HighIncome
mex	Mexico	Developing
cam	Central America and Caribbean	Developing
ven	Venezuela	Developing
co	Colombia	Developing
rap	Rest of the Andean Pact	Developing
arg	Argentina	Developing
bra	Brazil	Developing
chl	Chile	Developing
ury	Uruguay	Developing
rsm	Rest of South America	Developing
gbr	United Kingdom	HighIncome
deu	Germany	HighIncome
dnk	Denmark	HighIncome
swe	Sweden	HighIncome
fin	Finland	HighIncome
reu	Rest of European Union	HighIncome
eft	EFTA	HighIncome
cea	Central European Associates	Developing
fsu	Former Soviet Union	Developing
tur	Turkey	Developing
rme	Rest of Middle East	Developing
mar	Morocco	Developing
rnf	Rest of North Africa	Developing
saf	South African Customs Union	Developing
rsa	Rest of southern Africa	Developing
rss	Rest of sub-Saharan Africa	Developing
row	Rest of World	Developing

Table A2. Descriptions of 28 regional groupings used for the analysis

AUSNZL	& Australia and New Zealand
JPN	& Japan
KOR	& Republic of Korea
IDN	& Indonesia
MYS	& Malaysia
PHL	& Philippines
SGPHKG	& Singapore and Hong Kong
THA	& Thailand
VNM	& Viet Nam
CHN	& China
TWN	& Taiwan
IND	& India
RSAS	& non-India South Asia, includes
CAN	& Canada
USA	& United States of America
MEX	& Mexico
ARG	& Argentina
BRA	& Brazil
CHL	& Chile
RSAM	& Rest of South America, include
EU	& European Union
EFT	& European Free Trade Area
EIT	& Economies in Transition: FSU a
MDL	& Middle East
NAF	& Rest of North Africa
SAF	& South African Customs Union
RSSA	& Sub Saharan Africa outside of
ROW	& Rest of World

Table A3. Detailed mapping of sectors into four aggregate categories (extracted from the GTAP, version 4 mapping file)

Pdr	Paddy rice	& Agric
Wht	Wheat	& Agric
Gro	Cereal grains nec	& Agric
v_f	Vegetables, fruit, nuts	& Agric
osd	Oil seeds	& Agric
c_b	Sugar cane, sugar beet	& Agric
pfb	Plant-based fibers	& Agric
ocr	Crops nec	& Agric
ctl	Cattle,sheep,goats,horses	& Agric
oap	Animal products nec	& Agric
rmk	Raw milk	& Agric
wol	Wool, silk-worm cocoons	& Agric
for	Forestry	& Minerals
fsh	Fishing	& Agric
col	Coal	& Minerals
oil	Oil	&Minerals
gas	Gas	& Minerals
omn	Minerals nec	& Minerals
cmt	Meat: cattle,sheep,goats,horse	& Agric
omt	Meat products nec	& Agric
vol	Vegetable oils and fats	& Agric
mil	Dairy products	& Agric
pcr	Processed rice	& Agric
sgr	Sugar	& Agric
ofd	Food products nec	& Agric
b_t	Beverages and tobacco products	& Agric
tex	Textiles	& Mnfc
wap	Wearing apparel	& Mnfc
lea	Leather products	& Mnfc
lum	Wood products	& Mnfc
ppp	Paper products, publishing	& Mnfc
p_c	Petroleum, coal products	& Mnfc
crp	Chemical,rubber,plastic prods	& Mnfc
nmn	Mineral products nec	& Mnfc
i_s	Ferrous metals	& Mnfc
nfm	Metals nec	& Mnfc
fmp	Metal products	& Mnfc
mvh	Motor vehicles and parts	& Mnfc
otn	Transport equipment nec	& Mnfc
ele	Electronic equipment	& Mnfc
ome	Machinery and equipment nec	& Mnfc
omf	Manufactures nec	& Mnfc
ely	Electricity	& Svcs
gdt	Gas manufacture, distribution	& Svcs
wtr	Water	& Svcs

Table A3 (continued). Detailed mapping of sectors into four aggregate categories
(extracted from the GTAP, version 4 mapping file)

cns	Construction	& Svces
t_t	Trade, transport	& Svces
osp	Finance,business,rec service	& Svces
osg	PubAdmin,defence,educ,health	& Svces
dwe	Dwellings	& Svces

Table A4. Descriptions of 19 Sectors used in the Analysis

Grains	& rice, wheat, coarse grains
Lstk	& ruminants and non-ruminants
Othagr	& other farm products
Othfood	& other processed foods
Bevtobac	& beverages and tobacco
Extract	& mining, fish, forestry
Text	& textiles
Wapp	& wearing apparel
Woodpaper	& wood and paper products
Pchemineral	& petcoal, crp, nmm
Metals	& metals and metal products
Autos	& motor vehicles and parts
Electronics	& electronic equipment
Othmnfcs	& oth trans equipment, mach and
Houseutils	& housing and utilities
Tradetrans	& trade and transport services
Construction	& construction services
Busfinance	& business and financial service
Govservice	& government services
